

Link between Sleep Disturbances and Fluctuations in Weight-A Short Review

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ABSTRACT

Poor sleep has increasingly gained attention as a contributor to the obesity epidemic. The increased prevalence of obesity in Western nations over the past half-century has been paralleled by a severe reduction in sleep duration. Physiological studies suggest reduced sleep may impact hormonal regulation of appetite. Prospective studies suggest reduced habitual sleep duration as assessed by self-report is a risk factor for an increased rate of weight gain and obesity. Thus, reduced sleep appears to represent an independent risk factor for increased weight gain. Further research is required to determine whether interventions aimed at increasing sleep may be useful in combating obesity.

Key words: Obesity, sleep deprivation, weight gain.

INTRODUCTION

Sleep is a restorative process of the brain and for the brain therefore the sleep is important for health of body(1). There is a relationship between sleep and obesity. This obesity epidemic has been paralleled in modern society by a trend of reduced sleep duration (2). Inadequate sleep can refer to either shorter sleep duration or poor sleep quality. This obesity which is due to sleep loss increases risk of cardiovascular disease and diabetes, reduces life expectancy, impairs quality of life (3). Although diet and physical activity play an important role in risk of weight gain, a potential additional factor, this increased weight gain is due to the combination of increased caloric intake and reduced activity.

Sleep loss is associated with obesity:

When a person sleeps less than 7 hours a night there is a dose response relationship between sleep loss and obesity the shorter the sleep the greater the obesity as typically measured by body mass index (4).

Sleep loss: Sleep loss refers to sleep of shorter duration than the average need of 7 to 8 hours per night. The important symptom of sleep loss is excessive sleepiness during daytime, depressed mood and poor memory

Factors That Disrupt Sleep-

- Caffeine: It may take six to eight hours for the effects of caffeine to wear off completely. Caffeine interferes with sleep signals by blocking adenosine receptors.
- Nicotine: It is a stimulant that causes lighter-than-normal sleep patterns.
- Alcohol: It often has an initial sedating effect, but it can prevent rapid eye movement (REM) sleep and the deep stages of non-REM sleep during the night.
- Psychological disorders: They can disrupt REM and deep sleep. Depression may cause insomnia as well.
- Night time exercise: Daytime exercise is associated with improved night time sleep, but evening exercise can delay the release of melatonin that helps someone fall asleep at night. The National Sleep Foundation recommends leaving three hours between exercise and sleep, if possible.
- Large meals: They can make it tough to fall asleep because they can cause indigestion. Excessive fluid intake can cause you to awaken frequently to urinate.
- Chronic pain: Painful conditions such as fibromyalgia and arthritis can interfere with sleep.
- Medications: Many pain relievers contain caffeine; decongestants and steroid medications can disrupt sleep; and beta-blockers can make it difficult to fall asleep and cause frequent night time awakenings.
- Environment: Noise, lighting, and uncomfortable temperatures also can interfere with a good night's sleep(11).

How hormones affect sleep?

There are many hormones which affect the sleep especially growth hormone,gherlin,leptin,orexin. Growth hormone is secreted during the sleep which promotes growth if there is less sleep than the amount of growth hormone secreted will be very much less,the height is also lowered which increases the BMI ,gherlin an appetite stimulating hormone the level of this hormone is found to be elevated if there is sleep loss it is secreted

by stomach and is lowered in obese subject. Ghrelin is a 28 amino acid hunger-stimulating peptide and hormone that is produced mainly by P/D1 cells lining the fundus of the human stomach and epsilon cells of the pancreas. Ghrelin together with obestatin is produced from cleavage of the ghrelin/obestatin prepropeptide(also known as the appetite-regulating hormone or growth hormone secretagogue or motilin-related peptide) which in turn is encoded by the *GHRL* gene. The full-length preproghrelin is homologous to the motilin protein classified in the motilin family, and is cleaved into the following two chains: Ghrelin and Obestatin. Ghrelin receptors are expressed in a wide variety of tissues, including the pituitary, stomach, intestine, pancreas, thymus, gonads, thyroid, and heart (Howard, 1996). The diversity of ghrelin receptor locations suggests ghrelin has diverse biological functions.

Ghrelin levels increase before meals and decrease after meals. It is considered the counterpart of the hormone leptin, produced by adipose tissue, which induces satiation when present at higher levels. In some bariatric procedures, the level of ghrelin is reduced in patients, thus causing satiation before it would normally occur(13).

Ghrelin is a potent stimulator of growth hormone secretion from the anterior pituitary gland. The ghrelin receptor is a G protein-coupled receptor, known as the growth hormone secretagogue receptor. Ghrelin binds to the GHSR1a splice-variant of this receptor which is present in high density in the hypothalamus, pituitary as well as vagal afferent cell bodies and vagal afferent endings throughout the gastro-intestinal tract(13).

Leptin an appetite lowering hormone secreted by adipose tissue the level get lowered if there is sleep deprivation. Leptin is a hormone made by fat tissue that acts on the brain to regulate food intake and body weight. Orexins A and B is an important hormone which is involved in the regulation of sleeping and eating, it is a peptide , which is produced by the hypothalamus of the brain that interact with the neuron that stimulate the leptons(12).

Short sleep duration associated with reduced leptin,elevated ghrelin,and increased BMI: A number of hormones mediate the interaction between short sleep duration ,metabolism and high BMI but leptin and ghrelin play important role in appetite regulation(5)leptin is an adipocyte derived hormone that suppresses appetite (6) ghrelin is a stomach derived peptide that stimulate appetite (7,8)

This hormonally mediated increase in appetite explain how short sleep is related to obesity this sleep loss also have an effect on sympathetic nervous system and hypothalamic hormone which also influence appetite (9)growth hormone is secreted during sleep and promotes body height .sleep deprived subject show lower GH level this could result lower height and thus higher BMI(10).besides these hormones insulin which is secreted by beta cells of pancreas in

response to a meal is another important peripheral signal that inhibits appetite and reduces food intake, but these hormones are inhibited due to sleep restriction(14).

Impact of hormone leptin , ghrelin and orexin on obesity: Due to shorter sleep duration leptin level decreases and ghrelin level increases, in which leptin suppresses the appetite whereas ghrelin promotes appetite, therefore increase in the level of ghrelin leads to increased food intake and less physical activity during night which leads to obesity. This decreased leptin level and increased ghrelin increases the activity of another hormone orexin produced by the neurons in the hypothalamus which regulate feeding and wakefulness, which is also influenced by both central and peripheral signals, leading to increased food intake(15,16,17).

Other health hazards due to sleep loss:

- Obesity in adults and children
- Diabetes and impaired glucose tolerance
- Cardiovascular disease and hypertension
- Anxiety symptoms
- Depressed mood
- Alcohol use (18).

CONCLUSION

Sleep and body weight appear to share a constellation of contributing factors in child, family and society in which food intake pattern, physical activity and sleep which are integral contributors to obesity risk. Laboratory studies and multiple epidemiological studies have linked short-sleep duration and poor-sleep quality to obesity risk. People with short sleep had reduced leptin and elevated ghrelin. These differences in leptin and ghrelin increase appetite, possibly explaining the increased BMI observed with short sleep duration. In Western societies, where chronic sleep restriction is common and food is widely available, changes in appetite regulatory hormones with sleep curtailment may contribute to obesity. With the growing prevalence of chronic sleep loss, any causal association between sleep alterations and obesity would have important public health implications.

Conflict of interest: Nil.

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