



SLEEP DURATION AND OBESITY INDICES IN ADOLESCENTS

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ABSTRACT

Adolescent prevalence of obesity and at-risk waist circumference (WC) has continued to rise worldwide. Sleep duration (SDur) has been hypothesized as a contributing factor to this increase. **PURPOSE:** This study aimed to examine the sleep-obesity relation in adolescents. **METHODS:** Using data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES) ($n=454$; ages 16-18 years), the effect of sleep duration on body mass index (BMI) and WC by gender was analyzed via ANCOVA, linear regression, and logistic regression. Sleep hours were categorized as Under Recommended (<7 hours), Recommended (8-10 hours), and Over Recommended (>10 hours). **RESULTS:** The proportion of participants who were overweight or obese was approximately 21%. Over half of participants met the recommendations for SDur (53.3%). A significant main effect across sleep duration categories was observed via linear regression in the total sample for WC. Longer sleep duration was associated with increased BMI in males, but not females ($\beta=0.136-0.113$, $p<0.05$) and with increased WC in both males ($p=0.030$) and females ($\beta=0.143-0.148$, $p<0.05$). Logistic regression analyses yielded no significant influence of sleep category assignment on overweight BMI classification. **CONCLUSIONS:** For both males and females, WC was impacted by excessive sleep. Similarly, excessive sleep only impacted BMI in males. The greater number of females achieving the recommended amount of sleep, and thus, smaller proportion getting insufficient or more than the recommended amount, contributes to the absence of influence on BMI in females. Likewise, the cut points used to classify Under Recommended, Recommended, and Over Recommended may not be sensitive enough to adequately identify risk differences and weight-related maladies in females.

BACKGROUND & PURPOSE

- 19% of U.S. adolescents are overweight or obese (Hales, et al. 2018)
- The National Sleep Foundation recommends adolescents receive 8-10 hours of sleep per night (Hirshkowitz, 2015)
- Short sleep duration has been linked to adolescent obesity and central adiposity (Garaulet, 2011)
- This study examined the association between sleep duration and obesity in youth

METHODS

- Using 2015-2016 NHANES data ($N=454$), adolescents were grouped according to sleep duration using National Sleep Foundations sleep recommendations
 - Under recommendation (<8 hours)
 - Meets recommendation (6-8 hours)
 - Over recommendation (>8 hours)
- Height and weight were measured by NHANES technicians and used to determine Body mass index (BMI)
- BMI was used to determine weight classifications

METHODS cont.

- Waist circumference was measured by NHANES technicians via Gulick tape at the level of the navel
- Analysis of Covariance and linear regression were utilized to determine the effect of sleep duration on both BMI and WC by gender
- Logistic Regression analysis was utilized to determine influence of sleep category on WC and BMI
- Analyses were performed using SPSS (version 25.0; SPSS Inc., Chicago, IL) at an alpha level of 0.05 for statistical significance

RESULTS

Table 1: Participant characteristics

	Male ($n=218$)	Female ($n=236$)	Total ($n=454$)
Height (cm)	173.6 (7.1)	161.0 (6.9)	167.1 (9.4)
Weight (kg)	76.3 (21.9)	67.6 (18.1)	71.8 (20.5)
BMI (kg/m ²)	25.3 (7.0)	26.0 (6.5)	25.6 (6.7)
WC (cm)	84.9 (17.1)	84.3 (14.7)	84.6 (15.9)
SDur (hours)	8.1 (1.5)	8.0 (1.6)	8.1 (1.5)
Overweight (%)	13.8	26.7	20.5
Obese (%)	21.6	20.3	20.9

BMI: body mass index; WC: waist circumference; SDur: sleep duration
Continuous variables are presented as mean \pm standard deviation (SD).

Table 2: Differences in BMI and WC by sleep category

	BMI (kg/m ²)		WC (cm)	
	Male (n)	Female (n)	Male (n)	Female (n)
Under Rec	24.5 ^a (79)	25.3 (98)	83.1 ^a (78)	82.5 (96)
Meets Rec	25.2 (124)	26.2 (118)	84.9 ^b (122)	84.6 (111)
Over Rec	29.3 ^a (14)	28.2 (20)	96.7 ^{a,b} (14)	90.9 (20)

BMI: body mass index; WC: waist circumference
^a under recommended is significantly different from over recommended
^b recommended is significantly different from over recommended

RESULTS cont.

Table 3: Linear regression models predicting BMI and WC by sleep duration

	Male ($n=218$)		Female ($n=236$)	
	β	95% CI	β	95% CI
BMI (kg/m ²)	0.136*	0.033 – 3.188	0.113	-0.153 – 2.513
WC (cm)	0.148*	0.423 – 8.240	0.143*	0.302 – 6.353

BMI: body mass index; WC: waist circumference
Values are standardized beta coefficient and 95% confidence intervals
* $p<0.05$

- 21% of the sample were overweight or obese
- 53.3% of the sample met the guidelines for sleep duration
- Sleep over the recommended amount was associated with increased BMI in males only ($\beta=0.136-0.113$, $p<0.05$)
- Sleep over the recommended amount was associated with increased WC in both males and females ($p<0.05$)
- Logistic regression analysis suggested no significant influence of sleep category on WC and BMI classification

CONCLUSIONS

- In disagreement with our hypothesis:
 - WC was significantly influenced by sleep over the recommended amount for both genders
 - BMI was significantly influenced by sleep over the recommended amount for males only
- The greater number of females achieving adequate sleep may contribute to the absence of influence on BMI
- Sleep category cut points may not be sensitive enough to determine risk differences in weight classification
- Further research is warranted which subdivides the under recommended category into cut-points that are more sensitive in identifying expected associations between inadequate sleep and obesity