

## Hypoglycemia (low sugar)

### Definition

Hypoglycemia is low glucose (sugar). It is often called a “low” or a “reaction” or a “hypo”. Glucose can be measured in the blood with finger poke using a home blood glucose monitor, (HBGM) or in the body water (interstitial fluid using) a [continuous glucose meter](#) (CGM). For the purposes of this article hypoglycemia is present if

- 1) the individual looks or feels abnormal, or in acting abnormally and the blood glucose is < 4.0 or
- 2) the blood glucose is < 3.0 (on double-checking) regardless of how the individual looks or feels or in acting.

*Note glucose values from CGMs are less accurate than finger pokes particularly when the true blood glucose value is < 4.0. If a CGM repeatedly reports < 4.0 without symptoms a finger poke test should be performed to confirm hypoglycemia.*

The lack of awareness of hypoglycemia is called “[hypoglycemia unawareness](#)”. It is common in individuals who have had Type 1 diabetes for more than 20 years.

### Cause

Hypoglycemia is caused by excess insulin in the blood. For individuals with diabetes excess blood insulin is due to either excessive insulin given by injection (or pump) or sulfonylurea medications that release insulin into the blood including glyburide, gliclazide, glimepiride, glipizide and others

### Symptoms

Hypoglycemia is potentially serious, as glucose is the fuel of the body & the brain. The commonest symptoms associated with hypoglycemia are hunger, shaking, sweating & heart pounding. If these symptoms are ignored or if they are not appreciated (a condition called “neuroglycopenia”, not uncommon situation in people on insulin for > 15 years) the brain starts to fail - this follows a pattern sequence not dissimilar to alcohol intoxication: at first reduced concentration and attention (associated with increased reaction time), followed by a change in mood or personality (anger, excitement, and loss of inhibition), and then as the blood glucose falls, frank confusion followed by seizures, coma or even death.

The terms “mild”, “moderate” and “severe” hypoglycemia are used by the general public to describe the severity of the episode of hypoglycemia. Doctors reserve the term “severe hypoglycemia” to describe a situation when the individual is so impaired as to be incapable of identifying the episode of hypoglycemia or to be able to treat a low blood glucose successfully him/herself.

### Safety

All individuals using insulin or sulfonylurea medication must test their blood glucose before driving or operating machinery and must “not drive when their blood glucose is under 5”. Thus if the blood glucose is <5.0 and driving or the operation of machinery is intended, whether or not there are symptoms, sugar/starch should be consumed and the blood glucose retested 5 minutes later. Driving/machinery operation should not occur until the blood glucose is 5.0 or above.

### Routine treatment of hypoglycemia

Hypoglycemia is treated by consuming sugar, white starchy food like bread or crackers or by ingesting sugary drinks like juice or regular pop (not diet pop which contains artificial sweetener, and no sugar). For a mild low, the dose of sugar/starch is 10 grams, roughly one rounded teaspoon of sugar or half a cup of juice. If the blood glucose remains low after 5 minutes repeated doses of sugar/starch can be given. If the person feels low, blood glucose should be tested and the person should eat if he/she is indeed low. If the person feels very low, he/she should eat before testing his/her blood glucose.

### Prevention of hypoglycemia

Hypoglycemia can be prevented by purposeful testing of sugar to identify the cause of excessive insulin. If the low sugar occurs during the night or before breakfast then at least a 10% (often 20%) reduction in the dose of basal insulin (such as glargine, detemir or degludec) or or the basal insulin infusion rate(s) in pump users.

If the hypoglycemia occurs within 4 hours of a meal reduction in meal-time rapid insulin by 10-20% should be made in addition to considering a reduction in the basal insulin.

For individuals on a sulfonylurea medication that medication should be immediately stopped. Note the effect of sulfonylurea medication may last up to 72 hours.

### Special hypoglycemia treatment scenarios

- 1) **Severe hypoglycemia:** if an individual’s blood glucose is so low that they cannot or will not consume glucose, juice or starch then emergency treatment is required. In hospital or in a doctor’s office an intravenous injection of glucose is always the best treatment. Otherwise glucagon is a moderately effective treatment - it can be given either by injection (using a kit) or by an intra-nasal spray. Patients using hypoglycemic medications should ask their doctor for a prescription.

- 2) **Accidental insulin overdose:** given the complexity of modern insulin therapy including basal and rapid (mealtime) insulins that are packaged similarly, sometimes only the colour and writing on the insulin pen distinguishing one from the other, it is not surprising that accidental insulin dosing errors occur. Without appropriate corrective measures there is potential for severe hypoglycemia. Ultimately the treatment is to perform frequent finger-poke blood glucose measurements and to consume sugar/starch or juice if the blood glucose falls below 5.0. The person must continue to assess their blood glucose frequently until the unintentional insulin has left the system.

Below are the two commonest serious accidental insulin overdose scenarios:

A) rapid (mealtime) insulin given instead of intended basal (long-acting) insulin.

Because rapid insulin is 98% cleared within 6 hours additional surveillance is required for 6 hours. For this scenario the standard blood glucose testing recommendation is to test:

every 5 minutes until sugar >5.0 then  
every 15 minutes for an hour then  
every 30 minutes for 2 hours then  
hourly for 3 hours then resume routine monitoring

B) excessive basal (long-acting) insulin (glargine/detemir/degludec). Because these insulins do not enter the system for at least 4 hours, don't peak until 12 hours & are 95% cleared at 24 hours additional surveillance is required for 24 hours. For this scenario the standard blood glucose testing recommendation is to test sugar:

every hour for the first 16 hours then  
every second hour for 8 hours then  
every 4 hours for 8 hours then stop.

C) excessive regular insulin (Humulin R, Novolin R, "Toronto"). Regular insulin takes 20-40 minutes to enter the system, 2-3 hours to peak and is 95% cleared at 12 hours additional surveillance is required for 12 hours. For this scenario the standard blood glucose testing recommendation is to test sugar:

every 5 minutes until sugar >5.0 then  
every 15 minutes for an hour then  
every 30 minutes for 2 hours then  
hourly for 9 hours then resume routine monitoring

D) excessive intermediate-acting insulin (NPH). Because NPH does not enter the system for at least 2 hours, doesn't peak until 6-8 hours & is 95% cleared at 18 hours additional surveillance is required for 18 hours. For this scenario the standard blood glucose testing recommendation is to test sugar:

every hour for the first 10 hours then

every second hour for 8 hours then stop.