

Editorial

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Sleep and Diabetes in Adolescents: A Battle between Physiology and Social Factors

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About 200,000 of individuals under 20 years of age have been diagnosed with diabetes. Many of them have type 1 diabetes (T1D) but type 2 diabetes (T2D), a disease that used to be seen primarily in adults over age 45, is becoming more common in young people.¹ Results from the 'SEARCH for Diabetes in Youth study' released data showing that type 2 diabetes in 10 to 19-year-olds had increased 21% between 2001 and 2009. The study reported an increase among White, Black and Hispanic children.²

There are several causes that could be responsible for this jump in prevalence such as an increase in minority population, exposure to diabetes in utero, exposure to endocrine disruptive chemicals and the soaring obesity rates.³ The increase will have public health consequences. More children will enter adulthood with an increased risk of early complications. Younger patients also still have reproductive years ahead of them and diabetes in pregnancy is a risk factor for diabetes in the next generation.⁴

While it is well known that there is a complex genetic background to metabolic diseases,⁵ the rising prevalences of obesity and diabetes have been driven by lifestyle changes. These changes have been the main target for interventions aiming at the prevention and control of the conditions.^{6,7} It is well established that positive energy balance (excessive energy intake and insufficient energy expenditure) is a major contributor to diabetes and obesity.⁵ Sleep has, however, emerged as an additional lifestyle factor and has been suggested as a potential strategy to address adolescent obesity.^{8,9}

Sleep is a biological process that is crucial for our health. It is influenced by circadian rhythms, which are crucial for controlling the sleep-wake cycle, the timing of the release of hormones, our core body temperature regulation, our level of alertness, and our performance level.¹⁰ The sleep-wake cycle is controlled by 2 processes, the homeostatic and circadian processes, and their interaction determines the timing and structure of sleep.¹⁰ The homeostatic process is responsible for the increase in sleep propensity during wakefulness and its dissipation during sleep, whereas the circadian process is responsible for the alternation between periods of sleep and wakefulness (high and low sleep propensities). Another process underlying sleep regulation is the ultradian process, which is responsible for the architecture of the sleep period. This process occurs during the sleep episode and represents an alternation between the 2 basic sleep states, non-rapid eye movement sleep and rapid eye movement sleep.¹⁰ Thus, the synchronization between these processes is essential for health and their interaction determines the timing and structure of sleep.

In adolescence, the sleep-wake patterns are shifted.¹¹ The delays in sleep initiation and wakefulness are driven by multiple intrinsic and extrinsic factors. During puberty children who used to be early birds suddenly become night owls. This, together with early school start times, contribute to short sleep time. In addition, sleep hygiene, the sum of the habits and practices that are conducive to sleeping well on a regular basis, is a problem in adolescents.¹² Irregular sleep rhythms, lack of healthy eating habits and exercise, as well as long homework hours

make teenagers especially susceptible to sleep deficiency.¹² In addition, the body of a teenager will have a hard time getting ready for the night and a restful sleep if it is highly involved in social activities, especially if socialization happens behind the computer or on a tablet or cell phone, which causes sleep onset to be even more delayed, due to a delayed release of melatonin and the chronic sleep deficiency that builds up is not without metabolic consequences. Recent longitudinal data has confirmed that persistent later bedtimes across adolescence are linked to subsequent increases in body mass index (BMI) and an increased risk of obesity.¹³

Interventions focused on realignment of the two processes involved in sleep have shown that they can improve this behavior in adolescents. A study showed that one additional hour of sleep above the 6 hours, which is the usual amount of sleep in adolescents, can lead to a decrease of 9% in insulin resistance. Given the complexity of the factors known to influence sleep duration and quality, sleep improvement programs should be multi-faceted, emphasizing the key factors that affect sleep. Some studies have investigated the effects of sleep advice in those with poor sleep habits,¹⁴ and besides that, education and increasing awareness about healthy sleep habits in the adolescent populations is unlikely to be harmful. However, the development of an effective sleep education program to adolescents requires more studies before implementation can be realized. There have been a number of recent attempts to assess the efficacy of sleep education programs in adolescent populations¹⁴⁻²⁰ with positive results on sleep hygiene, but very few studies have investigated if sleep enhancement has downstream positive effects on metabolic function or body weight. Only two programs have been conducted with obesity and/or metabolic outcomes.^{14,21} Larger, well thought out, randomized controlled trials with regular, objective and prospective sleep assessments. This will help to determine the efficacy of the programs and will shine light on the potential downstream effects such as eating behaviors, physical activity, use of technology and other lifestyle that promote obesity and metabolic disturbances.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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