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The Association between Time in Bed and Obesity Risk in Young Adults

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Abstract

Young adults (YA) are at high risk for insufficient sleep and obesity. However, little research has focused on the association between sleep and obesity in this population. The present study examined the association between reported time in bed (TIB) and body mass index (BMI) in YAs. Participants were 250 18–25 year-olds who completed an online survey assessing several factors associated with weight control. After controlling for significant covariates, TIB was significantly associated with BMI. Specifically, ‘less than 6 hours/night’ TIB was associated with increased BMI compared to the referent category (7 to < 8 hours/night) ($p = .01$). Findings demonstrate that young adults who report shorter TIB are more likely to be classified as having higher BMI.

Introduction

Studies have demonstrated a significant association between short sleep duration and obesity status in both children and adults (Patel & Hu, 2008). Although multiple pathways through which sleep may influence obesity risk have been proposed (Patel & Hu, 2008), neuroendocrine pathways are most strongly supported (e.g., Spiegel, Tasali, Penev, & van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004). Specifically, two appetite regulating hormones—leptin and ghrelin—are influenced by sleep duration. Following partial sleep restriction, ghrelin increases while leptin decreases, resulting in increased hunger and appetite (Spiegel et al., 2004). Recent experimental studies also demonstrate increased food intake upon partial sleep deprivation (e.g., St-Onge et al., 2011), although findings are not always consistent (e.g., Schmid et al., 2009).

Although the association between sleep duration and weight status has been well-documented across the lifespan and experimental studies point to plausible pathways through which sleep could influence weight, it is notable that little attention has been paid to sleep duration and obesity risk specifically in young adults. This is particularly striking given the high prevalence of both short sleep and weight gain in this population (Centers for Disease Control & Prevention [CDC], 2011; Lewis et al., 2000). Specifically, the period between 18 and 25 years of age, often referred to as “emerging adulthood” (Arnett, 2000) is a particularly high-risk period. Nearly 40% of 18–25 year olds are overweight or obese (McCracken, Jiles, & Blanck, 2007), and compared to older adults are at increased risk for weight gain (Lewis et al., 2000). It is also estimated that 31% of young adults 18–24 years

report sleeping less than seven hours in a 24-hour period (CDC, 2011). It has therefore been noted that the transition from adolescence to adulthood may represent an opportune time to intervene on negative health behaviors in an attempt to prevent future disease risk (McCracken et al., 2007). Thus better understanding the association between sleep duration and obesity risk during this time period could have important treatment implications for both sleep and weight.

To our knowledge, only two studies have specifically assessed the association between sleep duration and BMI in younger adults (Hasler et al., 2004; Meyer, Wall, Larson, Laska, & Neumark-Sztainer, 2012). Both of these studies demonstrated an association between sleep duration and weight status. However, neither study focused on this association during the particularly high risk period of 18–25 years of age.

The purpose of the present study was to determine whether reported time in bed (TIB) was associated with weight status in young adults. Analyses focused on young adults between 18 and 25 years of age given data indicating that this is a particularly high risk time for weight gain (Lewis et al., 2000) and insufficient sleep (CDC, 2011). It was hypothesized that compared to young adults who report 7- <8 hours TIB per night on work/school days, those who reported short TIB (i.e., less than 6 hours/night) would have higher BMIs.

Methods

Participants

Two hundred eighty eight participants 18–25 years old completed an online survey and provided complete information regarding height, weight, and TIB on work/school days. Of these participants, 38 (13%) had missing data on one or more demographic/lifestyle variable included in analyses, leaving a final sample of 250 participants. Participants were 66% female and 74% non-Hispanic White. They primarily identified themselves as single/living alone (82%) with 54% reporting annual income of \$50,000 or less. Most (88%) reported at least some college (38% were full time students). Twenty-two percent reported receiving a psychiatric diagnosis from a doctor (i.e., depression, eating disorder, or “other” psychological disorder), and 12% a medical diagnosis (i.e., type 1 or type 2 diabetes, hypertension, high cholesterol, heart disease, stroke, heart attack or cancer). Mean age was 21.9 (2.2) years. Participants included in analyses did not differ on BMI ($p = .24$), TIB ($p = .43$), or other demographics ($p = .19-.91$) from those excluded.

