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Examination of Night Eating and Loss-of-Control Eating Following Bariatric Surgery

Valentina Ivezaj, Ph.D.[1], **Jessica L. Lawson, Ph.D.**[1], **Janet A. Lydecker, Ph.D.**[1], **Andrew J. Duffy, M.D.**[2], **Carlos M. Grilo, Ph.D.**[1]

[1]Yale School of Medicine, Department of Psychiatry, New Haven, CT

[2]Yale School of Medicine, Department of Surgery, New Haven, CT

Abstract

Purpose: Post-operative loss-of-control [LOC]-eating is a negative prognostic indicator for long-term outcomes following bariatric surgery. Emerging research suggests that night eating might also be associated with poorer post-operative outcomes. This study examined the co-occurrence and clinical features of night eating in patients with LOC-eating following bariatric surgery.

Method: Participants were 131 adults who sought treatment for eating/weight concerns six months following sleeve gastrectomy. The Eating Disorder Examination (EDE) interview (Bariatric-Surgery-Version) assessed LOC-eating, regular night eating (at least weekly), and eating-disorder psychopathology. Participants completed the Night Eating Questionnaire (NEQ), Beck Depression Inventory (BDI-II), and the Pittsburgh Sleep Quality Index (PSQI).

Results: Approximately 15% met screening criteria for night eating syndrome based on the NEQ. Greater NEQ scores were associated significantly with race, lower percent total weight loss (%TWL), and greater EDE, BDI-II, and PSQI scores. Similar results were observed when comparing groups with regular night eating (21.4%) versus without (78.6%); adjusting for race and %TWL revealed similar findings.

Discussion: In post-bariatric patients with LOC-eating, 15% likely had night eating syndrome and 21.4% engaged in regular night-eating behavior. The co-occurrence of LOC-eating and regular night eating following sleeve gastrectomy may represent a more severe subgroup with elevated psychopathology, poorer sleep and %TWL.

Keywords

night eating; disordered eating; obesity; bariatric surgery; binge eating; loss of control eating

Introduction

Night Eating Syndrome (NES), now included in the *Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (DSM-5)* as an “other specified feeding or eating disorder,” is defined by recurrent episodes of nocturnal eating after awakening from sleep and/or by

Correspondence should be addressed to Valentina Ivezaj, Ph.D., Yale School of Medicine, 301 Cedar Street, New Haven, CT 06519. valentina.ivezaj@yale.edu.

excessive (>25% daily calorie intake) evening food consumption [1]. This inclusion, as well as formal diagnostic criteria proposed by a workgroup [2], has helped standardize NES for research and clinical practice. Theorized to be a combination of disordered eating, sleep, and mood [3], a core feature of this psychopathology involves a distressing or impairing shift in eating and sleeping circadian patterns involving evening hyperphagia and nocturnal (or night) eating episode(s) [2]. Night eating is also associated strongly with binge-eating disorder [4] although research has documented important distinctions [5]. The rate of NES appears higher among patients seeking bariatric surgery at 2-20% [6] relative to the general population, 1.1-1.5% [7]. Research on NES and bariatric surgery is relatively scarce; however, available data suggest that, similar to findings based on non-surgical weight loss study groups [8, 9], night eating is associated with other forms of disordered eating including loss of control [LOC] eating [10, 11] pre- and post-bariatric surgery [8, 9]. While the severity of both behaviors tends to decrease acutely post-surgery, research suggests a significant long-term increase, beginning approximately one year after surgery [11, 12].

Both night eating and LOC-eating have emerged as contributing factors to poorer post-operative outcomes [11–15]; however, fewer studies have examined the presence of NES before and after surgery. Available research suggests that up to 6% of biliopancreatic diversion patients [16] and 8% of laparoscopic gastric band patients [17] experience continued or new onset NES after surgery [16, 17]. These studies, however, employed earlier definitions of NES [18] and examined patients who had undergone bariatric surgeries that are no longer commonly used. Whether findings generalize to other commonly performed bariatric surgeries [19, 20], including sleeve gastrectomy, is unknown.

