

# Managing Your Diabetes Basics and Beyond

Diabetes Action Research and Education Foundation



### About Diabetes Action Research and Education Foundation

The Diabetes Action Research and Education Foundation (Diabetes Action), a non-profit 501(c)3 organization founded in 1990, is committed to the prevention and treatment of diabetes and to the funding of innovative, promising research aimed at finding a cure for diabetes and diabetes related complications.

Diabetes Action's additional projects include:

- being an advocate for diabetes health promotion;
- providing educational programs;
- funding innovative treatment and prevention programs for American Indians; and
- providing medical equipment throughout the world.

Diabetes Action has provided over \$37 million in program services including over 250 grants for research and treatment programs. To meet the goal of supporting viable alternative medical approaches for preventing and treating diabetes, Diabetes Action has funded innovative studies such as:

- Cinnamon and Chromium antioxidant studies for diabetes and Alzheimer's Prevention and Treatment, USDA Beltsville Human Nutrition Research Center
- A Novel Program for Curing Type 1 Diabetes, Massachusetts General Hospital
- Vitamin D studies to prevent and treat both type 1 and 2 diabetes, Bastyr University, University of Florida, and University of California, San Francisco
- Antioxidants to improve islet cell graft function, UCLA
- Nutritional approaches to improve B cell function, Joslin Diabetes Center
- Role of chlamydia pneumoniae infection in causing insulin resistance and diabetes, Auburn University
- Oral Interferon to delay full onset of type 1 diabetes, University of Texas Health Science Center, Houston

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## Important Note:

This booklet is not meant to be a substitute for any professional medical advice or treatment being provided by your personal physician; it is meant to offer new ideas to potentially help persons with diabetes improve their health status. It is important to seek the guidance of a physician or other qualified health practitioner before implementing any of the approaches to health suggested in this book.

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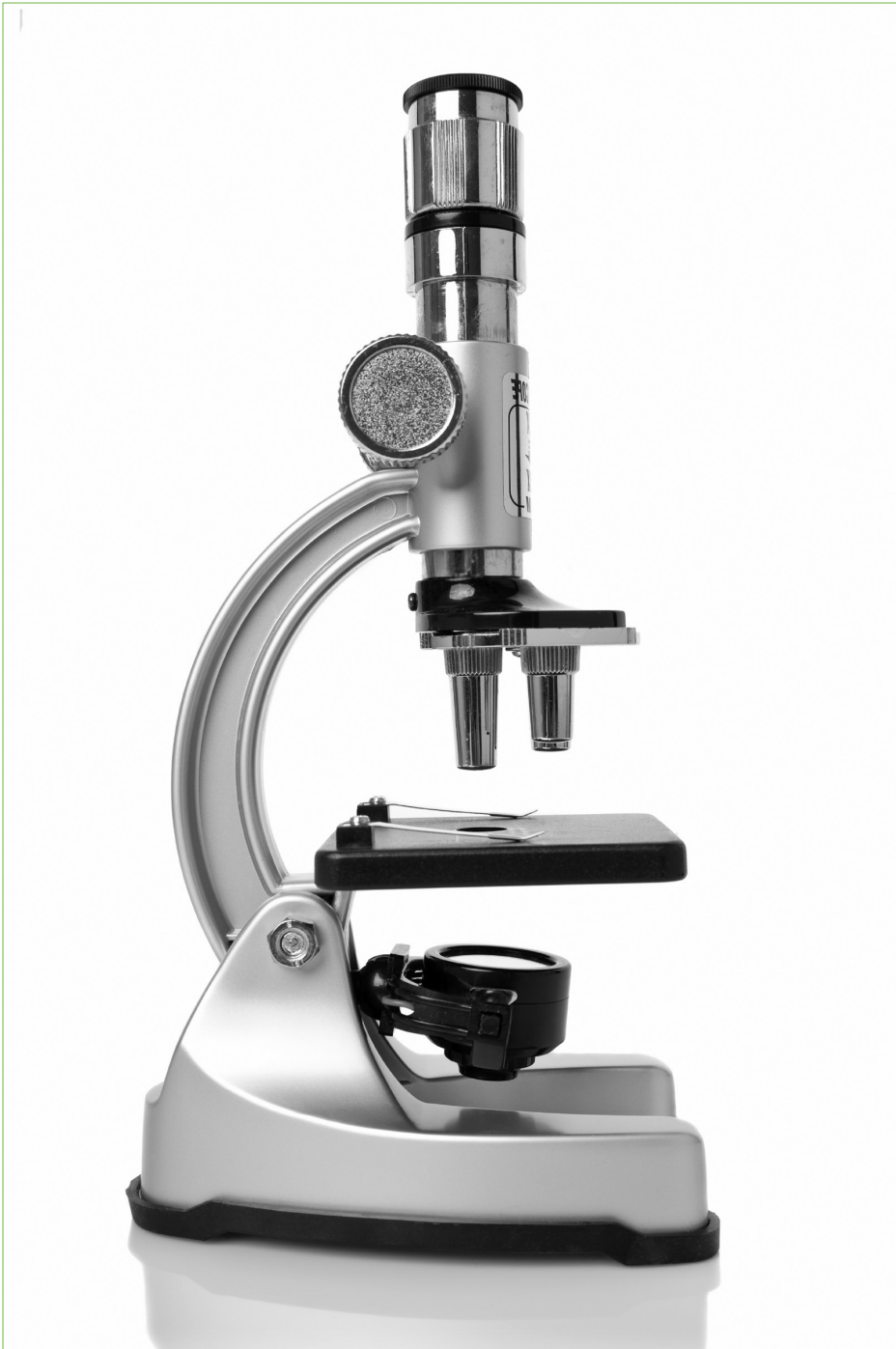
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What  
is  
Diabetes?