Procedures

Participants were invited to take part in an online study of factors associated with weight control in young adults via Internet ads, email blasts, and ads posted in University newspapers/on campuses in the greater Providence area. After consenting to participate electronically, participants were immediately directed to complete an online survey on a secure server, which took on average 30 minutes to complete. Order of presentation of questionnaires was counterbalanced to control for order effects and fatigue. Participants received \$10 for participation and were enrolled in a raffle to win one of three iPods. All procedures were approved by the Institutional Review Board at the Miriam Hospital.

Measures

Demographics and Medical History—Given their association with both sleep and weight status (Patel & Hu, 2008), participants reported their age, gender, ethnicity, race, education, and employment status (working full time, in school full time, working part time and in school part time). They also reported on whether a doctor had diagnosed them with either a psychiatric (i.e., depression, eating disorder, or “other” psychological disorder) or

medical (i.e., type 1 or type 2 diabetes, hypertension, high cholesterol, heart disease, stroke, heart attack or cancer) condition.

Body Mass Index (BMI)—Current height and weight were obtained via self-report and used to calculate BMI (kg/m^2).

Lifestyle/Health Behaviors—Participants reported on the number of hours/day spent watching television, on the computer, and playing video games. They also reported on weekday alcoholic beverage intake (number of drinks/day).

Time in Bed (TIB)—Questions taken from AddHealth (Harris et al., 2009) were used to ascertain work/school day and non-work/non-school day TIB. Given that sleep during the work week is a more stable construct and represents sleep obtained most days of the week (Bjorvatn et al., 2007), analyses focused on work/school day TIB. Specifically, the following was asked of participants for work/school days: “On days when you go to school, work, or similar activities, what time do you usually wake up?” and “What time do you usually go to sleep the night (or day) before?” TIB data were categorized as follows: < 6 hrs, 6–<7 hrs, 7–<8 hrs, 8–<9 hrs, and 9 hrs or more sleep. The ‘7–<8hrs’ category was used as the referent in analyses.

Data Analysis

Analyses were conducted using PASW Statistics 18, Release 18.0.0 (©SPSS, Inc., 2009, Chicago, IL, www.spss.com), and Stata/SE 12.0 for Windows (StataCorp, 2011, College Station, TX, www.stata.com). Initial analyses examined the relationship between demographic, medical, and lifestyle/health behavior variables and BMI using Pearson correlations or analyses of variance (ANOVA). The following variables were assessed given their possible association with BMI: age, gender, ethnicity, race, education, employment status, psychiatric and medical histories. Next, the unadjusted effect of TIB on BMI was assessed using linear regression. Because it was kurtotic (i.e., individuals tended to endorse half and whole hour increments for TIB), the TIB variable was converted into the five sleep categories noted above to more closely represent obtained data. Furthermore, previous research suggests that the association between TIB and BMI should be U-shaped with the lowest BMI for individuals reporting approximately 7–8 hours TIB/night (Patel & Hu, 2008). Categorizing the data allowed for direct comparisons to this ‘protective’ TIB amount. We used a quadratic orthogonal contrast within the regression to assess the overall association of the five-category TIB variable with BMI. We then added significant covariates to determine the independent effect of TIB on BMI, and tested for pairwise differences between the referent and remaining TIB groups. Significance was set at $p < .05$.

Results

Mean BMI of participants was 26.1 (5.4). Mean reported work/school day TIB was 7.62 (1.24) hours per night. When TIB was converted into the five categories for analysis, 16 (6%) participants reported less than 6 hours/night TIB, 45 (18%) reported 6 to less than 7 hours/night TIB, 71 (28%) reported 7 to less than 8 hours/night TIB, 75 (30%) reported 8 to less than 9 hours per night TIB, and 43 (17%) reported nine hours per night or more TIB on work/school days.

Preliminary analyses found that the following demographic and lifestyle/health behaviors were significantly associated with higher BMI: income ($r = -.13$, $p = .03$); weekday hours of television ($r = .24$, $p < .001$); school/work status (i.e., working full/part time and simultaneously working and going to school), $F(1, 286) = 24.64$, $p < .001$; presence of one

or more medical diagnosis, $F(1, 286) = 17.00, p < .001$; and presence of a psychiatric condition, $F(1, 286) = 16.38, p < .001$.