Taken together, little is known about the presentation of night eating behaviors and co-occurring eating-disorder psychopathology among post-operative bariatric patients. On their own, the symptoms of NES and LOC-eating may represent a harbinger for weight re-gain; co-occurring night eating and LOC eating behaviors might also yield increased psychological burden and influence global outcomes. For instance, compared to individuals seeking bariatric surgery without any disordered-eating symptoms, those with co-morbid NES and binge-eating disorder endorsed higher likelihood of eating when not physically hungry as well as greater emotional eating and food addiction symptoms [21]. Thus, this study examined the co-occurrence of night eating behaviors and NES in patients with LOC-eating following bariatric surgery and examined whether the co-occurrence of night eating represents a marker for poorer functioning and outcomes. We hypothesized that the co-occurrence of night eating and LOC-eating would be associated with greater psychopathology and less weight loss.

Methods

Participants

Participants were 131 adults seeking treatment for eating/weight concerns approximately six months (M = 6.34; SD = 1.54; range: 4-9 months) following sleeve gastrectomy surgery. All participants were recruited from the Yale Bariatric/Gastrointestinal Surgery Center of Excellence either by direct referral or by mailings or flyers soliciting patients with postoperative eating concerns. All research assessments were conducted independently from

the bariatric clinical program as part of a research study. The study was conducted at a research program located at an academic medical institution (separate from the bariatric surgical center). Inclusion criteria included ages 18 to 65 and regular LOC-eating (defined as feeling unable to stop or control an eating episode at least once weekly regardless of the quantity consumed). Exclusion criteria were minimal to enhance generalizability and included medications known to effectively influence eating or weight, substance dependence, or severe psychiatric illness requiring acute care. This investigation received approval from the university Institutional Review Board and all participants provided written informed consent.

Participants were predominately female (n= 111, 84.7%) and reported a diverse range of racial backgrounds (50.4% identified as White, Not Hispanic; 34.4% identified as Black or African American; 14% identified as Latino or Hispanic; remaining were “Other”). Participants had an average age of 45.5 (SD = 10.9) and BMI of 37.6 kg/m^2 (SD = 7.1), and 19.3 (SD = 7.1) percent total weight loss (%TWL).

Procedures and assessments

Participants were assessed by doctoral-level clinicians with advanced training in eating and weight disorders and completed a battery of self-report measures.

Lifetime binge-eating disorder.—The Mini International Neuropsychiatric Interview version 7.0 for DSM-5 was used to assess lifetime binge-eating disorder at any time before undergoing bariatric surgery.

Weight Variables.—Pre-surgical BMI, post-surgery BMI, and %TWL were calculated using measured variables. Height and pre-surgical weight were obtained from the bariatric center’s medical record and post-operative weight was collected at the initial study visit using a high-capacity digital scale. %TWL was computed as follows: [(Pre-Operative Weight) – (Postoperative Weight)]/[(Pre-Operative Weight)]*100.

Eating Disorder Examination (EDE) - Bariatric Surgery Version, a semi-structured interview adapted for bariatric surgery patients [22, 23] assesses eating-disorder psychopathology and behaviors. For the present study, the alternative three-scale structure of the EDE (Restraint, Overvaluation, Dissatisfaction) was used. Recent data supports this alternative factor structure, which demonstrated superior psychometric properties in non-clinical and clinical samples [24, 25] including bariatric surgery [26]. Subscales on the EDE range from 0 to 6, with higher scores indicative of greater severity. Frequency of LOC-eating episodes, irrespective of the amount of food consumed, over the prior 28 days was assessed. Frequency of night eating episodes, which required waking up during the night, eating, and returning to sleep, during the prior 28 days was also assessed.

Night Eating Questionnaire (NEQ) is a 24-item self-report measure which assesses both a dimensional score of night eating (range = 0-52) and categorical cut-points “suggestive” (≥ 25) or “strongly suggestive” (≥30) of NES. Items are assessed on a 5-point Likert scale, the sum of which yields a NEQ total score; higher scores are indicative of greater frequency

of night-eating behaviors [27]. The NEQ has adequate psychometric properties [27] and has been used in the bariatric literature [10, 11].

The Beck Depression Inventory-Second Edition (BDI-II), often used at bariatric clinics and in bariatric clinical research, is a widely used 21-item self-report measure which assesses current depressive symptomatology during the prior two weeks [28]. Scores range from 0-63; higher scores are indicative of greater depressive symptomatology. Scores of 0-13 suggest minimal depression, 14-19 mild, 20-28 moderate, and 29-63 severe.

Pittsburgh Sleep Quality Index (PSQI) is a widely used 19-item self-report measure which assesses sleep quality during the prior month [29]. The PSQI generates a global score ranging from 0 to 21; scores greater than five are indicative of poor sleep quality.