## Overview

Diabetes develops when the body cannot properly use the energy provided by food. The ability to utilize food for energy is as important as having air to breathe.

### What happens in a normal system?

- Food breaks down into sugar (the body's main fuel)
- Sugar enters the bloodstream and the blood sugar level rises
- The body sends a signal to the pancreas where the increased blood sugar is sensed
- The pancreas secretes insulin into the bloodstream
- Insulin lowers the blood sugar by letting sugar into the cells
- The blood sugar level falls
- The body cells use the sugar as fuel

### What if this system does not work?

With diabetes, this cycle does not work because the sugar made by the body does not enter the cells, and instead constantly builds up in the bloodstream. This occurs because either there is a lack of insulin (which acts as the key to let sugar into the cells of the body), or the insulin is not working properly.



## Understanding Your Test Results

	Fasting Blood Glucose	Oral Glucose Tolerance Test (OGTT)	Random Blood Sugar *	A1C
<b>Preferable Result</b>	Less than 100 mg/dl	Less than 140 mg/dl	Less than 140 (even after eating a large meal)	Less than 5.7%
<b>Pre-diabetes</b>	100-125 mg/dl	140-199 mg/dl	140-200	5.7% to 6.4%
<b>Diabetes</b>	126 mg/dl and greater	200 mg/dl and greater	200 or greater	6.5% or more

\* taken any time of day with or without fasting

Some doctors may begin reporting the A1C numbers as "Estimated Average Glucose" (eAG) which uses the same units seen on glucose testing meters. For example:

<b>A1C(%)</b>	<b>=</b>	<b>eAG (mg/dl)</b>
5.5	=	111
6	=	126
6.5	=	149
7	=	154
7.5	=	169



## Types of Diabetes

**Type 1 diabetes** - In this condition, because the body makes little or no insulin, the sugar cannot gain access into the body cells and the blood sugar remains high. People with type 1 diabetes are dependent on insulin injections. Oral medications are often used to supplement the use of insulin. Less than 10 percent of people with diabetes have type 1 diabetes. Although type 1 diabetes begins most often in childhood, it may also occur in adults (known as Latent Autoimmune Diabetes/LADA or “type 1.5”).

- **Symptoms** - The symptoms of type 1 diabetes, which almost always come on suddenly, are as follows:
  - Weakness and fatigue
  - Increased urination (Polyuria)
  - Increased hunger (Polyphagia)
  - Increased thirst (Polydipsia)
  - Weight loss
- **Causes** - The exact cause of type 1 diabetes is unclear. The following are possible causes:
  - A genetic history of type 1 diabetes in the family;
  - Environmental factors such as viral infections or chemicals that can injure the pancreas; or
  - An autoimmune condition that has destroyed the insulin-making islet cells of the pancreas.

**Type 2 diabetes** - In this kind of diabetes, the body may make insulin, but the body either does not make enough or cannot use it. More than 90 percent of people with diabetes have type 2 diabetes. Previously called adult-onset diabetes, it usually appears after the age of 40, although it is starting to show up in children at an alarming rate. Although there may be insulin present, little or no sugar enters the cells, causing it to build up in the bloodstream. This is called insulin resistance. Type 2 diabetes can sometimes be managed by nutrition and lifestyle changes alone, although

supplemental insulin or oral medication may also be necessary. About 40 percent of people with type 2 diabetes require insulin injections to achieve blood sugar control.

- **Symptoms** - The symptoms of type 2 diabetes can be easy to overlook and may present themselves over a long period of time. They may include:
  - Weakness and fatigue
  - Dry, itchy skin/numbness, and tingling of hands and feet
  - Frequent infections
  - Blurred eyesight
  - Slow healing cuts and sores
  - Frequent urination (Polyuria)
  - Increased hunger (Polyphagia)
  - Increased thirst (Polydipsia)
- **Risk Factors** - Type 2 diabetes is most likely to occur in people who:
  - are over 40 years in age;
  - are overweight;
  - have a sedentary lifestyle;
  - have a family history of diabetes;
  - have had diabetes during a pregnancy;
  - have a high blood pressure; or
  - are African American, Hispanic American or Native American.

**Gestational diabetes (GDM)** - This type of diabetes develops during pregnancy, usually between the 24th and 28th weeks of pregnancy. Women over 30 years of age with a family history of diabetes have the greatest risk of developing GDM, although it can occur in 2—4 percent of all pregnant women. If GDM has occurred in one pregnancy, it is likely to occur again. GDM is most prevalent in Hispanics, Native Americans and African Americans. About 40—60 percent of women may develop type 2 diabetes within 15 to 20 years after having had GDM. However, exercise and maintenance of a healthy weight can decrease the chances of a woman who has had GDM from developing type 2 diabetes.

## Preventing Complications

The best approach to dealing with any complication is preventing it in the first place by adopting healthier habits. If complications have already started, it is not too late to control them and keep them from worsening. Not all people with diabetes develop all the complications mentioned. Easy ways to reduce the risk of complications include the following:

- maintaining normal blood sugar levels;
- controlling blood pressure, cholesterol and weight;
- exercising regularly;
- quitting smoking;
- getting regular (at least once/year) checkups of eyes and kidneys;
- taking nutritional supplements such as essential fatty acids with professional guidance; and
- maintaining a positive attitude.

