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The association between night eating and body mass depends on age

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ABSTRACT

Night eating syndrome (NES) is marked by substantial evening or nocturnal food intake, insomnia, morning anorexia, and depressed mood. Originally, NES was described as an eating pattern among obese individuals. However, subsequent studies showed that NES also occurs among non-obese individuals, who appear to be younger than obese individuals with NES. Thus, it has been proposed that NES may lead to future weight gain, which may explain inconsistent findings about associations between NES and body mass. The current study investigated the relationships between age, body mass index (BMI), and night eating severity in a representative sample of German adults ($n = 2317$). It was found that age moderated the relationship between night eating severity and BMI. Specifically, night eating was positively associated with BMI in participants who were between 31 and 60 years old, but not in younger (<31 years) or older (>60 years) participants. Results indicate that age may indeed play an important role when examining the relationship between night eating and obesity. That is, weight gain may only occur after longer periods of engaging in night eating and, thus, no or only small relationships can be found in younger samples such as students. The positive association between night eating and BMI disappears in older individuals, which may be related to onset of illness associated with wasting.

1. Introduction

Night eating syndrome (NES) was first described in 1955 as a pattern of night eating behaviors among obese individuals (Stunkard, Grace, & Wolff, 1955). It has not been included as a stand-alone diagnosis in diagnostic manuals, and it is not yet widely recognized by eating disorder professionals (Goncalves, Moore, Stunkard, & Allison, 2009; Vandereycken, 2011). However, it is now listed in the *Otherwise Specified Feeding and Eating Disorders* section of the fifth revision of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013). Proposed research diagnostic criteria involve (1) consumption of at least 25% of daily food intake after the evening meal or at least two episodes of nocturnal eating per week, (2) awareness of those eating episodes, and (3) at least three of the following: morning anorexia, a strong urge to eat between dinner and sleep or at night, insomnia, a belief that one must eat in order to initiate or return to sleep, or a worsening of mood in the evening (Allison et al., 2010).

In the general population, prevalence of NES is approximately 1–1.5% (de Zwaan, Müller, Allison, Brähler, & Hilbert, 2014; Vander Wal, 2012) and prevalence in the obese population is 4–9% (Allison et al., 2006; Cleator, Abbott, Judd, Wilding, & Sutton, 2013). Thus, NES appears to be associated with obesity, but it has also been speculated that morning anorexia may compensate evening hyperphagia and nocturnal eating, thereby preventing weight gain (Vander Wal, 2012). Accordingly, it has been shown that night eating also occurs in non-obese individuals (Lundgren, Allison, O'Reardon, & Stunkard, 2008; Marshall, Allison, O'Reardon, Birketvedt, & Stunkard, 2004). Those appear to be younger than obese individuals with NES and, thus, it has been hypothesized that NES may precede weight gain (Marshall et al., 2004; Vander Wal, 2012). To conclude, findings about the association between night eating severity and body mass have been inconsistent, showing either no or only small, positive correlations (e.g., Harb et al., 2012; Moizé et al., 2012; Runfola, Allison, Hardy, Lock, & Peebles, 2014; Striegel-Moore et al., 2008).

Based on the finding that non-obese individuals with NES appear to be younger than obese individuals with NES (Marshall et al., 2004), we speculated that age may be a moderator of the relationship between NES and body mass. In the present study, the relationships between night eating severity, body mass index (BMI), and age were examined in a representative sample of German adults. We expected that night eating severity would be positively associated with BMI and that this relationship would particularly be observed in middle-aged and older participants, but would be attenuated or absent in younger participants.

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Table 1
Comparisons of the different age groups on age, gender, night eating severity, and body mass index.

