

Chapter 11. Blood Glucose Testing/ Doctor Visits



Blood Glucose Testing

Because of the major advances of medical science and technology, blood glucose testing is a very important tool for diabetics to track the progress of their blood glucose levels. Blood glucose (BG) testing is the **most powerful diagnostic tool** that a diabetic has to determine the state of their health on a daily basis. In addition to diet, exercise, and medication, it is the most important key to effectively managing the disease. And, for Type 2 diabetics, it has the power to *reverse* the disease – once effective nutritional, exercise and spiritual programs have been implemented. Unfortunately, most diabetics either do not test their blood glucose on a frequent-enough basis or do not take the appropriate corrective actions to take based on the results. Consequently, most diabetics can never get to a point where they can *proactively* control their blood glucose level and their diabetes.



By increasing your blood glucose testing, you can more readily determine the potential cause and effect relationships between your high glucose readings and the events that may be driving those high readings, e.g. meals, drugs, exercise, stress, illness, emotional state, menstrual cycle start (for women). Keep in mind that there will be times when your glucose levels will be high for no apparent reason, but, the more you test, the more infrequent will be those types of occurrences. Blood glucose testing is probably the most misunderstood and least-performed activity of the eight “living” elements for managing and controlling diabetes, so do not overlook this critical activity.

Blood Glucose Tests & Normal Ranges

The fasting blood glucose test is performed by pricking your finger and placing a drop of blood on a test strip. This drop of blood is analyzed by your blood glucose meter and translated into a number that is displayed in the window of your glucose meter. This number indicates your blood glucose level at that particular moment and is based on what you ate and did during the past few hours since your last meal. The following is the set of normal ranges for blood glucose levels.

Fasting glucose level before meals: 80 to 120 mg/dl

Optimum Range: 80 to 100 mg/dl

Optimum Running Average: less than 100 mg/dl

Postprandial glucose level (2 hours after meals): 90 to 130 mg/dl

Optimum Range: 80 to 110 mg/dl

Optimum Running Average: less than 100 mg/dl

Note: To convert mg/dl to mmol/L, divide the number by 18. Refer to the following table to compare readings in mg/dl vs. mmol/l.



Hemoglobin A1C Testing

Another important blood glucose test is the Hemoglobin A1C test. This test measures the percentage of glucose in the blood for the past two to three months and provides a more reliable measure of your blood glucose control during that time frame. Because A1C values are directly proportional to the concentration of glucose in the blood over this time period, they are not subject to the wide fluctuations of the day-to-day fasting blood glucose tests. The test is also known by several other names, including such variations as glycated hemoglobin test, glycosylated hemoglobin test and HbA1C test.

You will know whether your blood glucose has been under control during the past two to three months, based on the hemoglobin A1C percentage. The hemoglobin A1C normal range of 4.4% to 5.5% correlates to the blood glucose monitor normal range of 80 mg/dl to 120 mg/dl.

DEATH TO DIABETES GLUCOSE TESTING/DOCTOR VISITS

Refer to the following table, which correlates the hemoglobin A1C percentages and blood glucose meter readings.

HbA1C (%)	4	4.4	5	5.5	6	7	8	9	10	11
BG (mg/dl)	65	80	100	120	135	170	205	240	275	310
BG (mmol/l)	3.6	4.4	5.5	6.6	7.5	9.4	11.4	13.3	15.3	17.2

Figure 9. Hemoglobin A1C & Blood Glucose Readings

The hemoglobin A1C number indicates if your treatment strategy is working, making the A1C test one of the most effective tools in diabetes care. If your A1C is higher than desired, you and your health care team can adjust your strategy to help you better control your diabetes and prevent the onset of complications. If you can lower your A1C percentage, you will dramatically improve your chances of controlling the disease and preventing complications.

Your red blood cells contain hemoglobin, a protein that carries oxygen from your lungs to all the cells in your body. When a red blood cell first forms, it has no glucose attached to it. But with diabetes, you have too much glucose in your bloodstream. That extra glucose enters the red blood cells and attaches (glycates) to the molecules of hemoglobin. The more glucose in your blood, the more hemoglobin that gets glycated. The A1C test measures the percentage of that glycated hemoglobin, offering a snapshot of your average blood glucose control for the past few months.