## Short-Term Complications

**Hypoglycemia** - Blood sugar drops below 70 mg/dl when too much diabetes medication is taken, meals or snacks are eaten at the wrong time, alcohol is ingested without food, or more physical activity than usual takes place. Symptoms include shakiness, sweating, hunger, tiredness, confusion and irritability, blurred vision or headaches, and numbness or tingling of the mouth and lips. Some people may have low blood sugar without these symptoms, so frequent blood sugar monitoring is important to cope with this problem.

About 15 grams of readily available carbohydrates can raise the level of blood sugar by 50-100 mg/dl within 15 minutes. Use any of the following:

- 1/2 cup of juice (apple or orange)
- 1/2 cup regular soda
- 6-7 small hard candies
- 1 small box of raisins
- 3 glucose tablets
- 1 cup milk or
- 5 small sugar cubes.

If these methods do not work, they should be repeated. If the symptoms still do not improve, the doctor or diabetes education team must be contacted. Any hypoglycemic treatment should be followed by a small snack to avoid further drops in blood sugar level before the next meal. It is essential to always have glucagon available for emergencies.

**Hyperglycemia** - Very high blood sugar can be caused by a lack of normal exercise, illness, stress, too little insulin, or a heavy meal. Symptoms include excess thirst, excess hunger, frequent urination, hazy vision, signs of infection, or cuts and sores that heal slowly. To treat high blood sugar, the person with diabetes must take the correct dose of medication, monitor their blood sugar levels regularly, exercise regularly, follow a meal plan, and replace fluids and electrolytes. If the situation becomes serious, a doctor should be notified as soon as possible.





**Hyperglycemic Hyperosmolar Non-ketotic Syndrome (HHNS)** - A condition sometimes found in older persons where ketones are absent but blood sugars are very high. Treatment requires fluid replacement to prevent severe dehydration. HHNS is usually caused by an infection or illness.

**Diabetic Ketoacidosis (DKA)** - DKA is a serious condition which occurs mostly in type 1 diabetes. DKA occurs when the body becomes too acidic as a result of a build up of ketones. Ketones are an acid waste product made by the body when it burns fat for energy. If excessive, ketones can lead to a coma. Symptoms of DKA are vomiting, fruity smelling breath, stomach pain, and excessive tiredness in addition to the other symptoms of high blood sugar. This condition can come on very quickly, especially during an illness, and a doctor must be contacted immediately. DKA can be prevented by checking blood sugar regularly, testing urine for ketones (especially when ill), and maintaining a proper insulin schedule with respect to meals and exercise.

## Long-Term Complications

A person with diabetes is more likely than other people to have a heart attack, stroke, kidney failure, eye problem, frequent infection, and foot or leg amputation, because of stress on the body organs due to years of uncontrolled high blood sugar. These complications arise when the high levels of blood sugar get deposited in the walls of blood vessels causing them to harden. The various organs of the body suffer when the hardened vessels eventually rupture.

**Decreased ability to fight infection** - This is the result of damage to small blood vessels, which causes poor blood flow to the skin and a breakdown of the germ fighting system of the body. These infections can occur in the mouth and bladder. Commonly, infections occur on the feet since injuries often go unnoticed due to the loss of sensation in the damaged nerves.

**Kidney Damage (Nephropathy)** - Nephropathy is kidney damage caused when high blood sugar and high blood pressure damage the tiny blood vessels in the kidney called nephrons. The ability of the kidneys to filter the blood and dispose of unwanted material is destroyed to the extent that useful products like protein are thrown out of the body and unwanted wastes are retained. When that happens, it is necessary to



shift the work of the kidneys to dialysis machines. Timely blood and urine tests can help detect early damage.

Studies have been done that indicate a lower protein diet is beneficial in reducing the amount of protein excretion in the urine and thereby slowing down the progression of kidney failure. Research has shown that high doses of thiamine can decrease the excretion of albumin and reverse early stage kidney disease in type 2 diabetes<sup>1,2</sup>. Practically speaking, a protein intake of 0.8—1.0 gm/kg/day is a realistic goal. For a person weighing 150 pounds, this means a total daily intake of 54—68 grams of protein spread between all meals and snacks.

**Eye Damage (Retinopathy)** - Retinopathy, or damage to the retina of the eye, is a serious condition that affects nearly 40 percent of people with diabetes. In addition to inadequate blood sugar control, hypertension and kidney disease contribute to the swelling of numerous tiny vessels that supply blood to the retina causing fluid to leak into the surrounding tissue. If this delicate tissue is damaged, impaired vision leading to blindness may result. In some people the leakage from the blood vessels continues, leading to a condition called macular edema which can often be helped with laser treatments<sup>3</sup>.

Other therapies for vision loss include hyperbaric (high pressure) oxygen treatment, and special vision devices. Regular eye exams are important to help detect early damage. Strict blood sugar control can help improve treatment results<sup>4</sup>.

**Large Blood Vessel/Heart Damage (Macroangiopathy)** - Damage to the large blood vessels that surround the heart and supply the arms, legs, and head is called macroangiopathy. This complication is more common in type 2 diabetes, but it does occur in type 1 as well. When the blood sugar level is raised, it tends to form scars on these large blood vessels, trapping the cholesterol and then blocking it. Trying to pump out blood through these clogged vessels overworks the heart and can lead to heart attacks, strokes, and decreased blood flow to the arms, legs, and head. Smoking and high blood pressure can further aggravate this situation. Slow healing of cuts and sores, leg cramps, and dizzy spells may forewarn people with diabetes to the onset of this problem.





**Nerve Damage (Neuropathy)** - Neuropathy is caused when recurring high blood sugar levels cause the nerve cells to swell and scar. As this continues, the nerves lose their ability to transmit signals through the body. This may cause either a tingling of the feet and legs or a numbness or lack of pain from cuts and bruises.