	Age groups						Test statistic	*p*-Value	η_p^2
	21–30 years ($n = 332$)	31–40 years ($n = 335$)	41–50 years ($n = 450$)	51–60 years ($n = 437$)	61–70 years ($n = 399$)	>70 years ($n = 364$)			
Age (years; *M*/*SD*)	25.76/2.80[a]	35.44/2.99[b]	45.48/2.85[c]	55.39/2.68[d]	65.34/2.83[e]	77.05/4.77[f]	$F_{(5,2311)} = 12{,}495.59$	<.001	.96
Sex (male/female in %)	43.4/56.6	48.1/51.9	44.9/55.1	50.6/49.4	47.1/52.9	42.9/57.1	$\chi^2_{(5)} = 6.97$	*ns*	–
Body mass index (kg/m^2; *M*/*SD*)	23.55/3.29[a]	24.77/4.09[b]	25.43/3.74[c]	25.72/4.00[c,d]	26.20/3.48[d]	26.04/3.70[d]	$F_{(5,2311)} = 24.61$	<.001	.05
Night Eating Questionnaire (*M*/*SD*)	9.39/4.81	9.17/4.61	9.72/5.14	9.61/4.89	9.35/4.48	9.51/4.26	$F_{(5,2311)} = 0.68$	*ns*	.001

Notes. Group means with different superscripts differ from each other (all *t*s > 3.09, $p < .05$).

2. Methods

2.1. Participants and procedure

The study was approved by the Ethics Committee of the University of Leipzig Medical School (Leipzig, Germany). A representative sample (based on age, sex, and education) of the German general population was selected with the assistance of a demographic consulting company. All participants were visited in-person and informed about the study procedures by a trained research assistant. They also received a written explanation of the study including information on data management and provided their oral informed consent prior to assessment. Further information about this study is reported elsewhere (de Zwaan et al., 2014).

A total of $N = 2508$ individuals agreed to participate, but $n = 52$ were excluded from analyses because of missing data. Furthermore, only participants older than 20 years were considered for the current analyses as the standardized BMI should have been used for younger participants ($n = 139$) and, thus, values would not have been comparable to the rest of the sample. Hence, the final sample comprised $n = 2317$ participants (age: $M = 51.45$ years, $SD = 16.97$, range 21–92; BMI: $M = 25.35$ kg/m^2, $SD = 3.83$, range 14.65–50.41; sex: $n = 1245$ women [53.7%], 1072 men [46.3%]).

2.2. Night Eating Questionnaire (NEQ)

The NEQ (Allison et al., 2008; Meule, Allison, & Platte, 2014a) is a 14-item instrument for the assessment of night eating severity. It consists of four subscales: *morning anorexia*, *evening hyperphagia*, *mood/sleep*, and *nocturnal ingestions*. Items are scored on a five-point scale ranging from 0 (e.g. *not at all*) to 4 (e.g. *extremely*). The questionnaire contains two stop criteria, that is, if item #9 or #12 is answered with zero the following questions are also scored with zero. Item #13 is used for excluding cases of sleep-related eating disorder and is not included in the total score. Two additional items (#15 & #16) assess impairment and distress from night eating and are also not included in the total score. Internal consistency was $\alpha = .70$ in the original validation study (Allison et al., 2008) and the standardized Cronbach's alpha was .71 in the current study.

Table 2
Simple slope coefficients for body mass index on night eating severity for the individual age groups.

Age group	*B*	β	*SE*	95% CI	$t_{(2305)}$	*p*
21–30 years	0.05	.07	.06	−.05; .19	1.19	*ns*
31–40 years	0.20	.23	.05	.13; .33	4.66	<.001
41–50 years	0.15	.20	.05	.11; .29	4.34	<.001
51–60 years	0.15	.19	.04	.10; .27	4.20	<.001
61–70 years	−0.02	−.03	.05	−.13; .08	−0.51	*ns*
>70 years	0.08	.09	.05	−.01; .19	1.74	*ns*

2.3. Data analyses

The sample was split into six age groups with comparable sample sizes (Table 1). Age groups were compared for age, BMI, and NEQ scores using ANOVAs and post-hoc *t*-tests and for sex distribution using a χ^2-test. Pearson correlations were calculated to examine associations between continuous study variables across the entire sample. In order to test a moderating role of age on the relationship between night eating severity and BMI, a multiple regression was calculated with NEQ scores as continuous independent variable, age groups as categorical moderator, and their interactions when predicting BMI. For this, the SPSS syntax provided by O'Connor (1998) was used.

3. Results

BMI differed between most age groups, indicating a higher BMI with higher age (Table 1). Likewise, age was positively correlated with BMI across the entire sample ($r = .20$, $p < .001$). Sex distribution and NEQ scores did not differ between age groups (Table 1).