We found evidence for the hypothesized U-shaped pattern in average BMI, $F(1, 245) = 7.98, p = .005$, in unadjusted analyses. In subsequent pairwise comparisons, BMI was significantly greater in the group reporting 'less than 6 hours of work/school day TIB' per night ($t = 2.04, p = .04$), compared to the referent category (7 to < 8 hours TIB per night). No other TIB categories differed from the referent. Significant covariates (i.e., income, television viewing, school/work status, presence of medical diagnosis, and presence of psychiatric condition) were then entered into the regression model predicting BMI. The hypothesized U-shaped pattern in average BMI remained significant, $F(1, 240) = 8.99, p = .003$, and the pairwise comparison of the group reporting 'less than 6 hours TIB' remained significant ($t = 2.54, p = .01$) compared to the referent category; individuals who reported 'less than 6 hours TIB' had BMIs that were 3.4 units higher than the referent group. No other TIB categories differed from the referent.

Discussion

Short TIB on work/school days is associated with higher BMI in young adults. Specifically, individuals who report 6 hours or less TIB on work/school days are more likely to be classified as having higher BMI based on self-reported heights and weights. This finding is consistent with previous work with children and adults (Patel & Hu, 2008), but of note, ours is one of the first studies to demonstrate this association in a young adult sample. In fact, to our knowledge, this is the only study that focused on the particularly high-risk period between 18 and 25 years of age.

The present findings regarding short sleep and obesity risk in this population are particularly relevant for several reasons. Given their high risk for weight gain (Lewis et al., 2000) and poorer enrollment and outcomes in standard behavioral weight loss trials (Gokee-LaRose et al., 2009), there has been a call to develop novel approaches for prevention and treatment of obesity in young adults (Loria, Signore, & Arteaga, 2010). Furthermore, in and of itself, reported short sleep is an important behavioral target in need of effective intervention approaches. It is associated with a number of impairments in daytime functioning (Banks & Dinges, 2007) as well as cardiovascular disease risk (e.g., Knutson, 2010). Estimates from the present study and others suggest that anywhere from 24–31% of young adults report less than seven hours per day TIB (CDC, 2011). Thus, there is a great need to develop effective prevention and treatment approaches for both obesity and reported short sleep duration in this population.

The cross-sectional, correlational design in the present study precludes judgment regarding the benefit of enhancing sleep for prevention or treatment of weight gain during this high risk period. Rather, they indicate that young adults who report shorter TIB are more likely to have higher BMIs. Given that most empirical support for an association between sleep duration and obesity risk is cross-sectional and correlational in nature (Patel & Hu, 2008), evidence to date more strongly supports consideration of short sleep and obesity as comorbid conditions both of which may benefit from intervention. Although there is some support from experimental studies that partial sleep restriction leads to changes in eating and activity behaviors that would promote weight gain over time (e.g., St-Onge et al., 2011), much work remains prior to being able to prescribe changes in sleep as a means for regulating weight.

Although the present study has a number of strengths, including its focus on young adults, findings should be considered in light of limitations, including use of a convenience sample,

which could affect generalizability. Furthermore, self-report was used to obtain TIB and to calculate BMI. Although self-report is a valid proxy for measured height and weight (e.g., Stunkard & Albaum, 1981), self-reported TIB (particularly the single point estimates used in the present study) may not be a strong proxy for actual sleep achieved, which may be a stronger correlate of weight status. It also does not reflect sleep quality, which could impact weight outcomes. In addition, the present sample's mean self-reported TIB was typically higher than what has been reported previously (CDC, 2011). We were also unable to control for the full range of factors (e.g., dietary intake, physical activity levels) that may have influenced the association between TIB and BMI. However, consistency in findings with previous work (Patel & Hu, 2008) lends credibility to the present findings. Finally, the cross-sectional nature of the study design precludes any conclusions regarding causality, and cannot rule out that a third underlying variable may account for the association seen. Future studies that attempt to change sleep duration are needed before such claims can be made.

In sum, findings suggest that reporting TIB of six hours or less on work/school days is associated with higher calculated BMIs in young adults. Future studies would benefit from exploring the association between sleep and weight status in this young adult sample in an attempt to disentangle the potential of future treatment approaches to effectively address sleep and weight concerns to decrease subsequent disease risk.

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