The hemoglobin A1C test helps to confirm the validity of your daily blood glucose self-testing. Some people, especially young children, may not perform their self-tests correctly. If you mistakenly think your blood glucose has been well controlled but your A1C is high, it could mean there's a problem with your self-testing routine. On the other hand, if the A1C reading is within the normal range but your average fasting blood glucose level is high, the A1C reading may be wrong, depending on your health state. Be careful not to draw any significant conclusions from the A1C test if it does not align with your fasting average blood glucose readings. You may want to retest the A1C and/or increase your fasting blood glucose tests to resolve any potential differences.

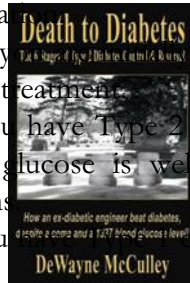
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Because the normal range for glycated hemoglobin values varies among laboratories, ensure that you understand what numbers represent the normal range for your test. Your healthcare professionals will take that variation into account when they interpret the results of your A1C test.

You may also be able to check your A1C level at home with an over-the-counter test approved by the Food and Drug Administration. For this test, you draw a large drop of blood from your finger, mix it with a special solution, place it in the A1C monitor and receive results in several minutes. Talk to your doctor about using a home test if that's your preference.

Your A1C testing schedule may vary depending on your individual situation and how your diabetes changes over time. In general, have the A1C test two to four times a year. Here is the schedule recommended by the American Diabetes Association:

- First test your A1C when you are newly diagnosed with diabetes or when you start your initial treatment.
- Test every 6 months if you have Type 2 diabetes and you don't use insulin, and your blood glucose is well-controlled with diet and exercise or oral medications.
- Test every 3 months if you have Type 1 diabetes or you have Type 2 diabetes and use insulin.
- Test every 3 months if you change treatment, such as starting a new medication, or if your blood glucose is not well controlled.



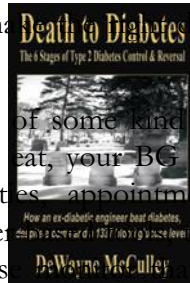
However, as previously mentioned, if your A1C tests and blood glucose tests conflict with each other, you may want to have your A1C tested more frequently. Usually, the more you test your blood glucose at home, the more unlikely that you will have any major conflicts with any lab tests.

Objectives of Blood Glucose Testing

The key objectives of blood glucose (BG) testing include the following:

- Determine how well your BG levels are being controlled between meals.
- Determine how well your BG levels are being controlled *after* meals.
- Determine your cells' level of insulin resistance.
- Determine what actions to take, to better control your BG levels, reduce your insulin resistance and eventually eliminate your insulin resistance.
- Determine what actions to take to reduce and then eliminate the need for the diabetic drugs.
- Determine what actions to take to reverse the disease.
- Provide invaluable data/information to your doctor so that he/she can better help you make decisions to better control your BG levels.

Tip: Purchase a notebook of some kind to record your daily activities, including when/what you eat, your BG readings, medications/dosages, other health data, activities, appointments, events, etc. If you are comfortable with computers, then, you may want to consider purchasing a blood glucose meter that provides a robust set of test data that can be transported to a computer (spreadsheet) for further analysis or to a tool that can provide corrective actions.




Blood Glucose Testing Techniques

Proper blood glucose testing requires practice and patience. The following are some guidelines and tips that will help to ensure that your readings are accurate.

- Purchase a glucose meter that aligns with your health needs, personal preferences and fits within your financial pocketbook. (Refer to the next section for details).
- Read the instructions that explain how to use your glucose meter. But, don't try to use the meter for the first time on your own – let the nurse or diabetes educator walk you through the steps.