Statistical Analyses

Data were analyzed using SPSS 24.0. Normality was inspected prior to analyses and a log transformation was used to adjust the skewness of the LOC-eating frequency variable. Partial correlations adjusting for %TWL and race were conducted to examine the relationship between the NEQ total score and eating-disorder psychopathology (frequency of LOC-eating episodes, EDE subscales), depressive symptoms (BDI-II), and sleep quality (PSQI). Regular night-eating was operationalized as endorsing night eating at least once weekly during the past 28 days based on the EDE. Independent samples *t*-tests examined mean differences in psychosocial and weight variables between the two groups with and without regular night eating. A series of analyses of covariance (ANCOVA) were conducted to compare differences between groups with and without regular night eating while adjusting for %TWL and race. Cohen's *d* was used as an effect-size measure when comparing two groups. Because Cohen's *d* is not appropriate when covariates are used, partial eta-squared (η_p^2) was calculated to estimate the effect size when covariates were used. For Cohen's *d*, values are considered small at .20, medium at .60, and large at .80. For partial eta-squared, values are considered small at .01, medium at .06, and large at .14 [30].

Results

Of the overall participant group with NEQ data (n = 131), 19 worked night shift and thus were excluded from the NEQ screen, thus yielding n=112 for the present analyses). Of these, n = 17 (15.2%) exceeded the NES threshold, with n = 7 (6.3%) exceeding the threshold for "s*uggestive*" NES" and n = 10 (8.9%) exceeding the threshold for "*strongly suggestive*" NES"; n = 95 (84.8%) would not likely meet NES criteria based on the NEQ. When examining the frequency of night-eating *behavior* based on the EDE (n = 131), however, n = 41 (31.3%) reported at least one night-eating episode over the prior 28 days. Regular night eating behavior, defined as at least one night-eating episode per week, was met by n = 28 (21.4%) of the study group. The mean number of night-eating episodes during the prior month was 2.88 (SD = 6.11) with a range of 0 to 28.

Table 1 summarizes demographic and weight variables by regular night eating status. The two study groups with and without regular night eating did not differ significantly in time since surgery, age, sex, pre- or post-surgical BMI, BMI change, or pre-surgical binge-eating

disorder; however, the two groups differed significantly in %TWL and race. Specifically, the group with regular night eating had a lower %TWL than the group without regular night eating, and a significantly greater proportion of Non-White (67.9%) versus White (32.1%) participants engaged in regular night eating (p=.033).

Table 2 summarizes the partial correlations adjusting for race and %TWL between the NEQ total score and the relevant clinical measures. NEQ scores were correlated significantly with greater LOC-eating episodes and higher EDE Overvaluation, EDE Dissatisfaction, BDI-II, and PSQI scores, but not with EDE Restraint. Table 2 also includes the means and standard deviations of eating-disorder psychopathology, BDI-II, and PSQI overall and by group (participants with and without regular night eating behavior). Compared to those without regular night eating, the group with regular night eating reported significantly greater EDE Overvaluation, EDE Dissatisfaction, NEQ, BDI-II, and PSQI scores, as well as greater frequency of LOC-eating and less %TWL. No group differences in EDE Restraint scores were observed. Effect sizes based on Cohen's *d* were medium for the eating-disorder variables and strong for BDI-II and PSQI. ANCOVAs included race and %TWL as covariates given the significant group differences in these variables based on night eating status. Adjusting for race and %TWL revealed a similar pattern of findings without attenuation of most effects, although the effects for EDE Overvaluation and LOC-eating frequency were attenuated from medium to small effects.

Discussion

Among adults seeking treatment for eating and weight concerns and experiencing recurrent LOC-eating six months following bariatric surgery, roughly 15% also reported symptoms suggestive of NES [1]. Specifically, 6.3% had scores *suggestive* of NES while 8.9% had scores *strongly suggestive* of NES based on the NEQ recommended cut-points. Greater night-eating scores were associated significantly with elevated eating-disorder psychopathology, depressive symptomatology, and poorer sleep quality. Examining night-eating behavior based on frequency over the past 28 days, however, captured a larger number of individuals with some night eating. Specifically, 31.3% reported at least one night-eating episode over the prior 28 days, while 21.4% reported regular night eating, defined as engaging in night eating at least once weekly during the prior 28 days. Notably, compared to those without regular night eating, the group with co-occurring LOC eating and regular night eating were significantly more likely to identify as Non-White and report significantly greater frequency of LOC-eating episodes, greater eating-disorder psychopathology and depressive symptoms, and poorer sleep quality and %TWL by six months following surgery. Our rates of night eating among individuals with LOC eating after sleeve gastrectomy are considerably higher than evening hyperphagia observed one year after gastric bypass (2%) [15] and night eating after lap band (7.8%) [17]. Different definitions and surgical procedures may have accounted for some of these discrepancies across previous studies; however, it appears night eating might be more common in treatment-seeking patients with eating/weight concerns six months after sleeve gastrectomy, which is consistent with findings that NES and binge-eating disorder are highly co-morbid in non-bariatric samples [4]. Our overall findings also mirror those previously reported for the frequency

