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## Obesity and hormones

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### Summary

- The hormones leptin, insulin, oestrogens, androgens and growth hormone influence our appetite, metabolism and body fat distribution.
  - People who are obese have hormone levels that encourage the accumulation of body fat.
  - Obesity is a risk factor for disease.
  - Obesity-related disease is preventable with weight loss.
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Hormones are chemical messengers that regulate processes in our body. They are one factor in causing obesity. The hormones leptin and insulin, sex hormones and growth hormone influence our appetite, metabolism (the rate at which our body burns kilojoules for energy), and body fat distribution. People who are obese have levels of these hormones that encourage abnormal metabolism and the accumulation of body fat.

A system of glands, known as the endocrine system, secretes hormones into our bloodstream. The endocrine system works with the nervous system and the immune system to help our body cope with different events and stresses. Excesses or deficits of hormones can lead to obesity and, on the other hand, obesity can lead to changes in hormones.

### Obesity and leptin

The hormone leptin is produced by fat cells and is secreted into our bloodstream. Leptin reduces a person's appetite by acting on specific centres of their brain to reduce their urge to eat. It also seems to control how the body manages its store of body fat.

Because leptin is produced by fat, leptin levels tend to be higher in people who are obese than in people of normal weight. However, despite having higher levels of this appetite-reducing hormone, people who are obese aren't as sensitive to the effects of leptin and, as a result, tend not to feel full during and after a meal. Ongoing research is looking at why leptin messages aren't getting through to the brain in people who are obese.

### Obesity and insulin

Insulin, a hormone produced by the pancreas, is important for the regulation of carbohydrates and the metabolism of fat. Insulin stimulates glucose (sugar) uptake from the blood in tissues such as muscles, the liver and fat. This is an important process to make sure that energy is available for everyday functioning and to maintain normal levels of circulating glucose.

In a person who is obese, insulin signals are sometimes lost and tissues are no longer able to control glucose levels. This can lead to the development of type II diabetes and metabolic syndrome.

### Obesity and sex hormones

Body fat distribution plays an important role in the development of obesity-related conditions such as heart disease, stroke and some forms of arthritis. Fat around our abdomen is a higher risk factor for disease than fat stored on our bottom, hips and thighs. It seems that oestrogens and androgens help to decide body fat distribution. Oestrogens are sex hormones made by the ovaries in pre-menopausal women. They are responsible for prompting ovulation every menstrual cycle.

Men and postmenopausal women do not produce much oestrogen in their testes (testicles) or ovaries. Instead, most of their oestrogen is produced in their body fat, although at much lower amounts than what is produced in pre-menopausal ovaries. In younger men, androgens are produced at high levels in the testes. As a man gets older, these levels gradually decrease.

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The changes with age in the sex hormone levels of both men and women are associated with changes in body fat distribution. While women of childbearing age tend to store fat in their lower body ('pear-shaped'), older men and postmenopausal women tend to increase storage of fat around their abdomen ('apple-shaped'). Postmenopausal women who are taking oestrogen supplements don't accumulate fat around their abdomen. Animal studies have also shown that a lack of oestrogen leads to excessive weight gain.

### **Obesity and growth hormone**

The pituitary gland in our brain produces growth hormone, which influences a person's height and helps build bone and muscle. Growth hormone also affects metabolism (the rate at which we burn kilojoules for energy). Researchers have found that growth hormone levels in people who are obese are lower than in people of normal weight.

### **Inflammatory factors and obesity**

Obesity is also associated with low-grade chronic inflammation within the fat tissue. Excessive fat storage leads to stress reactions within fat cells, which in turn lead to the release of pro-inflammatory factors from the fat cells themselves and immune cells within the adipose (fat) tissue.

### **Obesity hormones as a risk factor for disease**

Obesity is associated with an increased risk of a number of diseases, including cardiovascular disease, stroke and several types of cancer, and with decreased longevity (shorter life span) and lower quality of life. For example, the increased production of oestrogens in the fat of older women who are obese is associated with an increase in breast cancer risk, indicating that the source of oestrogen production is important.

### **Behaviour and obesity hormones**

People who are obese have hormone levels that encourage the accumulation of body fat. It seems that behaviours such as overeating and lack of regular exercise, over time, 'reset' the processes that regulate appetite and body fat distribution to make the person physiologically more likely to gain weight. The body is always trying to maintain balance, so it resists any short-term disruptions such as crash dieting.

Various studies have shown that a person's blood leptin level drops after a low-kilojoule diet. Lower leptin levels may increase a person's appetite and slow down their metabolism. This may help to explain why crash dieters usually regain their lost weight. It is possible that leptin therapy may one day help dieters to maintain their weight loss in the long term, but more research is needed before this becomes a reality.

There is evidence to suggest that long-term behaviour changes, such as healthy eating and regular exercise, can re-train the body to shed excess body fat and keep it off. Studies have also shown that weight loss as a result of healthy diet and exercise or bariatric surgery leads to improved insulin resistance, decreased inflammation and beneficial modulation of obesity hormones. Weight loss is also associated with a decreased risk of developing heart disease, stroke, type II diabetes and some cancers.

### **Where to get help**

- Your doctor
- Dietitians Association of Australia Tel. 1800 812 942

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Hudson Institute of Medical Research

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