

## HUMAN GROWTH HORMONE

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### Annotation

Human growth hormone, also known as HGH and somatotropin, is a natural hormone your pituitary gland makes and releases that acts on many parts of the body to promote growth in children. Once the growth plates in your bones (epiphyses) have fused, HGH no longer increases height, but your body still needs HGH. After you've finished growing, HGH helps to maintain normal body structure and metabolism, including helping to keep your blood sugar (glucose) levels within a healthy range.

**Keywords:** pituitary gland, growth hormone-releasing hormone (GHRH), somatostatin, acromegaly.

Hormones are chemicals that coordinate different functions in your body by carrying messages through your blood to your organs, muscles and other tissues. These signals tell your body what to do and when to do it. Your body makes over 50 hormones, and many of them interact with each other, creating a complex web of processes. Your pituitary gland is a small, pea-sized endocrine gland located at the base of your brain below your hypothalamus. It's made of two lobes: the anterior (front) lobe and posterior (back) lobe. Your anterior lobe makes HGH. Your pituitary gland is connected to your hypothalamus through a stalk of blood vessels and nerves. This is called the pituitary stalk. Your hypothalamus is the part of your brain that controls functions like blood pressure, heart rate, body temperature and digestion. Through the stalk, your hypothalamus communicates with your pituitary gland and tells it to release certain hormones. In this case, your hypothalamus releases growth hormone-releasing hormone (GHRH), which stimulates your pituitary gland to release HGH, and somatostatin, which prevents (inhibits) that release. Healthcare providers use a synthetic form of HGH (sometimes called recombinant HGH) to treat certain health conditions, including growth hormone deficiency. You should never take synthetic HGH without a prescription from your provider.



Your pituitary gland normally releases HGH in short bursts (pulses) throughout the day. The release of HGH is mainly controlled by two hormones your hypothalamus releases: growth hormone-releasing hormone (GHRH), which stimulates hGH release, and somatostatin, which prevents (inhibits) HGH release. Several other endocrine hormones also regulate HGH, including insulin-like growth factor 1 (IGF-1). IGF-1 is a major suppressor of GH production, whereas thyroxine, glucocorticoids and ghrelin stimulate HGH release. IGF-1 that's released by your liver is one of the best-characterized effects of HGH activity. IGF-1 plays a critical role in preventing (inhibiting) the release of the HGH through a negative feedback loop by stimulating somatostatin and inhibiting GHRH release. However, HGH and IGF-1 secretion are regulated by each other, where HGH triggers IGF-1 release and the IGF-1 inhibits HGH release in a feedback loop. In healthy people, HGH release is inhibited by hyperglycemia (high blood sugar) and stimulated by sleep, stress, exercise, hypoglycemia (low blood sugar) and amino acids.

Human growth hormone has two main functions: stimulating growth (mainly in children) and impacting metabolism (how your body turns the food you eat into energy). Human growth hormone triggers growth in nearly every tissue and organ in your body. However, it's most well-known for its growth-promoting effect on cartilage and bone, especially in the adolescent years during puberty. Cells in cartilage called chondrocytes and cells in bones called osteoblasts receive signals from HGH to increase replication and thus allow for growth in size. Once the growth plates in a child's bones have fused, HGH no longer increases height. Instead, HGH helps to maintain normal body structure throughout the rest of your life. Metabolism consists of the chemical reactions in your body that change the food you eat into energy. All of the cells in your body need energy to function properly. Several different complex processes are involved in metabolism. HGH impacts metabolism primarily by increasing the production of insulin-like growth factor-1 (IGF-1) and its effect on cells in your body. IGF-1 is a hormone similar in structure to insulin that manages the effects of HGH in your body. Insulin is an essential hormone your pancreas makes that helps regulate your blood sugar (glucose) levels by decreasing them. Like insulin, IGF-1 has glucose-lowering effects. Your body normally carefully regulates your blood glucose levels. Blood glucose, or sugar, is the main sugar found in your blood. You get glucose from carbohydrates in the food you eat. This sugar is an important source of energy and provides nutrients to your body's



organs, muscles and nervous system. Insulin is the main hormone your pancreas makes to lower blood glucose levels when they get too high, and glucagon is the main hormone your pancreas makes to raise glucose levels when they get too low. Other hormones can counteract the effects of insulin, such as epinephrine (adrenaline) and cortisol. While HGH normally increases blood glucose levels when they get too low, if you have excess amounts of HGH in your body, it can counteract the effects of insulin, causing elevated blood glucose levels.