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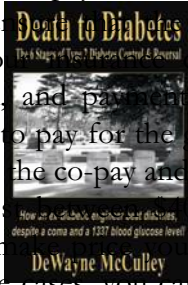
- Then, demonstrate those same steps to the nurse/diabetes educator so that he/she can correct anything that you may be doing wrong.
- Set aside a quiet, isolated place to test your blood glucose and record the readings.
- Always wash your hands before testing. Ensure your fingers are dry. If you use alcohol, ensure the alcohol has dried before puncturing your skin.
- Use a clean lancet to prick your finger (or forearm).
- Ensure the drop of blood covers the test strip fully. Be careful not to touch the test strip to prevent any contamination. While waiting for the reading, dab the puncture with a cotton swab of alcohol and throw it away.
- Record the number that is displayed in the glucose meter window into your logbook as soon as it is displayed. If you don't like the number because it is high,  Keep in mind that this is normal and part of the journey. *Author's Personal Note:* I believe that I learned more and healed faster because of the high readings. But, I must admit that I felt very anxious and nervous during my early testing. As I became more knowledgeable, I actually looked forward to the readings.
- Ensure that you store the test strips and meter in a cool, dry place.
- Recalibrate your glucose meter per the instructions, especially when you purchase a new set of test strips. This is to ensure the accuracy of the readings. If the readings seem to be off for some unknown reason, check the test strips for damage, expiration date and check the meter, e.g. for cleaning, a new battery. If you can afford it, use a second meter to compare your readings.
- Bring your meter to your doctor's office to perform the test and compare the number with the doctor's number. Keep in mind that your test readings are usually 10 to 15% lower than the readings at the doctor's office primarily because most home glucose meters measure whole blood, which consists of several ingredients including plasma fluid; whereas, your doctor measures only the plasma portion of the whole blood which is more concentrated. Also, your readings will be less accurate due to human error.

DEATH TO DIABETES GLUCOSE TESTING/DOCTOR VISITS

- While at the doctor's office, demonstrate to the nurse how you test your blood glucose so that he/she can identify any corrections that you need to make.
- Review what the blood glucose readings mean with your doctor to compare your understanding with his/her understanding. Reach agreement on any corrective actions to improve your blood glucose control.

Glucose Meters

Obtain a glucose meter system that aligns with your health needs, personal preferences and fits within your financial pocketbook. The following is a list of criteria to consider when purchasing a meter.

- Insurance: Ensure that you find out how much your insurance company or Medicare will pay before buying a glucose meter. If you buy from a website, e.g.  a glucose meter supply site will work directly with your insurance company or Medicare on the processing, paperwork and payment for the glucose meter. Many times, you won't need to pay for the glucose meter up front and will only be responsible for the co-pay and/or deductible.
- Price: Most meters cost between \$50 and \$100, depending on the feature set, but don't make price the only criterion for choosing a glucose meter. In some cases, you can get a free meter, because the company makes its money on the test strips.
- Features:
 - o Some meters provide alternate test sites (e.g. arm, thigh) that require less blood and are almost pain-free because the arm/thigh are not as sensitive as your finger, e.g. Prodigy, One Touch, TheraSense (FreeStyle Flash). This is very important, especially if you plan to increase your testing. Because the readings at alternate sites may vary due to the actual glucose concentration being different, you should not switch sites in the same week.
 - o Some meters contain built-in strips with discs or cartridges to make it easier to handle test strips, e.g. Accu-Check, Bayer.
 - o Some meters provide (English/Spanish) voice for people with vision issues, e.g. Prodigy.

GLUCOSE TESTING/DOCTOR VISITS DEATH TO DIABETES

- o Most meters provide enough memory to store at least the latest 100 readings, with date and time, plus a running average of the last 14 to 30 days.
- o If vision is a concern, some meters are designed with bigger, easier to read displays; and, others include audible controls.
- o Some meters provide data processing and additional testing data such as a running average and trend reports, which can be downloaded into a computer.
- o Other more sophisticated meters allow you to record insulin doses, carbohydrates eaten and exercise performed; and can even provide suggestions, based on your glucose readings.

Author's Personal Note: My daughter bought my first glucose meter (Accu-Check) while I was in the hospital. I bought a second meter (TheraSense Freestyle) because it allowed me to more easily test my glucose several times a day by using my arm instead of my fingers.

When to Test & What to Do

The following are some guidelines to utilize when testing your blood glucose (BG) level. Keep in mind that the more you test, the more data you can capture, and the easier it will be for you (and your doctor) to draw conclusions and take corrective actions that will control your blood glucose level and improve your health. Unfortunately, many diabetics try to draw conclusions and take corrective actions from one or two tests a day. When this fails, they become discouraged and stop testing all together; or, they continue to test but they don't take any corrective actions with their nutrition and exercise.

1. Measure and record your BG several times a day, at the same times.
 - a. Measure your BG at the following times each day: before breakfast; two hours after breakfast; before lunch; before dinner; two hours after dinner; before bedtime.
 - b. For additional data, measure your BG at one or more of the following times each day: two hours after lunch; before snacks, two hours after snacks; after stressful events; before and after exercise; before driving your car (especially if your average glucose level is too high or low).

