Thoughts on the Association Between Sleep and Obesity

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The rising prevalence of obesity in both adults and children is among the most important current public health issues worldwide. Lifestyle modifications involving increased exercise and dietary modifications for maintenance of healthy weight are frequently promoted by pediatricians, but there is limited evidence to show efficacy.[1] This makes the identification of other modifiable factors to prevent childhood obesity of great importance. Recent studies in diverse populations and various age groups have confirmed associations between shorter sleep duration or poor sleep quality and increased risk of obesity.[2–13] Furthermore, recent data document an inverse correlation between sleep duration in children and risk markers for type 2 diabetes that persists after adjusting for differences in adiposity and differences in physical activity.[14]

Given the increasing evidence linking sleep habits and obesity, it is essential to understand the nature of this association. Theories suggesting both causative and noncausative associations might be proposed. It is possible that obesity and inadequate sleep might jointly reflect the effects of other influences such as excess screen time, inadequate exercise, or less vigilance overall about health habits on the part of the family.[15] Alternatively, reduced or altered sleep and obesity might both represent manifestations of altered hypothalamic functions controlling sleep and controlling neuroendocrine regulation of appetite and insulin sensitivity. The circadian locomotor output cycles protein kaput gene and several related genes form the foundation for the brain's circadian system.[16,17] Alterations in the circadian locomotor output cycles protein kaput gene and related genes have been found to influence both sleep and weight gain and affect metabolic processes that contribute to type 2 diabetes and the metabolic syndrome.[16,17] Furthermore, several brain regions involved in regulating sleep and wake cycles also are involved in regulating fasting and feeding, and these neural systems are influenced by the same hormones and neurotransmitters.[16,17] Sleep and body weight regulation are therefore intricately intertwined on multiple levels.

Although a clinical trial comparing weight gain in children randomly assigned to different sleep conditions could address the question of a causal relation between insufficient sleep and obesity, such a trial would involve substantial logistic and ethical hurdles. In the absence of such a trial, it is essential to collect other types of evidence to characterize the association between sleep and obesity. In this issue of *Pediatrics*, Xiu et al[18] longitudinally followed children 2 to 6 years of age with yearly objective measurements of sleep and adiposity. They found that more frequent late sleep was associated with greater increases in measures of adiposity and that this association was more pronounced in children of parents with overweight or obesity. This study increases the evidence for a causal relation between sleep and obesity because the findings were similar

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(although of lesser magnitude) in children not genetically predisposed to obesity, and there were no significant differences in sleep patterns at baseline on the basis of obesity risk. In addition, children were young and of normal weight at enrollment, so obesity-related factors that could interfere with sleep (ie, sleep apnea) were less likely to be present. The study unfortunately involved a relatively small sample size, and therefore statistical power to detect differences was somewhat limited. It is possible that differences in some sleep measures may have been significant had the sample size been larger. A more robust picture of associations between sleep and adiposity could be gained by following a larger sample for a longer time period.

The data from Xiu et al[18] make an important contribution to the accumulating evidence supporting a link between decreased sleep and adiposity. Whether this association is causal, and therefore amenable to intervention, will be a far more difficult question to answer. Future studies, using interventions to increase sleep duration and sleep quality, will be needed to address this weighty question.

REFERENCES

1. Mead E, Brown T, Rees K, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *Cochrane Database Syst Rev*. 2017;(6):CD012651
2. St-Onge MP, Grandner MA, Brown D, et al; American Heart Association Obesity, Behavior Change, Diabetes, and Nutrition Committees of the Council on Lifestyle and Cardiometabolic Health; Council on Cardiovascular Disease in the Young; Council on Clinical Cardiology; and Stroke Council. Sleep duration and quality: impact on lifestyle behaviors and cardiometabolic health: a scientific statement from the American Heart Association. *Circulation*. 2016;134(18):e367–e386
3. St-Onge MP. Sleep-obesity relation: underlying mechanisms and consequences for treatment. *Obes Rev*. 2017;18(suppl 1):34–39
4. Bell JF, Zimmerman FJ. Shortened nighttime sleep duration in early life and subsequent childhood obesity. *Arch Pediatr Adolesc Med*. 2010;164(9):840–845
5. Chaput JP, Gray CE, Poitras VJ, et al. Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Appl Physiol Nutr Metab*. 2016;41(6, suppl 3):S266–S282
6. Wu Y, Gong Q, Zou Z, Li H, Zhang X. Short sleep duration and obesity among children: a systematic review and meta-analysis of prospective studies. *Obes Res Clin Pract*. 2017;11(2):140–150
7. Anderson SE, Whitaker RC. Household routines and obesity in US preschool-aged children. *Pediatrics*. 2010;125(3):420–428
8. Cappuccio FP, Taggart FM, Kandala NB, et al. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*. 2008;31(5):619–626
9. Rutters F, Besson H, Walker M, et al. The association between sleep duration, insulin sensitivity, and β-cell function: the EGIR-RISC Study. *J Clin Endocrinol Metab*. 2016;101(9):3272–3280
10. Grandner MA, Seixas A, Shetty S, Shenoy S. Sleep duration and diabetes risk: population trends and potential mechanisms. *Curr Diab Rep*. 2016;16(11):106
11. Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. *Lancet*. 1999;354(9188):1435–1439
12. Rao MN, Neylan TC, Grunfeld C, Mulligan K, Schambelan M, Schwarz JM. Subchronic sleep restriction causes tissue-specific insulin resistance. *J Clin Endocrinol Metab*. 2015;100(4):1664–1671
13. Klingenberg L, Chaput JP, Holmbäck U, et al. Acute sleep restriction reduces insulin sensitivity in adolescent boys. *Sleep*. 2013;36(7):1085–1090
14. Rudnicka AR, Nightingale CM, Donin AS, et al. Sleep duration and risk of type 2 diabetes. *Pediatrics*. 2017;140(3):e20170338
15. Bathory E, Tomopoulos S. Sleep regulation, physiology and development, sleep duration and patterns, and sleep hygiene in infants, toddlers, and preschool-age children. *Curr Probl Pediatr Adolesc Health Care*. 2017;47(2):29–42
16. Gotlieb N, Moeller J, Kriegsfeld LJ. Circadian control of neuroendocrine function: implications for health and disease. *Curr Opin Physiol*. 2018;5:133–140
17. Cedernaes J, Waldeck N, Bass J. Neurogenetic basis for circadian regulation of metabolism by the hypothalamus. *Genes Dev*. 2019;33(17–18):1136–1158
18. Xiu L, Ekstedt M, Hagströmer M, Bruni O, Bergqvist- Norén L, Marcus C. Sleep and adiposity in children from 2 to 6 years of age. *Pediatrics*. 2020;145(3):e20191420

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