When it affects the extremities, nerve damage is called peripheral neuropathy. Nerve damage can also affect the nerve function of various organs such as the stomach causing bloating, nausea, and vomiting. Nerve impulses to the heart can also be damaged, resulting in painless ischemic heart disease and irregular heart rate. Sexual function, especially in men, can be impaired as well.

Some options to help treat damage to peripheral nerves in patients with diabetic neuropathy include the use of

**Acupuncture** has been studied by Diabetes Action as a safer alternative to other medical treatments for neuropathy. (see page 49)

**Essential fatty acids** - A deficit of gamma linoleic acid is thought to be responsible for many of the microvascular changes in diabetic neuropathy. In one study, supplementation of GLA increased the nerve conduction velocity in diabetic rats, but more research on humans is needed<sup>5</sup>.

**Capsaicin cream** - This cream provides relief by desensitizing the nerves so that some symptoms of neuropathy, such as tingling, are less painful<sup>6</sup>.

**Lipoic Acid and Vitamins B1, B6, and B12 injections** - These vitamins have been shown to relieve symptoms in some individuals<sup>7</sup>. Alpha Lipoic Acid has shown the ability to improve symptoms of peripheral diabetic neuropathy<sup>8</sup> and it was found to be especially helpful when combined with Benfotiamine (a lipid-soluble form of Vitamin B-1)<sup>9</sup>.

**Lyrica (pregabalin)** - This new prescription drug can relieve pain from diabetes-related nerve damage by binding to a protein on overstimulated nerve cells. This helps decrease the sensation of pain but does not treat the underlying nerve damage. Potential side effects include dizziness, sleepiness, and blurred vision.



### Sleep Apnea

Sleep apnea, a serious condition marked by loud snoring, irregular breathing and interrupted oxygen intake, affects an estimated nine million Americans. Sleep apnea can lead to obesity, lack of energy, and insulin resistance which can cause or aggravate diabetes<sup>10</sup>. Because untreated sleep apnea can cause other serious conditions like high blood pressure, cardiovascular disease, memory problems, weight gain, impotency, and headaches, it would be wise for all people with diabetes to be screened for sleep apnea, and those with sleep apnea to be tested for diabetes.



First  
Lines  
of  
Defense

## Eating Basics

**Everyone is different** - There is no such thing as a “diabetic diet”. No single eating plan will work the same for everyone. Some people will be able to eat more carbohydrates and still achieve good blood sugar control. Others may require a higher protein intake, with a reasonable balance between plant and animal protein sources. The key is to monitor blood sugar levels carefully to determine which foods work best.

**Balanced meals** – In general, the ideal meal might consist of the following proportions: 1/2 vegetables, 1/4 complex carbohydrate foods, and 1/4 or less of protein foods. A small amount of healthy fat with each meal can also help control blood sugar levels.

**Small meals every 4-5 hours** - The body does not make enough insulin to handle a large meal. A person with diabetes who is dependent on injections may require extra insulin if eating a large meal. In addition, small, frequent meals prevent hypoglycemic episodes.

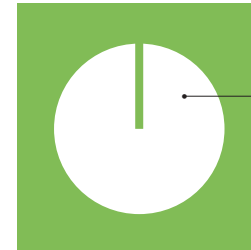
**No Starving!** - Skipping meals is a set-up for a food binge.

**Complex carbohydrates** - Whole grains, vegetables, and fruits are the most efficient sources. The body not only burns more calories while digesting them, but also gets fiber and more nutrients from these foods than from other food sources.

**Water** - For most individuals, a minimum of six to eight glasses of water per day — preferably spring water — is required. The body becomes dehydrated before one feels thirsty. Those with high blood sugars levels require large amounts of water in order to pass the sugar out in the urine.

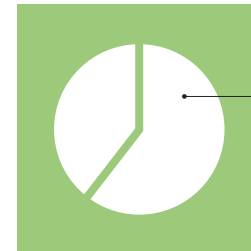
**Carbs, Proteins, Fats** - Carbohydrates, proteins, and fats are each turned into blood sugar at different rates. Eating a combination of foods will help keep blood sugar levels balanced throughout the day.

## Calories Turned into Blood Sugar



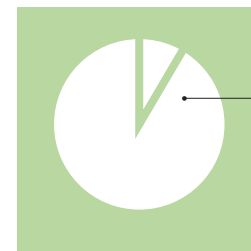
**Carbohydrates** – Have the greatest and fastest impact on blood sugar

100% turned to blood sugar 15 minutes to 2 hours after eating



**Protein** – Has a medium and slower impact on blood sugar

60% turned to blood sugar 2 - 3 hours after eating



**Fat** – Has the smallest and slowest impact on blood sugar

10% turned to blood sugar 3 - 4 hours after eating

## Fiber

Higher fiber foods are good for everyone, especially for people with diabetes. It is best to try to eat between 30—40 grams of fiber a day.

There are two types of fiber: soluble and insoluble. Soluble fiber is more important as it helps in slowing or reducing glucose absorption from the intestines. It has also been shown to be beneficial in lowering fats in the blood.

**Soluble fibers** are found mostly in fruits, vegetables, and some seeds. They include pectins, gums, and mucilages that increase the thickness of the food in the intestine. Among the highest soluble fiber foods are legumes such as cooked kidney beans which have 7.3 grams per 1/2 cup.

**Insoluble fibers** are found in brans, husks of whole grains, nuts, and seeds. Their primary role is to act as an intestinal scrubber and clean out the lower gastro-intestinal tract where buildup can occur, contributing to potential cancers, among other things.

Fiber is also found in other, lesser known substances that positively affect blood sugar levels such as flax seed meal and fenugreek seeds.

