



Review Paper

# A link between chronic sleep restriction and obesity: Methodological considerations

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**Summary** Emerging evidence suggests that chronic sleep restriction contributes to obesity. Targeting short sleep duration may therefore offer a novel and effective method of preventing and treating obesity. However, this area of research is only in its infancy, and a complete understanding of how chronic sleep restriction and obesity are linked is currently lacking. The aim of this paper is to briefly review epidemiological evidence for an association between chronic sleep restriction and obesity in adults, and outline the key methodological limitations of these studies. Particular attention is paid to the methods used to measure sleep and obesity, as well as the need to control for potential confounding variables. Methodological recommendations are provided for future studies that will facilitate a more complete understanding of how chronic sleep restriction and obesity are linked in the general population. This has implications for the development of public health programmes that target sleep as a modifiable risk factor for obesity.

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## Introduction

The prevalence of obesity has increased dramatically over the past 30 years and is currently considered a global epidemic.<sup>1,2</sup> Unhealthy diets and insufficient exercise are cited as the main

causes of this epidemic,<sup>2</sup> but public health programmes that target these factors have only been moderately effective in combating obesity.<sup>3</sup> Part of the reason for this could be that other factors also contribute to obesity, but have not been incorporated into existing obesity interventions.<sup>4</sup> One

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possible, overlooked, cause of obesity is chronic sleep restriction (sleep duration <7 h/night), which has become more common in the past 30 years<sup>5,6</sup> and is associated with increased body mass indices (BMI) in children<sup>7</sup> and adults (see Table 1).<sup>5,8–19</sup> It appears that the association between chronic sleep restriction and increased BMI is evident up until

middle age, but is absent in adults aged >40 or 49 years.<sup>9,10</sup> The relationship between sleep duration and BMI could also be U-shaped, but the implications of long sleep for obesity are not clear and will not be discussed.

Unfortunately, causal inferences cannot be drawn from these cross-sectional studies, and it

**Table 1** Summary of major studies examining the link between sleep and obesity in adults

Author and year	Obesity measures	Sleep measures	Confounding variables <sup>a</sup>	Major findings
Vioque et al., 2000	BMI (measured)	Self-reported sleep duration (hours of sleep per day)	None	Sleep duration inversely associated with BMI
Shigeta et al., 2001	BMI (measured)	Self-reported sleep duration and bedtime	None	Short sleep ( $\leq 6$ h) associated with increased BMI
Kripke et al., 2002	BMI (calculated from self-reported height and weight)	Self-reported sleep duration: 'On average, how many hours do you sleep each night?'	None	U-shaped association between sleep duration and BMI in females, and inverse association between sleep duration and BMI in males
Hasler et al., 2004	BMI (calculated from self-reported height and weight)	Interview regarding bedtime, wake time, sleep latency, sleep behaviours and sleep disorder symptoms	Gender, education, physical activity, smoking, binge eating, childhood depression, family history of obesity	Short sleep predicted a non-significant increase in BMI over a 13-year period
Patel et al., 2004	BMI (calculated from self-reported height and weight)	Self-reported sleep duration: 'How many hours of sleep do you get in a 24-h period?'	None	U-shaped association between sleep duration and BMI in women
Taheri et al., 2004	BMI (measured)	Polysomnography Self-reported sleep duration: 'How many hours of sleep do you get on work-day nights and non-work-day nights?'	Age and gender	U-shaped relationship between sleep duration (sleep diary) and BMI. Short sleep linked to decreased leptin and increased ghrelin
Gangwisch et al., 2005	BMI (measured at baseline, self-reported at follow-up)	Sleep diary over 6 days Self-reported sleep duration: 'How many hours of sleep do you usually get a night (or when you usually sleep)?'	Depression, physical activity, education, ethnicity, alcohol consumption, cigarette use, gender, waking during the night, daytime sleepiness, age	Independent association between short sleep duration and obesity. Short sleep predicted a non-significant increase in BMI over a 10-year period
Singh et al., 2005	BMI (calculated from self-reported height and weight)	Night-time awakenings Daytime sleepiness Self-reported sleep duration	Age, gender, loud snoring, hypertension, diabetes, arthritis and alcohol consumption	Short sleep duration associated with increased BMI after controlling for confounding variables

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