

## Basal Basics

Whether you use an [insulin pump](#) or take multiple daily injections of insulin, having the right basal insulin program and setting the right doses is very important. Receiving too much basal insulin, or receiving it at the wrong times, can result in frequent (and perhaps severe) hypoglycemia as well as unwanted weight gain. Receiving too little basal insulin will produce high blood sugars and make it very difficult to set appropriate mealtime bolus doses. Insulin pumps allow the greatest degree of precision in setting basal insulin levels and can produce the best control and lifestyle flexibility.

Each person's basal insulin requirement is unique, affected by factors such as body size, activity level, stage of growth, hormone levels, and the amount (if any) of internal insulin production from one's own pancreas.

During a person's growth years (prior to age 21), basal insulin requirements tend to be heightened throughout the night. This is due to the production of large amounts of hormones (growth hormone and cortisol) that stimulate the liver to release extra glucose into the bloodstream. After the growth years, production of these hormones is reduced and limited primarily to the predawn hours. The "dawn effect", as this is called, results in an increased secretion of glucose by the liver in the early morning. Thus, basal insulin requirements in most adults tend to peak during the early morning hours.

In most cases, the daily (24-hour) dose of basal insulin is slightly less than the daily mealtime insulin. This depends on a person's body weight and sensitivity to insulin, which is affected greatly by physical activity. The bigger you are, the more basal insulin you will need. The more active you are, the less you will need. During a person's growth/teen years, basal insulin needs can be particularly high. In advanced age, basal insulin needs can be quite low.

## Setting Basal Doses

When evaluating basal insulin levels, keep this important fact in mind: In the absence of food, exercise and mealtime/bolus insulin, basal insulin should hold the blood sugar steady. Any significant rise or fall in blood sugar during a fasting basal test probably means that the basal rates need to be adjusted – even if the blood sugar winds up near normal by the end of the test.

It is a good idea to fine-tune your pump's basal insulin settings before settling on specific bolus doses or insulin/carb ratios to use at mealtimes. When high or low blood sugars appear, it is difficult to know what to adjust unless the proper basal insulin levels have already been established.

To test your basal insulin settings, you will need to wait approximately 4 hours after your last bolus and meal/snack. This will give the carbs time to finish digesting and the bolus time to finish working. The meal (or snack) eaten before the test should be fairly low in fat (no restaurant food or take-out) in order to avoid a delayed blood sugar rise. You must stay connected to the pump continuously during the test, and go about your normal daily activities. However, heavy exercise should be avoided during the fasting phase of the

test. Testing should not be performed during an illness or onset of menses, following hypoglycemia, or if the blood sugar is greater than 250 at the beginning of the test. (see “requirements for basal insulin testing” below)

### **To start the test:**

- Check your blood sugar about four hours after your last bolus
- If the blood sugar is above 250, bolus for the high blood sugar and cancel the test
- If below 70 (or 80 if you have hypoglycemia unawareness), eat to bring your blood sugar up and cancel the test
- If the blood sugar is not too high or too low, proceed with the test
- Check your blood sugar every couple of hours until you next usual mealtime

If your blood sugar drops by more than 30 mg/dl during the test period, the basal rate is probably too high. If it rises by more than 30 mg/dl, the rate may be too low. The basal rate should be changed in increments of .05 to .2 units/hr depending on your usual settings and the magnitude of the rise or drop that took place. The next day, re-test to see whether the adjustment produces a steadier blood glucose level. Continue to adjust and re-test until steady blood glucose levels are obtained.

Although basal tests can be conducted in any order, it is usually advisable to test the overnight basal rates first, and then move on to daytime testing/fine-tuning. Setting proper overnight basal rates does not mean that the daytime settings are correct: each phase of the day (morning, afternoon, evening, overnight) should be tested independently.

Note that basal rates are usually changed one or two hours prior to an observed rise or fall in the blood sugar, since the rapid-acting insulin infused by the pump takes about an hour to peak. For example, if your blood sugar rises between 3 am and 7 am, you would increase the basal rate between 2 am and 6 am. Also, keep in mind that it is rare to have multiple “peaks” and “valleys” to a basal insulin program. The vast majority of people require one peak and one valley.

Fine-tuning basal insulin can be complex. Don’t hesitate to reach out to your diabetes provider.

## Requirements for Basal Insulin Testing

1. No food being digested
  - a. You may not consume any calories for at least 4 hours leading up to the basal test.
  - b. The meal/snack preceding the basal test should be low in fat.
  - c. Do not consume any calories during the basal test, unless your blood glucose drops low.
  - d. You may have water, diet beverages and other non-caloric foods during the test.
  - e. No caffeinated beverages during the basal test.
2. No bolus insulin working during the basal test
  - a. Do not bolus for at least 4 hours preceding the basal test.
  - b. Bolus normally (do not extend the bolus) for the last meal/snack.
  - c. Do not bolus during the test, unless your blood glucose is above 250.
3. No changes in the body's normal glucose output
  - a. No hypoglycemic episodes for at least 6 hours preceding the basal test.
  - b. No illnesses during the testing (fever, infection, virus).
  - c. No steroid medications being used.
  - d. Avoid testing basal rates within two days of starting a menstrual cycle.
4. Allow basal insulin to be delivered uninterrupted
  - a. Do not put the pump into suspend.
  - b. Do not disconnect from the pump.
  - c. Do not have a temporary basal rate running.
  - d. Do not change your cartridge, tubing or infusion set during the test.
5. Maintain low-moderate activity level.
  - a. You may perform light/moderate exercise soon after your last meal/snack if it is your normal time to do so.
  - b. Perform usual daily activities during basal test.
  - c. Do not engage in heavy exercise once the basal test begins.
6. Monitor blood glucose levels
  - a. Start testing at least 4 hours after last bolus.
  - b. Check blood glucose level every 1-2 hours during daytime tests; every 2-3 hours during overnight tests.