## Fats

The human body needs the right kinds and right amounts of fat to function. All fats are not bad. The key is knowing which fats are the healthiest choice.

All fats are basically mixtures of saturated, monounsaturated, and polyunsaturated fatty acids in different proportions.



## Three types of fat

Types of Fat	Comments	Best Sources
<b>Saturated</b>	<p>The prevailing advice from most medical professionals is to avoid all saturated fats and oils. However, some saturated fat such as from butter, fish oil and coconut oil is beneficial.</p> <p>For many people, low fat diets are not an effective strategy for weight loss as low fat foods are nearly always high-carbohydrate foods, which trigger the release of insulin, causing the body to store fat<sup>1</sup>.</p>	Butter, fish oil, coconut oil
<b>Monounsaturated</b>	<p>Many diet plans recommend monounsaturated oils, such as olive oil and canola, as the best oils for weight loss. However, these oils should still be used sparingly because they have a high ratio of omega 6 fatty acids.</p>	Unrefined olive oil, sesame oil, avocados, and most nuts
<b>Polyunsaturated</b>	<p>Two of the essential fatty acids that are polyunsaturated include linoleic acid (omega-6) and alpha linoleic acid (omega-3). However, excess consumption of polyunsaturated oils results in an unhealthy ratio of omega 3 to omega 6 fatty acids.</p>	Unrefined safflower oil, flax oil, sunflower oil



In the quest to reduce fat consumption, most people do not eat enough of the right kind of fats known as essential fatty acids (EFAs). These fats are termed “essential” because they are critical for good health and cannot be made by the body. Without essential fatty acids in the diet, the brain and body do not develop properly.

Fatty Acids:	Health Benefits	Best Sources
<b>Omega-3</b>	<p>Most people need to eat more omega-3 fatty acids.</p> <p>Improves heart health, reduces hypertension, improves rheumatoid arthritis, lupus, Raynaud's disease, and other autoimmune diseases, improves depression and symptoms of other mental health problems</p> <p>Research suggests that in individuals with non-insulin-dependent (or type 2) diabetes, omega-3s can improve insulin sensitivity<sup>2</sup>.</p>	<p>Cold water fish (especially wild salmon), flaxseed, hemp seed, walnuts, green leafy vegetables</p>
<b>Omega-6</b>	<p>Most people eat enough omega-6 fatty acids and need to eat more omega-3 fatty acids instead.</p> <p>More research is needed to determine the optimum ratio of omega-6 to omega-3 fatty acids. For early humans, the ratio was 1:1 while the typical western diet is 10:1. A program to create meal plans with acceptable ratios is available at: <a href="http://efaeducation.nih.gov/sig/kim.html">http://efaeducation.nih.gov/sig/kim.html</a>.</p> <p>The high concentration of GLA (gamma linolenic acid) found in omega-6 fatty acids are anti-inflammatory in nature and therefore have been found to be useful in reducing the aches and pains of rheumatoid arthritis, PMS, endometriosis, and neuropathy (see Plant Pharmacology chapter).</p>	<p>Most vegetable oils, evening primrose oil, borage oil, cereals, eggs, poultry, and whole grain breads</p>

Fatty Acids:	Health Benefits	Best Sources
<b>Conjugated Linoleic Acid (CLA)</b>	<p>CLA is a little known fatty acid which is found primarily in the meat and milk of grass fed animals. Range fed animals contain 10 times the CLA of those that are grain fed.</p> <p>CLA normalizes impaired glucose tolerance and promotes weight loss<sup>3</sup>.</p>	<p>Meat and milk of grass fed animals</p>
<b>Medium chain</b>	<p>One of the most important medium chain fatty acids is lauric acid, which may also be considered an essential fatty acid because it can only be made by the lactating female.</p> <p>Medium chain fatty acids increase the body's metabolism and aid in weight loss<sup>4</sup>.</p>	<p>Coconut oil, palm kernel oil</p>

**Avoid Trans Fat!**

Trans fat is made by adding hydrogen to vegetable oil. This improves shelf life and crispiness of foods like crackers and baked goods. These chemically altered fats raise bad cholesterol (LDL) and lower good cholesterol (HDL). As of 2006, all nutrition labels are required to list the trans fat content. However, foods can still contain up to .5 gram per serving. To be sure to avoid eating hidden trans fats, do not eat any product that lists hydrogenated or partially hydrogenated oil in the ingredients.

**Diabetes Medications**

An understanding of how diabetes medications function either in the form of insulin or pills, is important for good blood sugar control.

**Types of insulin**

- **Short acting (regular) insulin** kicks in 30 minutes after eating and peaks approximately 2—3 hours after injection but continues to work for 3—6 hours.

- **Rapid acting (Humalog/Novolog)** insulin is designed to mimic the first few minutes of digestion and is usually taken at mealtime. It is important not to delay eating when taking rapid acting insulin since it starts to work within 5 minutes of injection and peaks within 1 hour.
- **Intermediate acting insulin (NPH/lente)** goes to work in 1—2 hours, peaks in 6—10 hours, and lasts 16—24 hours. Generally, these insulins are taken in two doses but are being used less since the advent of Lantus in 2001. Since these products are being discontinued, anyone still using them should talk to their doctor about switching to one of the newer human insulin analogs.
- **Long acting** human insulin analogs, such as Levimir, and glargine (Lantus) go to work in 1 hour and last all day without a peak. These drugs are designed to mimic the basal or steady rate of insulin production. They can be effective with only one daily dose and are sometimes complemented with a short acting insulin at mealtime. A big advantage appears to be the reduction of hypoglycemic episodes.
- **Pre-mixed insulins** are made from a combination of NPH with either regular or Humalog. These insulins are especially useful for people with poor eye sight or manual dexterity.
- **Non-Insulin Injectable Medication** - Byetta, a medication that mimics the action of incretin hormones in the body, increases insulin production post-meals. This is only used to treat type 2 diabetes.
- **Inhalable Insulin** - Although the first inhalable insulin, Exubera, was approved by the FDA in 2006, many questions about its long term health effects remain unresolved.

