



PATIENT RESOURCES

# Pancreas Hormones

January 23, 2022

The main function of the pancreas is to maintain healthy blood sugar levels. It is a large gland located behind the stomach. It produces insulin, glucagon, and other hormones. Diabetes occurs when the pancreas does not produce enough insulin or when the body does not use insulin properly (called insulin resistance).

## Glucagon

## ► Glucagon

Glucagon is a hormone that works with other hormones and bodily functions to control glucose levels in the blood. It comes from alpha cells found in the pancreas and is closely related to insulin-secreting beta cells, making it a crucial component that keeps the body's blood glucose levels stable.

While glucagon keeps blood glucose from dropping too low, insulin is produced to keep blood glucose from rising too high. The two hormones counterbalance each other to stabilize blood glucose. When blood glucose levels fall too low (low blood glucose), the pancreas pumps out more glucagon. This hormone helps blood glucose rise back up in multiple ways:

- › It causes the liver to convert stored glucose into a usable form and then release it into the bloodstream. (A process called glycogenolysis.)
- › Glucagon also stops the liver from taking in and storing glucose, so more stays in the blood.
- › Glucagon helps the body make glucose from other sources, such as amino acids.

When everything is working well, insulin moves glucose out of the blood and into the cells, where it is used for energy. Meanwhile, a complex feedback system within the body lets it know when no more glucagon is needed. In a nutshell, glucagon normally keeps blood glucose from dropping too low. Insulin keeps it from rising too high. The two hormones counterbalance each other.

## **Potential problems with glucagon function**

Glucagon function is crucial to proper blood glucose levels, so problems with glucagon production will lead to problems with glucose levels. Low levels of glucagon are rare but are sometimes seen in babies. The main result is low levels of blood glucose. The treatment is to inject the patient with glucagon. When the individual has recovered sufficiently, eating carbohydrates will then raise the blood glucose levels even more.

High levels of glucagon are also rare but can occur when a patient develops a specific type of tumor in the pancreas. Patients with high levels of glucagon can develop diabetes mellitus or experience unexpected weight loss.

## **Hypoglycemia and Glucagon**

A mild case of hypoglycemia may cause shakiness, headache, sweating, clammy skin, or a pounding heartbeat. Blood glucose level falls to 54–69 mg/dL. Mild hypoglycemia can generally be treated by consuming 15 grams of a fast-acting sugar source, such as fruit juice, non-diet soda, hard candies, or glucose tablets.

If hypoglycemia becomes severe, you may not be able to safely swallow food or drink. By this point, the blood glucose level is less than 54 mg/dL—often below 40 mg/dL. You may feel very confused, pass out, or have a seizure. Without prompt treatment, severe hypoglycemia may lead to a coma or even death.

Fortunately, severe hypoglycemia in a person with diabetes can be treated with prescription glucagon. Someone else will likely need to administer the

glucagon, but this person does not have to be a health care professional. Relatives, friends, coworkers, and others can learn to give glucagon.

## ▸ Emergency Glucagon

### Types of Emergency Glucagon

**Injection Kit:** A traditional injection kit contains a vial of powder (glucagon) and a syringe filled with saline (salt water).

**Auto-injector Pen:** A pre-mixed, ready to use dose of glucagon. It is similar to the EpiPen used to treat serious allergic reactions.

**Dry Nasal Spray:** A (needle-free) nasal powder form of glucagon. It uses a plunger to spray into the nose, much like a typical nasal spray.

### What Happens After a Dose of Glucagon?

If you pass out due to severe hypoglycemia, you will usually regain consciousness within 15 minutes after receiving glucagon. Once you are awake and able to swallow, your helper should give you a fast-acting sugar source. After that, eat a long-acting sugar source, such as crackers and cheese or a sandwich with meat. In addition, call your health care provider right away. Your provider may have additional treatment advice.

If you remain unconscious 15 minutes after receiving glucagon, your helper should administer one more dose of glucagon and call 911. Your helper should also call 911 if you wake up but are still confused.

## Side Effects of Emergency Glucagon

Possible side effects of glucagon treatment include:

- › Nausea and vomiting
- › Headache
- › Temporary increase in heart rate
- › Redness and swelling at the injection site.

*For nasal glucagon, additional side effects may include:*

- › Runny or stuffy nose
- › Red or watery eyes
- › Itchy nose, eyes, or throat

If you are struggling with managing blood sugar, or chronic low blood sugar levels, a number of factors could be causing your problem. Talk to your doctor about glucagon and whether or not it could be a factor. Consider asking:

- › Which treatments and lifestyle changes can help manage my diabetes?
- › Is glucagon impacting my blood sugar levels?
- › What can I do to improve glucagon levels?
- › What should be my target blood glucose range?
- › How can I better control blood sugar levels?
- › What can I do to increase my awareness of low blood glucose?
- › How can I treat mild hypoglycemia to help keep it from becoming severe?
- › Do I need a glucagon prescription? If so, which product is best for my needs?

> Where can people in my support network find training on how to give glucagon?

>

## Insulin is Essential

### ► Insulin

Essential for life, the hormone insulin regulates many metabolic processes that provide cells with needed energy. Understanding insulin, what insulin does, and how it affects the body, is important to your overall health. Tucked away behind the stomach is an organ called the pancreas, which produces insulin. Insulin production is regulated based on blood sugar levels and other hormones in the body. In a healthy individual, insulin production and release is a tightly regulated process, allowing the body to balance its metabolic needs.

### What Does Insulin Do?

Insulin allows the cells in the muscles, fat and liver to absorb glucose that is in the blood. The glucose serves as energy to these cells, or it can be converted into fat when needed. Insulin also affects other metabolic processes, such as the breakdown of fat or protein.

### Problems with Insulin Production or Use

The most common problem associated with insulin is diabetes. Diabetes occurs when the body either does not secrete enough insulin or when the

body no longer uses the insulin it secretes effectively. Diabetes falls into two categories:

Type 1 diabetes occurs when the pancreas cannot produce insulin sufficiently to meet its own needs. This commonly occurs in children, and while an exact cause has not been found, many consider it to be an autoimmune disease. Some symptoms of type 1 diabetes include tiredness, increased urination and thirst, and problems with vision.

Type 2 diabetes is more commonly associated with adults and lifestyle choices. People with type 2 diabetes will produce insulin but often not enough for their body's needs. They may also struggle to use the insulin they produce effectively. Patients may not know they have type 2 diabetes until they have an annual checkup, as symptoms tend to be mild until the disease has become severe.

When the body does not produce enough insulin or use it efficiently, blood sugar levels build in the body. Also, the body's cells do not receive the energy they need from glucose, so the patient may struggle with fatigue. When the body turns to other tissue, like fat or muscle, for energy, weight loss may occur.

High blood sugars are a common symptom of diabetes, but patients who are treating their diabetes with insulin injections may inject too much insulin on occasion. This causes the body's cells to take too much glucose from the blood, leading to a low blood sugar episode. Low blood sugar can cause confusion, dizziness and fainting. Because nerve cells rely entirely on glucose for energy, low blood sugar can also trigger a nervous system response.

If you suspect that you are struggling with insulin levels and production, your healthcare provider can have your insulin levels checked by an A1c blood test. If you are diagnosed with diabetes, you will need medical oversight to manage the condition. Consider asking:

- › How can I manage blood sugar and insulin levels?
  - › What type of monitoring do I need?
  - › What lifestyle changes can make blood sugar levels more stable?
  - › How can I prevent diabetes from developing if I am at risk but have not developed the disease?
-