Can HGH make you taller? Human growth hormone increases vertical growth in children. However, once your growth plates have fused, HGH cannot make you taller. Instead, after you've reached your final height, HGH helps maintain your body's structure and has other important effects on your metabolism. Your pituitary gland releases HGH in pulses. The size and duration of the pulses vary with the time of day and your age and sex. Because of this, random HGH measurements are rarely useful to healthcare providers in confirming or ruling out a diagnosis. Instead, HGH measurement tests are most useful when measured as part of a stimulation or suppression test.

In general, the normal range for HGH levels include:

- **For adults assigned male at birth:** 0.4 to 10 nanograms per milliliter (ng/mL), or 18 to 44 picomoles per liter (pmol/L).
- **For adults assigned female at birth:** 1 to 14 ng/mL, or 44 to 616 pmol/L
- **For children:** 10 to 50 ng/mL, or 440 to 2200 pmol/L

Normal value ranges may vary from lab to lab. Be sure to reference your lab's normal range on your lab report when analyzing your results. If you have any questions about your results, talk to your healthcare provider.

Having lower-than-normal levels of HGH is called growth hormone deficiency. It's usually due to an issue with or damage to your pituitary gland that results in hypopituitarism — when one, several or all of the hormones your pituitary gland makes are deficient. Human growth hormone could be one of the affected hormones. Growth hormone deficiency affects adults and children differently.

HGH deficiency in adults: when adults have a lack of HGH, it causes the following issues:

- Reduced sense of well-being.
- Increased body fat.
- Increased risk of heart disease.



- Weak heart, muscles and bones.

In adults, hypopituitarism that results in HGH deficiency may develop due to a benign pituitary adenoma (a noncancerous tumor) or damage to your pituitary gland or hypothalamus.

HGH deficiency in children: a lack of HGH in children results in poor growth. The main sign of HGH deficiency in children is slow height growth each year after a child's third birthday. This means they grow less than about 1.4 inches in height a year. A child with HGH deficiency may also have:

- A younger-looking face than what's expected for their age.
- Impaired hair growth.
- Delayed puberty.

In children, hypopituitarism that results in HGH deficiency may be present from birth where the cause can be unknown (idiopathic), genetic or due to injury to their pituitary gland (during fetal development or at birth). Children can also develop hypopituitarism due to damage to their pituitary gland or hypothalamus later in life. The main condition associated with higher-than-normal HGH levels is a condition called acromegaly, though it affects adults and children differently. It's a rare condition.

Acromegaly in adults: adults with acromegaly usually have enlarged or swollen hands and feet and altered facial features. Adults with acromegaly can also have thickened bones and enlarged organs and are more likely to have conditions such as high blood pressure (hypertension), Type 2 diabetes and heart disease. Over 99% of acromegaly cases are due to pituitary adenomas, noncancerous (benign) tumors on your pituitary gland. These tumors can produce excess amounts of HGH. Acromegaly is more common after middle-age when growth is complete. Because of this, adults with acromegaly don't get any taller. Instead, their bones can become thicker.

Acromegaly in children: very rarely, children can experience elevated growth hormone levels before they reach their final height, which can lead to excessive growth of long bones and very tall height. This condition is called pediatric acromegaly, but it's sometimes called gigantism. If left untreated, children with acromegaly usually grow to be seven feet tall or taller. Children with acromegaly



may also have general weakness, delayed puberty and headaches. Pituitary adenomas are usually the cause of pediatric acromegaly.

The U.S. Food and Drug Administration (FDA) has approved the synthetic form of HGH for the treatment of certain conditions. The synthetic form of HGH is available only by prescription and is injected.

In children, healthcare providers prescribe HGH to treat:

- Growth hormone deficiency.
- Conditions that cause short stature, such as chronic kidney disease, Turner syndrome and Prader-Willi syndrome.

In adults, providers prescribe HGH to treat:

- Growth hormone deficiency.
- Loss of muscle tissue from HIV.
- Short bowel syndrome.

It's important to only take synthetic HGH if your provider has prescribed it for you.

All in all, Human growth hormone (HGH) is a powerful hormone that's necessary for several important bodily processes. Sometimes, your pituitary gland can make too much or too little of it. If you or your child are experiencing symptoms related to HGH deficiency or excess, it's important to talk to your healthcare provider.

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