



## Associations of sleep duration and quality with disinhibited eating behaviors in adolescent girls at-risk for type 2 diabetes



Nichole R. Kelly<sup>a,b</sup>, Lauren B. Shomaker<sup>a,c,\*</sup>, Rachel M. Radin<sup>a,b</sup>, Katherine A. Thompson<sup>a</sup>, Omni L. Cassidy<sup>a,b</sup>, Sheila Brady<sup>a</sup>, Rim Mehari<sup>a</sup>, Amber B. Courville<sup>d</sup>, Kong Y. Chen<sup>e</sup>, Ovidiu A. Galescu<sup>a</sup>, Marian Tanofsky-Kraff<sup>a,b</sup>, Jack A. Yanovski<sup>a</sup>

<sup>a</sup> Section on Growth and Obesity, National Institute of Child Health and Human Development (NICHD), National Institutes of Health (NIH), Department of Health and Human Services (DHHS), 10 Center Drive, MSC 1103, Bethesda, MD 20892, United States

<sup>b</sup> Department of Medical and Clinical Psychology, Uniformed Services University of the Health Sciences, Department of Defense, 4301 Jones Bridge Road, Bethesda, MD 20814, United States

<sup>c</sup> Department of Human Development and Family Studies, Colorado State University, 410 Pitkin Street, Campus Delivery 1570, Fort Collins, CO 80523, United States

<sup>d</sup> Nutrition Department, NIH Clinical Center, DHHS, 10 Center Drive, MSC 1078, Bethesda, MD 20892, United States

<sup>e</sup> Diabetes, Endocrinology, and Obesity Branch, National Institute of Diabetes and Digestive and Kidney Diseases, NIH, DHHS, 10 Center Drive, Bethesda, MD 20814, United States

### ARTICLE INFO

#### Article history:

Received 1 April 2016

Received in revised form 28 April 2016

Accepted 1 June 2016

Available online 2 June 2016

#### Keywords:

Binge eating

Eating in the absence of hunger

Obesity

Sleep

Sleepiness

### ABSTRACT

**Objectives:** Short sleep duration and daytime sleepiness have been associated with an increased risk for the onset of type 2 diabetes in adults. There has been far less attention to the characterization of sleep in adolescents at-risk for diabetes or to the possible behavioral mechanisms, such as disinhibited eating, through which sleep may affect metabolic functioning.

**Methods:** We evaluated the associations of sleep duration and daytime sleepiness with a multi-modal assessment of disinhibited eating in 119 adolescent girls at-risk for type 2 diabetes based upon being overweight/obese and having a family history of diabetes. Girls also endorsed mild-to-moderate depressive symptoms. Adolescents reported sleep duration and daytime sleepiness with the Sleep Habits Survey and Children's Sleep Habits Questionnaire. They were administered a series of successive test meals to measure total energy intake and eating in the absence of hunger (EAH). Adolescent binge eating was assessed with the Eating Disorder Examination interview. **Results:** Accounting for age, race, puberty, body composition, depressive symptoms, and perceived stress, reported sleep duration was positively related to test meal total energy intake ( $p = 0.04$ ), but not to EAH. Adjusting for the same covariates, daytime sleepiness was associated with a greater odds of objective binge eating in the previous month ( $p = 0.009$ ).

**Conclusions:** In adolescent girls at-risk for type 2 diabetes, reported sleep characteristics are associated with disinhibited eating behaviors that have been linked to excessive weight and adverse metabolic outcomes. Future studies are called for to evaluate these links using objective measures of sleep.

© 2016 Elsevier Ltd. All rights reserved.

Consistent with extant data in adults (Cappuccio, D'Elia, Strazzullo, & Miller, 2010), accumulating evidence suggests that sleep may be a modifiable behavioral factor associated with obesity and type 2 diabetes risk among youth. Pediatric studies have identified significant associations between short sleep duration and higher adiposity among healthy youth of various weight strata (Bel et al., 2013; Hart, Cairns, & Jelalian, 2011; Navarro-Solera et al., 2015), as well as higher insulin resistance (Matthews, Dahl, Owens, Lee, & Hall, 2012), lower insulin secretion (Flint et al., 2007; Zhu et al., 2015), and hyperglycemia (Koren et al., 2011) among youth with obesity, all independent of adiposity.