## Oral medications

Oral medications work by

1. stimulating insulin production from the pancreas or
2. making body cells more sensitive to insulin and are often used in combination with insulin.

- There are several oral medications to accomplish these functions. Metformin, glyburide, and glipizide are three of the more commonly used medications.
- Although newer drugs have been developed in recent years, reported side effects show more research is needed. One of the newer class of drugs known as thiazolidinediones, which include Avandia and Actos, present a greater risk of bone fractures<sup>1</sup>. In addition, concerns over increased cardiovascular risks have been raised about both Avandia and another class of drugs called glitazars, especially muraglitazar<sup>2</sup>.

Whether using oral medications or insulin, the following points are important:

- The timeframe for when the medication peaks.
- When meals and snacks should be eaten.
- How to adjust medications for exercise.
- The appropriate injection site for insulin medications.
- How to adjust medications for sick days.
- The range for blood sugar to avoid levels that are too high or too low.
- Check expiration dates on insulin vials and return any discolored insulin to your pharmacy.

- Explore the advantages of insulin pump therapy if a more flexible lifestyle is desired or if blood sugars are not well controlled with a regimen of insulin injections.

Because there is continuous research and approval for new injectable, inhalable, and oral medications, be sure to check with your healthcare team to determine the best treatment for you.

## Carbohydrate Counting

### What is carbohydrate counting?

Carbohydrate counting is a way to keep track of the carbohydrates in food and gain control of blood sugar. With some practice, the amount of insulin needed can be determined by figuring out the amount of carbohydrates in a meal.

### Who is a candidate for carbohydrate counting?

Anyone using Humalog/rapid actin insulin, which is injected at the time of eating. This may vary with each individual.

Anyone using an insulin pump.

Anyone whose blood sugar levels are not within normal range with current eating patterns.

### How is carbohydrate counting done?

Know which foods contain carbohydrates.

- Starches (breads, cereals, grains, legumes, and starchy vegetables like corn and peas)
- Fruits and juices
- Milk and yogurt
- Pies, cakes, candy, ice cream, etc.

Know portion sizes. Use a carbohydrate counter and measure your food. One serving of carbohydrates = 15 grams. The following are equivalent to one carbohydrate serving:

- 1/2 cup of starch (e.g. potatoes, corn, peas, grains)
- 1 slice of bread
- 1 small piece of fruit
- 8 oz. milk or yogurt
- 1 1/2 cups of cooked vegetables

Estimate what is a reasonable carbohydrate intake per meal depending on height, weight, gender, age, and activity level.



- An average female needs 45—60 grams of carbohydrate per meal, or more with increased activity (in the form of a snack or a slightly larger meal).
- An average male needs 60—80 grams of carbohydrate per meal, or more with increased activity.
- A diabetes management team will be able to help determine this more precisely.

Check blood sugar levels 1—2 hours after eating, particularly after eating too many carbohydrates. This is the peak time for carbohydrate digestion.

Watch fat and protein intake to avoid gaining body fat and contributing to elevated blood sugar levels.

Eat balanced meals that include more whole foods and less processed foods.

Remember that sugar-free does not mean carbohydrate free. The total number of carbohydrates eaten will impact blood sugar levels, no matter whether they come from sugars, starches, or fruits.

## Sweeteners

**Sugar** - The human desire for sweetness in food is a universal one. Having too many sweet foods may not be healthy, but avoiding sweet foods completely is unrealistic. Many people falsely believe that sugar can never be eaten by a person with diabetes and that only artificial sweeteners are allowable. However, natural (unrefined) sugar can be eaten in small amounts as part of a healthy eating plan. Sugars are simply a form of carbohydrate and need to be factored into the total amount of carbohydrates eaten in a day. Since the amount of sugar that can be tolerated will vary between individuals, the best plan is to monitor blood sugar levels frequently.

**Sugar Alcohols** - Sugar alcohols are carbohydrates with a chemical structure that partially resembles sugar and partially resembles alcohol, but they don't contain ethanol as alcoholic beverages do. Common sugar alcohols are xylitol, sorbitol and mannitol. Other sugar alcohols include lacticitol, isomalt, maltitol, and hydrogenated starch hydrolysates (HSH).

A common drawback of sugar alcohols is that these unabsorbed sugars hold onto water in the intestines and can cause diarrhea in large amounts.

Although in general sugar alcohols have less effect on glucose and insulin than sucrose, sugar alcohols taken in excessive amounts can cause high blood sugar in people with diabetes.

### What are Net Carbs?

“Net carbohydrates” (also called “effective” or “impact” carbs) is a misleading marketing term found on products that have both sugar alcohols and insoluble fibers in them.

- For any product that has over 5 grams of fiber, 100% of the fiber grams may be deducted from the total carb count, but only 50% of the sugar alcohols can be deducted, not 100% as the label would imply.



- Blood sugars should be tested counting the full calories versus counting “net” since some people find that these designer foods have a greater impact on their blood sugar than suggested on the package.
- High intakes of sugar alcohols can cause diarrhea and/or affect LDL (bad cholesterol) levels.
- These “Sugar-free” foods may have fewer carbohydrates, but they are not “carbohydrate-free” nor do they always provide fewer calories. One must read all product labels and be skeptical about claims made on the label.