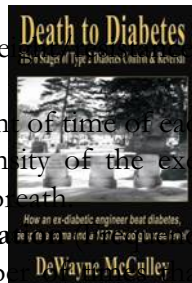
DEATH TO DIABETES GLUCOSE TESTING/DOCTOR VISITS

- c. Measure your BG at least 3 to 4 times a day if your objective is to manage and control your BG level from meal to meal; and, take corrective actions based on those readings.
 - d. Measure your BG at least 5 to 7 times a day if your objective is to *reverse* the disease because you will need more data to evaluate the proper actions to take. If finances are an issue, then, spread your BG measurements throughout the week to ensure you get a good sample of fasting and post-meal readings. After 2 to 3 months, you will have enough data and will be able to decrease the number of daily BG tests.
 - e. If your BG average is greater than **126** mg/dl, and/or your Hb A1C is greater than **5.5%**, then increase the number of blood glucose tests to help analyze what's causing your blood glucose level to be outside the normal range.
2. Review and analyze your BG readings before you take your medication to determine if you need to change your dosage. Also, review your readings in conjunction with your food log and other events at the end of each day, week, or month depending on your current health and health goals. Determine the specific corrective actions that you plan to take by modifying one or more of the following variables if your blood glucose level is too high (outside the normal range).
- a. **Nutrition** (Amount, Type of food, Frequency)
 - Reduce eating the “dead” processed foods.
 - Increase eating the “live” super foods to help the body repair the trillions of defective (insulin-resistant) cells.
 - Increase the number of meals for the day, but ensure the meals are evenly spaced throughout the day.
 - Decrease the total number of calories of the previous meal for those BG readings that are the highest.
 - Ensure there is a balance of carbohydrates, proteins, and fats with each meal.



GLUCOSE TESTING/DOCTOR VISITS DEATH TO DIABETES

- b. **Nutritional supplement** (Amount, Type, Frequency)
- Begin drinking 2 to 3 cups of raw vegetables juices daily, e.g. Brussel sprouts, string beans, carrots, parsley. Mix in 1 tbsp. of wheat grass or flaxseed for fiber, protein, and EFAs.
 - Add one or more nutritional supplements, depending on health needs, e.g. natural multivitamin/mineral, wholefood supplement, Omega-3 EFAs, CoQ10, alpha lipoic acid, chromium, biotin. Stop taking any synthetic vitamins!
 - Add a quality herbal supplement, e.g. gymnema sylvestre, bitter melon, organic cinnamon cassia bark extract.
 - Add a food-based supplement to your juice, e.g. flaxseed, super greens (spirulina, chlorella, barley grass), glyconutrients.
- c. **Exercise** (Frequency, Duration, Intensity)
- Increase the number of times that you exercise during the week.
 - Add anaerobic (weight lifting) exercise to your exercise program.
 - Increase the amount of time of each exercise session.
 - Decrease the intensity of the exercise, especially if you are constantly out-of-breath.
- d. **Cleansing/Detoxification** (Frequency)
- Increase the number of times that you cleanse/detoxify the body, especially if you have not noticed an increase in your energy level and an improvement in your bowel regularity.
 - Review the quality of the herbal products and the cleansing/detox process with an experienced herbalist, naturopathic doctor, or other healthcare professional. Ensure that you are not using synthetic supplements.
 - Add or increase juicing with raw vegetables and grasses.
- e. **Testing** (Frequency, Timing)
- Increase the number of BG tests to better understand the cause and effect relationships.
 - Re-evaluate your records to ensure your corrective actions align with your readings. If you are not certain, review this chapter and discuss with your doctor and other diabetic experts.



DEATH TO DIABETES GLUCOSE TESTING/DOCTOR VISITS

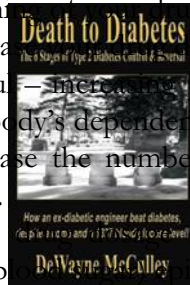
- Change the timing of your blood glucose testing, e.g. test after the meal to better understand your body's level of insulin resistance.
- Work with your doctor to determine whether you need any additional medical diagnostic tests if your health is not improving.

f. **Medication** (Dosage, Frequency)

(Obtain your doctor's approval before making any drug changes)

- Work with your doctor to get weaned off as many drugs as possible to reduce the number of side effects and the toxic load on your liver, kidneys and other organs – which all work to prevent the body from healing.
- Ensure you are taking the right dosage of each drug. Ensure the proper amount of insulin is in the syringe.
- Change the timing of your drug dosage relative to your meal.
- Increase/decrease your drug dosage before the meal.
- Note:* Be careful — increasing your drug dosage will gradually increase your body's dependency on the drugs.
- Increase/decrease the number of times that you take your drugs each day.
- Decrease your drug dosage if you are experiencing hypoglycemic (low blood sugar) episodes.
- Switch to a new drug or a new combination of the drugs you're taking.
- *Note:* The following types of drugs may increase your blood glucose level: ACE inhibitors, antibiotics, antidepressants, diuretics, steroids, and cancer drugs.