Subjective complaints of daytime sleepiness also have been associated with higher body and fat mass among youth (Calhoun et al., 2011; Gaina et al., 2007), even, in some cases, independent of sleep duration (Jarrin, McGrath, & Drake, 2013). Although links between daytime sleepiness and metabolic functioning have not been well-examined in pediatric samples, data from adults indicate that poor sleep quality, including daytime sleepiness, is associated with higher insulin resistance (Pyykkönen et al., 2012) and greater risk for type 2 diabetes (Kita et al., 2012), even after adjusting for body mass index (BMI). While emerging evidence indicates that shortened sleep duration and daytime sleepiness may be associated with a higher risk for excess weight gain and type 2 diabetes, the explanatory factors that account for the relationship of sleep with these adverse outcomes are poorly understood.

One strong possibility is that alterations in energy intake, which occur in response to inadequate sleep and daytime sleepiness, may be

\* Corresponding author at: Colorado State University, Department of Human Development and Family Studies, 410 Pitkin Street, Campus Delivery 1570, Fort Collins, CO 80523, United States.

E-mail address: Lauren.Shomaker@colostate.edu (L.B. Shomaker).

explanatory. In investigations of adults, experimentally-induced sleep loss has been associated with alterations in several physiological processes that may facilitate disinhibited eating, referring to behaviors characterized by a lack of self-regulation over intake, such as overeating, eating in the absence of hunger (EAH), and binge eating. For instance, alterations in appetitive hormones are common after sleep deprivation (Schmid, Hallschmid, Jauch-Chara, Born, & Schultes, 2008; Spiegel, Tasali, Penev, & Van Cauter, 2004) and may trigger disinhibited eating. Short sleep duration also prompts alterations in circadian schedules (Barion & Zee, 2007), which have been related to adults' disinhibited eating in the evening (Nedelcheva et al., 2009). Additionally, excessive daytime sleepiness may be an indicator of inadequate slow wave sleep (Fernandez-Mendoza et al., 2015). In turn, inadequate slow wave sleep has demonstrated a positive association with carbohydrate and fat consumption among adults (Shechter et al., 2012).

A small body of available data in youth largely has been consistent with adult studies. In a randomized cross-over study, adolescents with and without overweight reported consuming significantly more total energy (Simon, Field, Miller, DiFrancesco, & Beebe, 2015) and servings of sweet/dessert foods (Beebe et al., 2013) following a 5-day sleep restriction condition compared to a 5-day lengthier sleep condition. Similarly, children (27% with overweight) asked to increase sleep by 1.5 h for one week reported less total daily energy intake relative to a week when they decreased their sleep by the same amount (Hart et al., 2013). Further, self-reported short sleep duration (Bel et al., 2013; Kjeldsen et al., 2014; Weiss et al., 2010; Westerlund, Ray, & Roos, 2009) and daytime sleepiness (Westerlund et al., 2009) have been associated with lower self-reported diet quality, even after accounting for body composition, screen time, and physical activity. Measured continuously, sleep duration has been inversely associated with self-reported total energy intake among children (Firouzi, Poh, Ismail, & Sadeghilar, 2014; Golley, Maher, Matricciani, & Olds, 2013). By contrast, some studies have found the reverse effect. In adolescent boys with normal weight, three days of lengthier sleep increased observed energy intake and motivation to eat, compared to three days of sleep restriction (Klingenberg et al., 2012). Additional research evaluating the associations of sleep duration and daytime sleepiness with a multi-modal assessment of disinhibited eating, including the use of objective laboratory test meal studies, may help to clarify the nature of the associations between sleep dimensions and eating behavior.

