

SELF BLOOD GLUCOSE MONITORING

The whole purpose of self monitoring of blood glucose (SMBG) is to know where your blood glucose (BG) is. With the discovery of insulin 100 years ago and the development of many medications since that time to treat the elevated blood sugars characteristic of diabetes, it has become increasingly important to know where your blood glucose is throughout the day so that you can control the hyperglycemia of diabetes to avoid its complications and at the same time not to over treat the disorder and precipitate low blood sugar reactions. In non-diabetic individuals the body has finely tuned regulatory mechanisms to control blood sugars in a narrow range, typically 70 to 100 fasting in the morning, no greater than about 160 after the intake of sugars and other carbohydrates with meals, and most of the rest of the 24 hour day generally in the range of 70-110. People with diabetes, particularly Type 2 diabetes, can generally also achieve this level of blood glucose control with the use of diet, exercise and medications. The SMBG that you do at home can help you to adjust your regimen of diet, exercise and even some medications to better regulate your BG levels, and will help your physician adjust your medications to further approximate those goals. The purpose of this lesson is to help you understand how to properly test your BG levels, maintain your BG testing meter in good working order, and interpret the BG values that you get.

Using blood glucose meters is generally easy. When you first get a new meter, you will need to set the time and the date. This is important because if you use your meter to store the blood sample results, it has to use the correct time and date to properly identify the blood glucose values. You first need to turn the meter on and insert a test strip in the meter. Many of the meters on the market will turn themselves on and off when you insert or remove a test strip. When you insert the test strip, most meters will display a calibration code. You need to check to make sure the calibration code displayed matches the code on your current bottle of test strips. If it doesn't you need to set the meter to the correct code on your test strip bottle. This calibrates the meter to properly read the results from that bottle of test strips. Once you have verified the calibration code, the machine will typically signal you it is ready to receive a test drop of blood.

There are numerous types of lancing devices you can use to obtain a drop of blood. These devices can prick your finger, fleshy palm below the thumb, fleshy palm below the little finger, or forearm area. The lancets in these devices range in gauge from 22 gauge (larger) to 31 gauge (smaller) and most of the lancing devices can be set to puncture shallower or deeper. If you use your fingertips (the most commonly used area), you should puncture the areas along the sides of your fingertips, not the tips of your fingertips. Most of your sensory nerve endings are concentrated right on the tips of the fingers, and that area would be more painful. Going along the sides of the fingertips will lessen the pain.

The size of the drop of blood you will need varies with the type of meter. Most meters now use only 0.3 to 5 μl (microliters) of blood, a small fraction of a drop. With the test strip inserted into the machine, you touch the end of the test strip to the droplet of blood and by capillary action the blood will be drawn into the strip and the meter processing will begin. Within a few seconds, the results will be displayed on the meter. You should

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bring in a record of your BG readings to your physician for use in adjusting your diabetic medications.

There are several common problems associated with SMBG testing. If you are unable to get enough blood, try 1) getting a larger size (lower gauge number) lancet, 2) setting the lancing device to go deeper, 3) making sure you are not lifting the lancing device off your skin when you pull the trigger on the device, 4) warming your hands under warm water to increase the local circulation of your fingers by dilating the capillaries, 5) avoiding pricking the same spot time after time (You will build up a callus there if you do and it will be less painful, but become increasingly harder to get blood from that area), 6) using a different area, such as your forearm.

If you don't think the BG result is correct, check to make sure the code number in the meter matches the number on your bottle of strips. You can also use Control Solution to test the meter's accuracy. Control solution usually comes with a new meter. It can also be purchased for your meter from a pharmacy. Either the bottle of control solution or your bottle of strips will have on it an acceptable control range. What this means is that if you use the **control solution** instead of a drop of blood on a test strip in your meter, and the meter reads a number that is within the limits of the control range, everything is working properly with your meter and the strips. If you test a drop of the control solution and it reads outside of the control range, something is wrong with your meter or the test strips. At that point you should call the manufacturer's help line.

There are a number of good meters on the market. When used properly, most meters will perform quite well. Some meters have the advantage of not having to set codes with each bottle of strips. Some meters are capable of doing data manipulation and analysis for more useful data interpretation. Usually you can call a manufacturer or a help line and get a new meter for free. After all, the companies make their profits selling the strips to the meters, not the meters themselves. So the meter companies are happy to give out lots of meters as long as people use their test strips.

Once you've got some blood glucose numbers, how do you interpret the results? The first thing to do is to sort the results out in relation to the time of day. I usually ask my patients to categorize their BG readings as before breakfast, before lunch, before dinner or before bed. Sort out the readings in this fashion and then average the readings at each of these times. These average blood glucose readings will tell you what you typically run during these periods of time. I like to use readings before meals and at bedtime because these tend to be the lowest BG readings of the day, and they show me the maximal effect of your diabetic medications. This tells me if there is any room to increase the medications more. If all the BGs you are taking before meals and bedtime are running in the ranges cited under Setting Goals for Diabetes, it's likely your glycohemoglobin (HbA1c) will be about 6.5% or less. (There are some individuals who DO have good fasting BGs and good pre-meal BGs and good bedtime BGs yet have higher glycohemoglobins. These are usually people whose BG levels are going up too quickly and too high right after meals. For those individuals, other therapies may be needed that specifically target that kind of abnormality.) If your blood sugar averages

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are higher than the desirable range, there are a number of possible explanations. The amount of physical activity you've been doing over the last 24 hours may be substantially less than usual. The meal you ate last may have had more sugar and/or carbohydrate in it than usual. You could have missed taking one of your medications or had some kind of medication error. If all of those issues are not applicable, then perhaps your medication(s) needs adjustment to address the high average BG reading.

If your reading seems too low, perhaps you're having a low blood sugar reaction! A BG reading of 70 mg% or less associated with symptoms of hypoglycemia (such as sweats, shakiness, hunger feeling, weakness, nausea, confusion) is typical of these reactions. You need to have some sugar or a simple carbohydrate snack, sit down and rest for 15 to 20 minutes to allow the sugar to get into your bloodstream and start to raise your BG level, and then either recheck your BG to make sure it is getting better, or if its mealtime, go ahead and eat. If it's not mealtime, then you should have a snack to carry you through to the next meal.

The FDA has approved new continuous sensing blood glucose meters. These meters can be worn on your belt. There is a small catheter that fits within a needle that you insert just under the skin on your abdomen. You pull the needle out and leave the catheter in place for up to several days at a time. Through a wireless connection the catheter will send body fluid glucose level results to the meter on your belt every 5 minutes 24 hours a day. You DO still have to do 2 finger stick BG readings a day to calibrate the belt meter to your capillary blood glucose levels. But the meter has great advantages. It can be programmed with alarms to signal when the blood sugar level goes too high or too low. It can wake you up at night to check yourself if it senses a low BG level. It can help prevent low blood sugar reactions.

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