



Sleep less, weigh more

Numerous studies have looked at the link between sleep and weight. Overall, the results show that **if we get less sleep than we need, our weight tends to increase²**.

A recent clinical trial showed that when people were sleep-deprived:

- they ate significantly more calories.
- they had a preference for fatty foods.
- their energy expenditure did not change³.

Participants ate, on average, 300 extra calories per day when sleep-deprived and most of this extra intake was accounted for by fats.

Another study collated data from more than 170 participants subjected to partial sleep-deprivation and the results showed that just a single night of inadequate sleep led to eating, on average, an extra 385 calories the next day⁴.

Yet, while participants took in extra calories when sleep-deprived, they did not expend any extra energy. When this pattern continues for several days, the net result is weight gain. In fact, taking in as little as 200 extra calories a day can lead to meaningful weight gain.

To put this in perspective, one pound of fat is the equivalent of 3,500 calories. So fewer than 10 days of sleep-deprivation could lead to you gaining one pound of weight if you eat in a way that a sleep-deprived person would. **That's a potential gain of just under three stone per year!**

When we eat also appears to be important. Another study found that people who would be considered as 'night owls', whose activity peaks late in the day and who go to bed much later than most, also have a higher risk of weight gain. Late sleepers were found to consume nearly 250 calories more than 'normal' sleepers. They also consumed more fast food and less fruit and vegetables⁵.

So why do we reach for the high-calorie foods when we're tired?

It's probably a behaviour banked from way back in our evolution.

A sleep-deprived caveman may have needed the extra energy to keep alert to danger. However, in our modern world, where calorie-rich food is abundant, and dangerous beasts less so, this behaviour now backfires on us.

The exact mechanisms governing sleep and weight gain are not completely understood. But there is a wealth of data that shows how sleep deprivation alters biological processes in our bodies, how our brain functions and how we behave in our day to day lives. Looking at the the various components, then, we see that in the:

Brain

- Willpower is reduced ↓
- Pleasure and rewards centre signalling is enhanced ↑

Body

- Low leptin makes feelings of fullness decrease ↓
- High ghrelin makes feelings of hunger increases ↑

Behaviour

- Less inclined to exercise ↓
- More inclined to sit and do nothing ↑

While it makes it easier to see the different effects by grouping into these three separate categories, in reality all three interact. The body sends chemical signals to our brain. Our brain processes these messages and we react in certain ways.

Now, we'll look in greater detail at what's known about how sleep deprivation affects our bodies and minds, as well as how the interaction between them can play havoc with our weight.

Hormones and groans - why tiredness sends out the wrong signals

Hormones are chemicals that act as messengers to send signals from one part of our body to another. Many of our hormones are affected by lack of sleep, with several identified as being directly involved in why we gain weight when we don't sleep well.

Two such hormones are known to be important for regulating our drive to eat. These are **ghrelin** and **leptin**^{6,7}. They have roughly opposite effects: ghrelin makes us feel hungry and leptin is mostly responsible for making us feel full. In this way, ghrelin is our signal to go and eat and leptin tells us when to stop.



Leptin

Leptin is mainly produced by fat cells in the body and it works to regulate our fat levels by controlling appetite. The amount of leptin released is directly related to the amount of fat in the body. More fat equals more leptin.

In a healthy person carrying excess fat, leptin levels increase and this signals the brain to reduce appetite accordingly. The body can then use some of the fat stores to power itself, thus lowering the levels of stored fat⁷.

↑fat cells → ↑levels of leptin → ↑signals to the brain → appetite ↓

When we get enough sleep, leptin levels should increase steadily during the night, peaking around 2am. This gradual rise during the night may have evolved so that we don't feel hunger when we should be sleeping⁸.

Many studies have looked at how leptin levels are affected by sleep duration and the consensus seems to be that **leptin levels decrease in sleep-deprived individuals**⁹.

When we fail to get enough sleep our leptin levels remain low. The brain believes that the body needs to take in more energy.

The brain then sends hunger signals and we end up eating — even though we don't actually need the energy! The calories taken in are stored as fat because the body thinks that it needs to build up reserves.

Ghrelin

Ghrelin is mostly made in the stomach and is known as the 'hunger hormone' because it's responsible for making us feel hungry.

Just before we eat, ghrelin levels in the blood increase and this is thought to give rise to the hunger pangs which prompt us to eat. Once we've eaten, our ghrelin levels decrease⁸.

What we eat affects ghrelin levels: carbs and proteins lead to a greater decrease in ghrelin than fats, so healthier options may leave you feeling fuller than, for example, a fast-food burger.

When we sleep, our ghrelin levels naturally decrease because our bodies don't need to burn as many calories when we're not active. But when we don't get enough sleep our ghrelin levels don't decrease as much as they should. Feelings of hunger persist even when the body doesn't need more calories.

So by altering these two key hormones, **sleep deprivation leaves us feeling both hungrier and also less full that we actually are**. It's not hard to see how this situation can - and will - lead to weight gain.

In summary

- Failing to get the sleep your body needs can result in unwanted weight gain.
- Hormones important for hunger and satiety are disrupted, making us feel hungrier and less full.
- Happily, these effects can be easily reversed by taking steps to improve your sleep.

References

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