Insulin 101: Understanding Insulin

Without a working knowledge of the way insulin works in your body it is very difficult to effectively manage diabetes. . . Kind of like driving a car without knowing how to use the gas pedal and brakes . . . it can get you into a lot of trouble!

Insulin is a natural hormone that allows your body to utilize and store energy from the food you eat. Whenever you eat, the food is broken down into tiny particles of sugar, which are called Carbohydrates or Carbs. In addition to carbohydrates, foods contain proteins, fats, and other smaller nutrients like vitamins and minerals which are necessary for life.

As food is digested and absorbed into your blood stream, the sugar from carbohydrates causes blood sugar levels to rise. This in turn sends a signal to the pancreas, telling it to release insulin. I like to think of the sugar floating around in our blood as tiny bundles of energy, waiting to be used. The energy is there but it can't be used unless it is gets connected. . . Like a battery in a flashlight that is unable to make connection with the light bulb unless the switch is turned on. Insulin acts like the switch to allow connection between the sugar in your blood and your body cells in order to produce the light of LIFE. Everything your body does requires energy. . . Even sleeping! And, in order to use the energy you need insulin.

This is of course an oversimplification of a very complex regulatory process that takes place in your body everyday . . . and insulin is only one of the many hormones that impact and regulate blood sugar levels.

With diabetes, however, a lack of insulin is of primary concern, and your job is that of mimicking the natural function of your pancreas by managing your bodies' supply and demand for energy and insulin. Unfortunately, the act of taking an insulin injection does not mean that the insulin is ready for action, or that the insulin will get to the right place at the right time. Insulin has to be absorbed before it is able to work, just like food has to be broken down and absorbed before it can be used for energy and other body functions.

In order to manage your bodies' supply and demand for energy and insulin you have to know when to put pressure on the gas peddle, when to let up, when to break, and when to put the pedal to the metal.

To help you do this there are many different kinds of insulin, sometimes called "designer" insulin because they are designed to be absorbed at different rates and speeds . . . Designed to give you more control and the ability to direct when they absorbed, so you don't get too much too fast and crash, or too little too late and go high.

When insulin arrives too early or too late, it can send your bodies' hormonal balance on a roller coaster ride, and it can become a very discouraging and debilitating process. The goal is, of course, to get the insulin where it needs to be, at the time your body needs it. And, in

order to do that you have to think ahead, and try to match the amount of insulin you take to the amount of carbohydrate you eat. Correcting high blood sugar after the fact is stressful to your body, and contributes to rapidly changing blood sugar levels which can make you feel downright awful. The stress in turn contributes to the need for more insulin than would otherwise be necessary.

In order to make insulin work in your body, in the way your body needs it to work, it is important to understand the length of time that it takes for different types of insulin to be absorbed.

Rapid Acting Insulin: Fast and efficient

Rapid acting insulin is taken immediately before a meal to help prevent after meal highs, and is used to correct for high blood sugar.

Types of Rapid Acting Insulin:

Humalog® (lispro)

Novolog® (aspart)

Apidra® (glulisine)

Regular Acting Insulin: Middle of the road

Regular insulin was at one time the fastest acting insulin available. It is used in much the same way that we now use rapid acting insulin, but it is taken about 30 minutes before a meal so the insulin has opportunity to start working closer to the time that food from a meal is absorbed.

Although Regular Insulin is no longer state of the art in insulin therapy, it is still used due to the fact that it costs significantly less than that of rapid acting insulin.

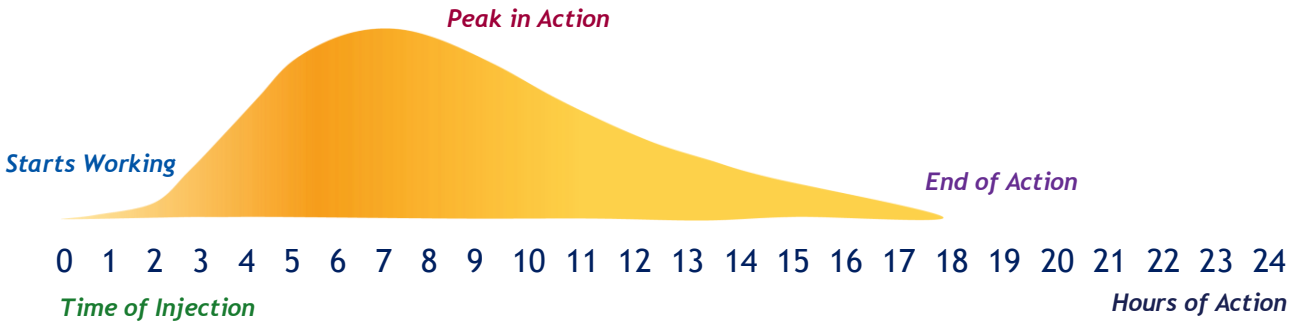
Types of Regular Insulin: Humulin® R and Novolin® R

Long Acting Insulin: Long for the road

Long acting insulin is designed to meet your bodies' ongoing need for insulin. Because you need energy all day long, it stands to reason that you need insulin all day long as well. For this reason long acting insulin is often called Basal or "base line" insulin. Your bodies' baseline need for energy varies at different times of day, due to changes in your bodies' circadian rhythm. Trying to match the delivery of basal insulin to your bodies' rhythm can be challenging, because there are so many variables at work. What works for one will not work for all, and what works now may not work latter.