**Artificial Sweeteners** - Artificial sweeteners such as Aspartame (found in Nutrasweet and Equal) and Sucralose (found in Splenda) are a mix of unnatural chemicals, combined in a laboratory that the body can't naturally process. There have been conflicting studies and personal reports about the safety of artificial sweeteners.

- **Aspartame**

Aspartame contains phenylalanine, aspartic acid, and a small amount of methyl ester. Some people have noted allergic reactions to aspartame that include severe itching, skin rashes, and throat and lung irritation. A 2005 study on rats found a correlation between low doses of aspartame to leukemia and lymphoma<sup>1</sup>.

- **Sucralose (Splenda)**

Sucralose is made by adding 3 atoms of chlorine to one atom of sucrose. Most of the research on the safety of sucralose has been conducted by the manufacturer. There are no long-term human studies of the effects of sucralose to date but it has been tied to a host of ills by researchers at Duke University in 2008. In addition, by destroying “good” intestinal bacteria it may prevent prescription drugs and other nutrients from being absorbed<sup>2</sup>.

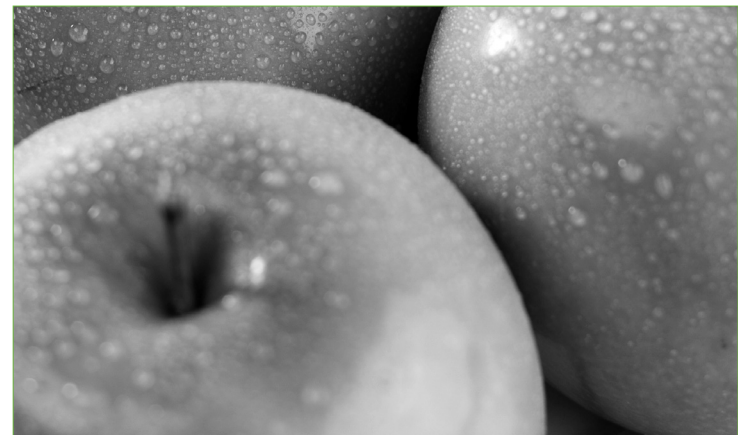
**Fructose** - Fructose is the chemical name for a kind of sugar that occurs naturally in honey and ripe fruit. Fructose contains the same amount of calories as sugar but it may be more likely to cause insulin resistance.

**High Fructose Corn Syrup** - Corn syrup and high-fructose corn syrup are highly refined sweeteners made from corn. High-fructose corn syrup is considerably cheaper than sugar so it is found in most processed food and drinks. Because the body metabolizes fructose differently than cane or beet sugar, it is best to avoid it completely. A 2004 study found that high-fructose corn syrup was positively associated with the prevalence of type 2 diabetes<sup>3</sup>.

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### Stevia – A natural alternative

Stevia is native to South America and is derived from the leaves of *stevia rebaudiana*. It is 200 times as sweet as sucrose and is used widely as a sugar substitute in different foods and beverages in countries like Japan. In addition to its sweetening property, Stevia has been shown to lower both blood pressure and blood sugar levels in rats<sup>4,5</sup>. Research has shown that stevia is a safe, non-toxic, sweetening alternative<sup>6</sup>. Stevia can be purchased from most health food stores and online under various brand names such as Truvia and PureVia.





# Basic Management

## Blood Sugar Monitoring: Essential to Self-Empowerment

Though there are many elements that are important for managing diabetes on a daily basis, blood sugar management is the most essential.

### Why monitor blood sugar?

If taking insulin, it is important to know the blood sugar level to determine the correct dosage. It is essential for the diabetic health care team to know blood sugar levels so that insulin, other medications, meal plans, and exercise schedules can be adjusted accordingly. It is possible that the need for diabetes medication could decrease or disappear entirely for some people. This cannot be determined without good monitoring.

### When to monitor blood sugar?

Most people with well-controlled diabetes who are not taking any medications need to have their blood sugar checked only 2—3 times a week. Monitoring 2—4 times a day is necessary for most individuals with diabetes in order to track the changes that may occur. People with diabetes who are ill, have more than two insulin shots a day, or are pregnant, may need to check blood sugar even more often. The best times to do this are before breakfast, lunch, and dinner, at bedtime, and 1—2 hours after meals.

### How to monitor blood sugar?

This can be done with a drop of blood which is obtained by pricking the side of a finger tip with a lancing device. A lancing device is usually a small spring loaded device with a sterile needle, or lancet. Be sure that hands are cleaned with soap and water and well massaged for good blood flow before pricking a finger.

### What is the A1C (also called HbA1c) test?

This blood test shows how blood sugar levels were controlled over the previous two to three months. It should be done by your doctor at least twice a year. Aim for a level below 6.5.

### What method to use?

Depending on what the physician and the rest of the health care team decide, one of two methods to read the sugar in the drop of blood can be used.

- **Visual testing** - This method consists of applying the drop of blood to a plastic test strip and comparing the color of the tip with the range of colors given on the strip bottle to determine the range that the blood sugar falls into.
- **Meter testing** - Meter testing provides a more exact reading of blood sugar levels. Though the strips used with a meter are similar to those used in visual testing, the glucometer reads the color of the strip in actual numbers.

### Which is the best meter to use?

There are a variety of meters available. Choosing the correct meter for testing blood sugar levels depends a great deal on individual dexterity, vision, hand size, lifestyle, and insurance coverage/cost. The visually impaired can choose from meters that give a verbal reading. Most companies exchange old meters for new ones.