Across the entire sample, NEQ scores were weakly, positively correlated with BMI ($r = .13$, $p < .001$). However, the regression model indicated an interaction of age group × NEQ scores when predicting BMI ($F_{(5,2305)} = 3.93$, $p = .001$, R^2 change = .01, $f^2 = .01$).[1] Night eating severity was positively associated with BMI in participants who were between 31 and 60 years old, but not in participants who were younger than 31 years or older than 60 years (Table 2).

4. Discussion

In the current study, a weak positive correlation between night eating severity and body mass was found, replicating prior studies (e.g., Harb et al., 2012; Moizé et al., 2012). Notably, this relationship was moderated by age such that no relationship between night eating and BMI was found in younger participants. These results are in line with the fact that night eating may precede weight gain, as has been suggested previously (e.g., Gluck, Venti, Salbe, & Krakoff, 2008; Marshall et al., 2004). This may also explain inconsistent findings reported in the literature, for example from studies in which no association between body mass and night eating was found in young adults such as university students (Runfola et al., 2014). The specific mechanisms, however, remain to be explored. For example, it is known that young adults are more physically active and report higher well-being than middle-aged adults (Blanchflower & Oswald, 2008; Sallis, 2000). Also, it has been found previously that nocturnal snacking is associated with lower mental health-related quality of life (Colles, Dixon, & O'Brien, 2007). Thus, there are several factors that potentially influence the association between night eating and BMI and it may be that a

[1] Beta weights for the full equation: NEQ $B = 0.05$, $\beta = .06$; dummy variable 1 $B = -0.18$, $\beta = -.02$; dummy variable 2 $B = 0.92$, $\beta = .10$; dummy variable 3 $B = 1.18$, $\beta = .12$; dummy variable 4 $B = 3.32$, $\beta = .33$; dummy variable 5 $B = 2.20$, $\beta = .21$; interaction term 1 $B = 0.15$, $\beta = .15$; interaction term 2 $B = 0.10$, $\beta = .11$; interaction term 3 $B = 0.10$, $\beta = .12$; interaction term 4 $B = -0.07$, $\beta = -.07$; and interaction term 5 $B = 0.03$, $\beta = .03$.

healthier lifestyle and less psychological distress prevent weight gain in young adults despite engaging in night eating.

Unexpectedly, the association between night eating and BMI disappeared in participants older than 60 years. This is particularly intriguing as NEQ scores did not change with age, but older participants had the highest BMI. BMI tends to peak between ages 55 and 60 years in men and women (Ng et al., in press). This may be related to the onset of disease states associated with wasting. It could then be hypothesized that night eating may continue, while BMI decreases due to medical conditions. However, some individuals may lose their drive for night eating with age, but their BMI may remain stable. The confluence of these factors may impact the relationship between BMI and night eating at these older ages.

Limitations of the current study include that all data were based on self-report, which may inadvertently affect data quality. For example, it is known that self-reported height and weight are biased such that height usually is overestimated and weight is underestimated. However, it has also been found that although such discrepancies exist, reports are usually sufficiently accurate (Bowman & DeLucia, 1992; Pursey, Burrows, Stanwell, & Collins, 2014). Another limitation is that this was a cross-sectional study and, thus, causal relationships cannot be inferred. Longitudinal studies need to be conducted in the future that show that night eating is prospectively associated with weight gain.

To conclude, the current study showed that the relationship between night eating and body mass depends on age. It should be noted, however, that effects were small, suggesting that there may be other important variables that influence this relationship. For example, it has been found recently that the relationship between night eating and body mass is also moderated by the extent individuals engage in emotional eating (Meule, Allison, & Platte, 2014b). Such moderators have rarely been investigated in past research and, thus, future research may examine other moderators that contribute to our understanding of NES and under which circumstances it is associated with weight gain and obesity.

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No funding was received for this study.

Contributors

MdZ designed the study. AM conducted the statistical analysis and wrote the first draft of the manuscript. All authors were involved in writing and revising the manuscript and approved the final version.

Conflict of interest

All authors declare that they have no conflicts of interest.

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