and significance of regular night eating in a clinical sample of patients with binge-eating disorder [31].

Large effects were observed for night eating group differences in depressive symptoms and sleep quality, even after adjusting for %TWL and race. Indeed, depressive scores neared the “moderate” range for the regular night eating group versus the “mild” range for the group without regular night eating, representing clinically meaningful group differences in depressive symptomatology. Further, while both groups reported poor sleep quality, the group with co-occurring regular night eating and LOC-eating reported significantly diminished sleep quality compared to those with LOC-eating alone. While poor sleep quality impedes weight control efforts [32], more research is needed to understand the relationship between poor sleep and night-eating behavior. For example, whether night eating is used to attain sleep, to placate the urge to eat, or to ease difficult physical or emotional states while attempting to sleep is unclear among this patient group.

Several clinical implications are offered based on the present findings. First, LOC-eating is not a criterion of NES, but the relationship between the two is well documented [10, 11, 33]. Thus, both LOC-eating and night eating should be assessed when bariatric patients present with eating or weight concerns in the post-operative period. The NEQ is a well-established self-report measure available to screen for NES, although the psychometric properties of the NEQ has not been examined in the post-operative bariatric population. Further, if health care providers are limited by time constraints and are unable to screen using the 24-item NEQ, bariatric clinics might consider assessing night eating by asking the one behavioral item from the EDE interview used in the present study (i.e., what is the frequency of night eating behavior (defined as waking up in the middle of the night, eating, and returning to sleep) during the previous 28 days). Relative to the NEQ, this one EDE item captured a larger number of individuals with meaningful differences in psychopathology and weight loss by six months post-surgery. Thus, screening for both frequency of night-eating and LOC-eating behavior might capture an important subgroup struggling with broad levels of impairment post-surgery. Second, understanding the function of night eating might have important implications for determining treatment recommendations. For instance, night eating treatment might be warranted (e.g., [34] whereas cognitive-behavioral therapy for insomnia (known as CBT-I) might be an optimal first-line treatment when sleep is the primary disturbance [35]. Third, better understanding of the interrelationships of LOC eating and night eating with mood and sleep is warranted in this patient group. Fourth, meal timing/structure may be an integral treatment target for post-bariatric patients struggling with LOC-eating and night eating. Structured eating and meal timing is one of the core tenets of cognitive behavioral therapy for LOC-eating. Relatedly, meal timing appears to be associated with weight loss response among bariatric patients. One study found that participants who ate their main meal after 3 pm were more likely to have a poorer weight loss response up to 6 years post-surgery [36]. Finally, early identification of both night eating and LOC-eating across racial groups is warranted at bariatric follow-up assessments. Because eating disorders often go undetected in general and often untreated, and particularly among racial minority groups [37–39], we emphasize the need for assessment of these behaviors across all individuals presenting with eating and weight concerns.

Strengths and limitations are noted as context for interpreting the findings. Participants were assessed with well-established measures for all variables of interest. Nonetheless, it is important to note that participants in this study were seeking treatment for eating and weight concerns about six months following one form of bariatric surgery (sleeve gastrectomy); thus, our findings may not generalize to non-treatment-seeking individuals or to individuals who undergo other forms of bariatric surgery. In addition, our findings are based on cross-sectional data approximately 6 months after surgery; prospective studies could help clarify the prognostic significance of co-occurring LOC-eating and night eating. Future research could examine the prognostic significance of pre-surgical variables on post-surgical eating behaviors such as loss-of-control eating and night eating as well as on associated psychological domains such as mood. Much of the literature to date, however, has suggested that while eating behaviors and mood variables are quite salient and clinically significant pre-surgically, that they have less prognostic significance than do post-surgical re-evaluations of disordered eating and mood disturbances (14, 40, 41).