3. In general, if you optimize your nutrition, exercise, and testing regimens, you should see an improvement with your fasting BG readings within two to three weeks. You should see an improvement with your post-meal BG readings within another two to four weeks, depending on your health state and drug therapy.
4. Review the proposed corrective actions to your nutrition and exercise with your doctor before you make any changes.



Doctor Appointments & Annual Scheduling

You should ensure that you set up the necessary doctor appointments during the calendar year as specified by your doctor (Primary Care Physician). If possible, try to schedule your appointments during the same time period each year. The following is a list of the key doctor visits that you should complete during the year.

Visit	Purpose	Frequency
Primary Care Physician/Endocrinologist	Check blood glucose, hemoglobin A1C, kidney tests, nerves (foot exam)	Every 3 to 6 months
Primary Care Physician	Physical exam; Other tests: blood pressure, cholesterol, kidneys, liver	Annual
Ophthalmologist	Eye tests for macular degeneration, cataracts	Every 6 months or annual
Wellness coach; Dietitian/Nutritionist	Wellness; Nutritional plan, etc.	As required
Dentist	Cleaning of teeth and gums, dental examinations	Cleaning: every 3 mos. Exams: annual
Podiatrist	Examining nerve damage	Every 3 to 6 months or as required

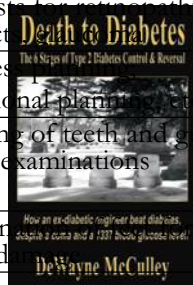


Figure 10. Schedule of Doctor Visits

You should visit your primary care physician and/or endocrinologist on a regular basis to review your progress, your blood glucose readings, corrective actions, and other notes – at least until you have your blood glucose level under control. Depending on your health needs and your health goals, you should get a complete physical and set of blood work every 6 to 12 months to identify any trends that may be getting overlooked, especially if you’re not making any significant improvements.

Concerning your feet, you should always clean and inspect them daily. Record any abnormalities to discuss with your physician at your next visit. Keep your feet clean and moist; and wear cotton socks for better absorbency. Concerning your teeth/gums, you should always check them for any bleeding that doesn’t stop, and, notify your dentist and primary

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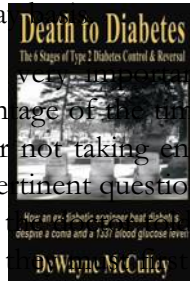
care physician immediately. Gum disease can increase internal inflammation and increase the risk of cardiovascular disease.

Depending on your health needs and your health goals, other members of your diabetes care team may include one or more of the following: cardiologist, neurologist, nephrologist, physiotherapist, naturopathic doctor, or psychiatrist. Other members may include a wellness coach, diabetes educator, pharmacist, community health nurse, or social worker.

Doctor Appointments

One of the best ways to manage your diabetes is to develop an effective working partnership with your doctor. Your doctor's role in this partnership is to provide medical advice, offer treatment options and recommend resources. Your role is to monitor your symptoms and blood glucose readings, report them accurately and do what you can to manage your disease on a day-to-day

Doctor appointments are prepared to take full advantage of the time with their doctor. Then, they complain about the doctor not taking enough time with them. Or, they don't ask the doctor any pertinent questions; or, they don't bother to take any notes and forget what they discussed with them. The doctor could spend more time with them, but they take full advantage of the time that they have with their doctor. Then, they will be pleasantly surprised how well their doctor responds when they take a more active role in their health.



The following is a set of guidelines to help improve the effectiveness of your appointments and the relationship with your doctor. If you are unable to establish a better partnership with your doctor, let him/her know your concerns. If there is no improvement, or you have a concern with taking drugs, consider talking with a doctor in the field of alternative medicine, e.g. a naturopathic doctor (www.naturopathic.org); or, work with a diabetes wellness coach who has a medical background.