For this reason there are several different types of basal insulin, each designed in a different way to allow absorption as it is needed over the long hall.

NPH:



NPH is the oldest long acting insulin available. It starts working within 1 ½ to 4 hours, peaks at 4 to 12 hours, and lasts up to 24 hours in the body. It has a white milky appearance due to particles of crystalline zinc and protamine that are added to delay its absorption.

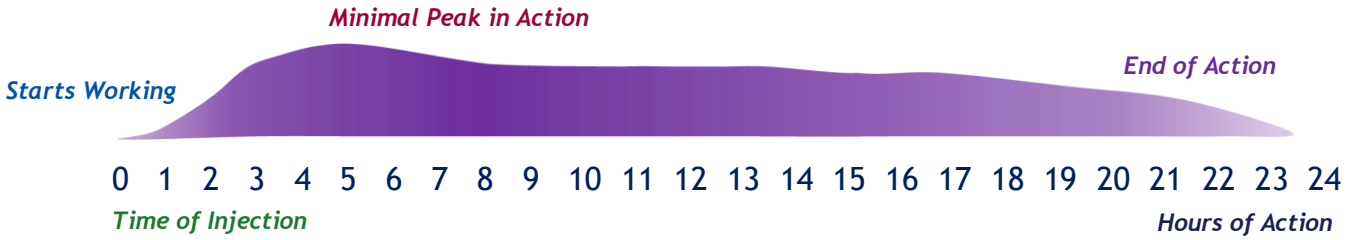
When using NPH insulin it is very important to gently roll the vial in your hands for 30 seconds, prior to drawing it up in a syringe, to insure that all the crystalline particles are evenly distributed. Proper mixing improves the consistency of absorption.

Limitations: NPH insulin is highly variable in absorption, with as much as 45% variability from one day to the next.

Benefits: NPH costs less than newer designer insulin

Types of NPH Insulin: Humulin® N and Novolin® N

Lantus *(glargine):*

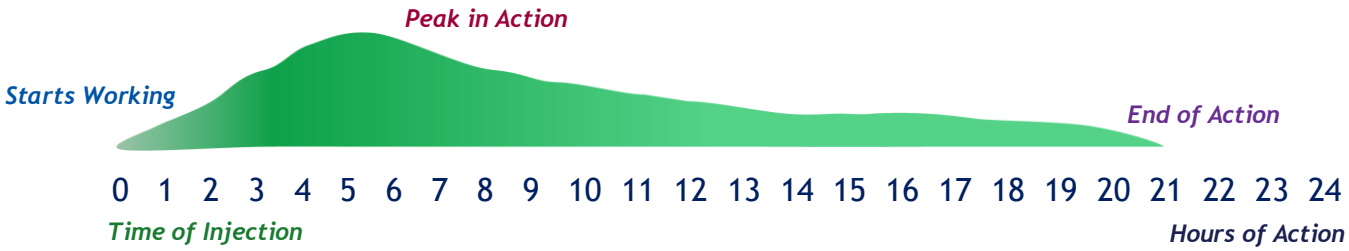


Lantus is considered 24 hour basal insulin because it has fairly consistent absorption over a period of about 24 hours. The insulin is clear, but after it is injected the difference between your bodies' pH and the insulin's pH causes a reaction that forms crystals. The crystals are then broken down for absorption throughout the day.

When using Lantus you should avoid giving an injection of rapid acting insulin within 2 to 3 inches of the site where Lantus was injected. Some people find it helpful to give Lantus in their lower abdominal area, while saving their upper abdominal area for injections of rapid acting insulin.

Benefits & Limitations: Every "body" is not the same, and some people absorb Lantus more quickly than others. This can lead to a limited supply of basal insulin towards the end of the day. For those who are less sensitive to insulin in the late evening hours, this can be good. Others may absorb Lantus more rapidly right after an evening injection, which can lead to early morning hypoglycemia. Alternatively, the increased absorption may provide a peak in action that is needed to cover the "dawn" rise in blood sugar levels that many people experience. To accommodate for individual variability in absorption, your doctor may recommend taking Lantus at different times of the day.

Levemir (detemir)**:**



Levemir is clear insulin that tends to have a smooth absorption curve. Following injection Levemir binds with proteins, known as albumin, at the injection site, and later it binds with proteins in the blood. This binding and rebinding with proteins helps modulate and slow its absorption over an extended period of time.

Absorption of Levemir is often "dose dependent," meaning that the insulin may work differently depending on the dosage that is taken. For some individuals this means that two injections, taken at different times of the day, may work better then a single daily injection.

Benefits & Limitations: Levemir is often well tolerated by people who are sensitive to insulin. In clinical trials, it was shown to cause less night time hypoglycemia than similar long acting insulin. On the flip side, the Total Daily Dosage (TDD) of insulin that is needed in use of Levemir may be slightly higher than that of other basal insulin, and may therefore be less cost effective for people who are extremely resistant to insulin.

Written by Claire M. Blum, MS Ed, RN, CDE