

# Opinion Article

## The first 1,000 days: how sleep and physical activity influence obesity risk

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In 2022, an estimated 159 million children and adolescents were living with obesity worldwide – a more than threefold increase since 1990, with prevalence rising from 1.7% to 6.9% in girls and from 2.1% to 9.3% in boys [1]. Traditionally, efforts to combat childhood obesity have focused on school-aged children. However, evidence from epidemiology, developmental biology, and neuroscience increasingly highlights the first 1,000 days of life – from conception through age two – as a critical window for lifelong metabolic health [2].

During this sensitive period, organ systems mature, neural circuits for appetite and energy regulation are shaped, and behavioral patterns take root. While nutrition in early life is well recognized, two underestimated but essential pillars of early obesity prevention are physical activity and sleep. These behaviors influence not only energy balance but also hormonal, cognitive, and emotional development. Understanding their roles in shaping obesity risk is crucial for families, clinicians, and policymakers alike.

### **Physical activity in the first 1,000 days: foundations of metabolic resilience**

Spontaneous motor activity emerges prenatally as part of early nervous system maturation. In infancy and toddlerhood, regular movement and developing motor skills are associated with favourable changes in body composition and markers related to metabolic health in early childhood [3].

The World Health Organization recommends that infants under 1 year engage in active play several times a day, and toddlers (1–2 years) accumulate at least 180 minutes of movement daily [4]. Despite clear international guidelines, adherence to recommended levels of physical activity, sleep, and limited screen time in early childhood remains low – with only 14.9% of children meeting all three components of the WHO 24-hour movement guidelines [5]. Low movement early in life is associated with excess weight gain, delayed gross motor skills, and increased adiposity by preschool age.

Early movement in infancy and toddlerhood plays a foundational role in shaping body composition and reducing obesity risk, with increased physical activity linked to lower central adiposity and improved motor development [6]. Proficient motor skills in early life are associated with healthier weight profiles and higher levels of physical activity, particularly in children with elevated BMI [7]. Parental support and a stimulating environment—including encouragement of active play and limited screen time—significantly enhance physical activity levels and body composition in toddlers [8]. Moreover, home- and community-based physical activity interventions in early childhood have been shown to support motor skill development and healthy weight-related outcomes, although consistent improvements in overall physical activity levels remain challenging to achieve [9].

### **Sleep: a metabolic regulator often overlooked**

Sleep is not passive rest – it is an active, anabolic process critical for memory consolidation, hormone regulation, and immune function. From birth to age two, recommended sleep duration ranges from 14–17 hours per day for newborns (0–3 months), 12–16 hours for older infants (4–11 months), and 11–14 hours for toddlers (1–2 years), including naps [4]. However, short sleep duration, poor sleep quality, and irregular routines are increasingly common.

Recent meta-analytic evidence indicates that short sleep duration in infancy, childhood, and adolescence is consistently associated with a higher risk of developing overweight and obesity, with risk ratios ranging from about 1.3 to over 2.0 across age groups [10]. Mechanistically, insufficient sleep leads to:

- (1) Short sleep duration affects the regulation of appetite-related hormones. Specifically, it increases ghrelin levels, which promote hunger, and decreases leptin levels, which signal satiety. This hormonal imbalance encourages increased food intake and food-seeking behavior [11];
- (2) Increased cortisol levels: Insufficient sleep elevates cortisol levels, particularly in the afternoon and early evening. Elevated cortisol is associated with increased visceral fat accumulation, contributing to obesity [12].
- (3) Behavioral dysregulation: Lack of sleep can lead to behavioral changes such as emotional eating and reduced physical activity. Increased fatigue and tiredness from sleep deprivation can reduce the motivation to engage in physical activities, further promoting weight gain.

In the first years of life, parental behaviors, such as inconsistent bedtimes, excessive screen exposure, and lack of sleep education, are major drivers of sleep disruption. Socioeconomic factors, including housing conditions, parental work schedules, and maternal mental health, further complicate sleep hygiene. Importantly, the relationship between sleep and obesity appears to be bidirectional, as excess adiposity may also impair sleep quality and duration, further reinforcing adverse metabolic and behavioral patterns [13].

The sleep–activity–obesity triangle

Although often studied in isolation, physical activity and sleep are interconnected. Active children tend to sleep better, and well-rested children are more likely to be physically active. The two behaviors may synergistically influence energy balance and adiposity.

Emerging evidence suggests that in early childhood, healthy sleep and activity patterns are important contributors to obesity prevention. Conversely, combined sleep and movement dysregulation can have cumulative negative effects, reinforcing poor habits that track into adolescence [14].

### **Key strategies for families and caregivers**

- Promote daily physical activity: Encourage infants and toddlers to engage in age-appropriate movement, from tummy time and crawling to active play and outdoor exploration. Daily movement should begin at birth and be supported throughout early childhood.
- Ensure adequate and quality sleep: Establish consistent sleep routines and create a sleep-friendly environment. Limit screen exposure before bedtime and ensure a quiet, dark, and comfortable sleep space.
- Balance lifestyle habits: Monitor the interplay between sedentary behavior, physical activity, and sleep. Simple changes—like replacing screen time with active play or ensuring earlier bedtimes—can significantly improve health outcomes.
- Practice responsive parenting: Caregivers should learn to recognize infants' cues for tiredness and readiness for activity, adjusting routines accordingly to support natural rhythms.

### **Conclusion**

The first 1,000 days represent a golden opportunity to shape health trajectories through simple but powerful behaviors: movement and sleep. These foundational pillars influence physiology, behavior, and metabolism in profound ways. Supporting families to establish healthy rhythms in these early years may be one of the most cost-effective strategies to prevent obesity and foster well-being across the lifespan.

### **References**

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