Conclusion

In post-operative sleeve gastrectomy patients with recurrent LOC-eating, approximately 15% had scores suggestive of NES, 31.3% reported any night eating, and 21.4% reported regular night eating behavior defined as at least once weekly during the past month. A significantly greater proportion of Non-White patients reported regular night eating than White patients. The regular night eating group also reported significantly greater frequency of LOC-eating behaviors, greater eating-disorder psychopathology, greater depressive symptoms, poorer sleep quality, and poorer %TWL by six months following surgery. Future research is needed to elucidate the relationship between night eating and LOC-eating and to identify individuals at risk for these disordered eating behaviors after bariatric surgery.

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What is already known on this subject?

Bariatric surgery is currently the most effective treatment for obesity; however, outcomes are variable. Post-operative loss-of-control eating is a negative prognostic indicator for long-term outcomes following bariatric surgery. Emerging research suggests that night eating might also be associated with poorer post-operative outcomes.

What this study adds:

In post-bariatric patients with loss-of-control eating, night eating is common. Approximately 15% likely had night eating syndrome and 21.4% engaged in regular night-eating behavior. The co-occurrence of loss-of-control eating and regular night eating following sleeve gastrectomy may represent a more severe subgroup with elevated psychopathology, poorer sleep and percent total weight loss.

Table 1.

Demographic and clinical characteristics and weight variables by night eating status

	Overall *N*=131	**Subthreshold Night Eating *n*=103**	**Regular Night Eating *n*=28**	**Independent samples *t*-test**	***p-value***
	M (SD)	***M (SD)***	***M (SD)***		
Age	45.47 (10.95)	45.32 (10.94)	46.04 (11.57)	−0.31	.760
Pre-surgical BMI	46.74 (8.86)	47.02 (8.68)	45.69 (9.57)	0.70	.483
Post-surgical BMI	37.57 (7.08)	37.38 (6.83)	38.24 (8.03)	−0.57	.569
BMI change	9.17 (4.18)	9.64 (4.29)	7.45 (3.29)	2.51	.013
%TWL	19.29 (7.07)	20.17 (7.10)	16.07 (6.05)	2.79	**.006**
Months since surgery	6.34 (1.54)	6.26 (1.61)	6.64 (1.22)	−1.36	.180
	***n* (%)**	***n* (%)**	***n* (%)**	**Chi-Square**	***p-value***
Gender (Female)[1]	111 (84.7%)	87 (85.5%)	24 (85.7%)	0.03	1.00
Race (White)[2]	66 (50.4%)	57 (55.3%)	9 (32.1%)	4.74	**.029**
Pre-surgical lifetime binge-eating disorder	62 (47.3%)	46 (44.7%)	16 (57.1%)	1.38	.241

M=mean; *SD*=standard deviation; BMI=body mass index; %TWL=percent total weight loss from pre- to post-surgery.

[1]Fisher's Exact Test

[2]Chi-square analysis for White versus Non-White

Table 2.

Eating behavior and psychopathology, depressive symptoms, and sleep by night eating status

	Overall *N*=131	NEQ	Subthreshold Night Eating *n*=103	Regular Night Eating *n*=28	Independent samples *t*-test	Sig.	Effect Size	ANCOVA Race %TWL
	M (SD)	*r*[1]	*M (SD)*	*M (SD)*		*p-value*	*Cohen's d*	η^2
NEQ	17.93 (7.06)	--	16.01 (4.79)	25.77 (9.28)	−4.78	<.001	1.32	.257
EDE- Restraint	3.20 (1.80)	.129	3.20 (1.80)	3.21 (1.80)	−0.04	.965	0.01	.001
EDE- Overvaluation	2.80 (1.90)	.326***	2.57 (1.82)	3.66 (1.98)	−2.76	.007	0.57	.067
EDE- Dissatisfaction	2.99 (1.56)	.320***	2.80 (1.56)	3.70 (1.37)	−2.77	.006	0.61	.046
LOC eating episodes[2]	22.73 (27.95)	.395***	20.37 (27.18)	31.39 (29.55)	−2.47	.015	0.51	.039
BDI-II	12.13 (10.33)	.541***	10.01 (8.53)	19.96 (12.59)	−3.94	<.001	0.93	.131
PSQI	7.53 (3.99)	.577***	6.78 (3.65)	10.32 (4.00)	−4.46	<.001	0.92	.136

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