In addition, there has been little attention to other, more specific forms of disinhibited eating behaviors associated with excess adiposity, such as EAH (Shomaker, Tanofsky-Kraff, Zocca, et al., 2010). EAH refers to the consumption of palatable foods in the absence of perceived physiological hunger (Kral & Faith, 2007). One study identified a significant inverse association between objectively-measured sleep duration and parent-reported EAH in response to external cues among young children, independent of children's BMI (Burt, Dube, Thibault, & Gruber, 2014). Binge eating, or the perception of losing control while consuming an objectively large amount of food (American Psychiatric Association, 2013), is another form of disinhibited eating that predicts excessive weight and fat gain in children and adolescents (Field et al., 2003; Sonnevile et al., 2013; Tanofsky-Kraff et al., 2006). Data from adult samples suggest that the associations of short sleep duration and poor sleep quality with adiposity may be explained by disinhibited eating behaviors such as binge eating (Chaput, Després, Bouchard, & Tremblay, 2011; Yeh & Brown, 2014). However, only one study examined the relationship between sleep characteristics and binge eating among youth. In this sample, children with obesity and binge eating had objectively worse sleep quality relative to children with obesity without binge eating (Tzischinsky & Latzer, 2006). Importantly, group differences may have been confounded by BMI, which was not statistically accounted for despite being significantly higher in the youth with binge eating. As such, carefully controlled evaluations of sleep characteristics and various disinhibited eating patterns are needed, particularly among

adolescents, a developmental period during which obesogenic eating patterns may be particularly salient (Vannucci et al., 2014).

We therefore evaluated the associations of reported sleep duration and daytime sleepiness with disinhibited eating. It was hypothesized that lower reported sleep duration and higher daytime sleepiness would be associated with greater observed energy intake, including EAH, and greater odds of binge eating. In all analyses, we adjusted for depressive symptoms and perceived stress, because prior studies indicate that associations between sleep and excess energy intake may be confounded by global mental health symptoms (Calamaro et al., 2010). All associations were evaluated in a sample of adolescent girls at elevated risk for type 2 diabetes.

## 1. Methods

### 1.1. Participants

The current study is a secondary analysis of baseline data from participants enrolled in a behavioral clinical trial for the prevention of type 2 diabetes (ClinicalTrials.gov: NCT01425905). All participants were adolescent girls (12–17 years) deemed at-risk for type 2 diabetes, as determined by being overweight or obese ( $\geq 85$ th BMI percentile for age and sex) and having a first- or second-degree relative with type 2 diabetes, gestational diabetes, or prediabetes. Additional eligibility criteria for study participation included having mild-to-moderate depressive symptoms, as indicated by a score of  $\geq 16$  on the Center for Epidemiologic Studies-Depression Scale (Roberts, Lewinsohn, & Seeley, 1991). Girls were excluded from participating if they had a major medical condition, including type 2 diabetes (fasting glucose level  $> 126$  mg/dL or 2-hour glucose after an oral glucose administration  $> 200$  mg/dL), psychiatric symptoms requiring immediate treatment referral, or major depressive disorder (American Psychiatric Association, 2013). Presence of psychiatric diagnosis was determined via the Schedule for Affective Disorders and Schizophrenia for School-Age Children (Kaufman et al., 1997), a valid and reliable semi-structured interview for youth (Ambrosini, 2000). Other exclusion criteria included pregnancy, participation in a structured weight loss or psychotherapy program, or use of medication that could affect mood or eating behavior. Recruitment efforts included direct mailings, local area community postings, and flyers to physician offices. All procedures were approved by the Institutional Review Board (IRB) of the Eunice Kennedy Shriver NICHD.

### 1.2. Procedures and measures

For the purposes of the current study, participants were studied at baseline, prior to the initiation of treatment, and after a parent/guardian and the participant signed IRB-approved consent and assent forms. All study visits were outpatient assessments completed at the NIH Mark O. Hatfield Clinical Center (Bethesda, Maryland) following an overnight fast.

#### 1.2.1. Sleep duration

Sleep duration was ascertained from a single item on the *Children's Sleep Habits Questionnaire* (Owens, Spirito, & McGuinn, 2000). This item asks youth to report, in hours and minutes, how much sleep they typically obtain on an average school/weekday night. Single items of habitual school/weekday sleep shows reasonable concurrent validity with actigraphy and diary data (Wolfson et al., 2003). Weekday (versus weekend) sleep was selected for the current study to facilitate comparisons across studies among adolescents. Consistent with prior research (Calamaro et al., 2010), participants who reported receiving less than two hours of sleep were re-coded as receiving two hours.

#### 1.2.2. Daytime sleepiness

Daytime sleepiness was evaluated with adolescents' report on the *Sleep Habits Survey* (Wolfson et al., 2003), a survey of general sleep

Download English Version:

<https://daneshyari.com/en/article/906207>

Download Persian Version:

<https://daneshyari.com/article/906207>

[Daneshyari.com](https://daneshyari.com)