### Are there any alternatives?

Research is ongoing to find better devices to eliminate finger pricking. There are several devices available but they are very expensive and the readings are not always accurate. Until these methods are refined, regular testing should be used to keep a record of blood sugar readings.



## Traveling with Diabetes

The following special precautions should be made by the person with diabetes while traveling.

- Extra insulin or oral agents. These should be packed as the particular medicine may not be available in other countries.
- Insulin protection: keep all insulin in hand-carried bags to avoid temperature changes; divide insulin and other diabetes supplies between at least two different bags in case one is lost; get an insulin carrying case, or pack between layers of clothing; refrigerate upon arrival; insulin can be stored in a cold thermos.
- Insulin prescriptions: bring prescriptions for insulin, syringes, and a glucagon emergency kit, plus a letter describing the medical condition. Include prescriptions for any other medicines that might be needed.
- Discuss travel plans with the health care team. This may require changing the timing and amount of insulin doses. Meal times and blood testing may also change.
- Test blood sugar levels often to judge how the new routine is affecting diabetes control.
- Find out where and how to obtain medical care. Traveling companions need to know how to help in an emergency.
- Carry an “I Have Diabetes” card in local language(s) of countries visited. Know appropriate phrases to use in emergencies.
- Drink plenty of water, particularly in hot climates. Check ahead on availability of bottled water where needed.
- Carry glucose tablets and other appropriate snack food.
- Check with airlines for any special requirements before traveling.

## Foot Care

When blood flow is poor or when there is nerve damage in the legs and feet, serious problems can develop. This can lead to a diminished ability of the body to heal itself, often leading to infections that can have consequences as serious as amputations. It is important to take the following points into consideration to prevent infections of the feet.

- Shoes that fit properly are essential. Feet swell during the day, so a shoe that fits in the morning may be tight by the evening. Leather breathes and is usually better than synthetic materials which can cause sweaty feet that are a breeding ground for bacteria. Orthotics may be needed to ensure a proper fit. Sandals, particularly thong types, can lead to rubbing, making feet vulnerable to cuts. Seamless athletic socks made of cotton or new fibers like Thorlo are best. Walking barefoot is not advisable.
- Foot inspections are crucial to finding anything out of the ordinary. A tiny splinter or callous can be the seed for foot ulcers. Unusual foot odors should also be noted as they could be an indication of a festering infection. These problems are not likely to go away on their own.
- Feet should be washed in warm soapy water and carefully dried, particularly between the toes. Moisturizers are fine for the bottom of the feet, but never between the toes. Toe nails should be clipped straight across.
- Medication should not be used on feet unless directed so by the health care team.
- Corn and callous removal should only be done by a podiatrist.
- Regular testing for levels of neuropathies is advised, and can be done by either the individual or his/her podiatrist.
- Some people find pain relief by using magnetic foot pad insoles<sup>1</sup>.

## Exercise and Diabetes: Gain without Pain

Exercise is beneficial for everyone but is especially so for people with diabetes. For some people with type 2 diabetes, exercise can make a difference in whether or not medication is needed.

### How does exercise help?

- Assists in lowering blood sugar. The more active person uses more fuel. When muscles are being employed, they use the sugar circulating in the bloodstream.
- Strengthens joints and muscles. Elevated blood sugar over the years can contribute to glycosylated (sugar-coated) joints, adding to stiffness and arthritic-like conditions. Moving each body part at its joint, daily, can help ease these problems.

### How much exercise?

- To lower blood sugar, exercise for 15—20 minutes at a pace where speaking can be easily accomplished.



- To burn body fat, a sustained activity at a moderate pace for 35—40 minutes will speed up the process.
- Doing some type of activity everyday is ideal.
- Being consistent is important to aid in blood sugar control.

### What types of exercise?

- A medical check-up, especially for those over 35, is necessary. This may include a stress test and possibly a medication adjustment.
- Activities should be appropriate for a person's physical condition.
- It is best to begin exercising slowly and to build up the length and intensity of the activity over time.
- Although either aerobic exercise or resistance training can help lower blood sugar levels, recent studies have shown that improved glycemic control is greatest when aerobic exercise is combined with resistance training<sup>1</sup>.

### What else is important when exercising?

- Blood sugar checks are most important. A blood sugar of 240 or greater could signify an insulin insufficiency or too much food intake. Those with insulin-requiring diabetes should check for ketones. If blood sugar is below 120, a snack of anywhere from 15—30 grams of carbohydrate is needed to raise the blood sugar level.
- Exercising in extreme hot or cold weather should be avoided as this can cause blood sugar fluctuations.
- Keeping some type of diabetes medication at all times with the medication dosage listed.
- If exercising outdoors or alone, be sure to carry some type of identification that states you have diabetes.

- Checking feet daily for blisters can help avoid foot ulcers.
- Wearing white cotton socks and supporting shoes that fit properly.
- Carrying glucose tablets or another quick energy source to elevate blood sugar levels if needed.
- Drinking water before, during, and after exercise.
- For endurance or more intensive activities, some protein and fat may be needed. Those with type 1 diabetes need to be especially observant of these guidelines.
- Exercising 30—90 minutes after a meal, when blood sugar is at its peak, will generally satisfy any need for snacking and will guard against hypoglycemic reactions.

## Diabetes and Illness

Illness can lead to an increase in blood sugar levels. The most important step to take during illness is to make sure that blood sugar levels are stable to prevent a small problem like a cold or the flu from causing greater problems. When ill, a person with diabetes is advised to:

- Take insulin or diabetes pills at the correct time, even if unable to eat, unless otherwise instructed by the healthcare team.
- Test blood sugar not less than every four hours, before each meal, and at bedtime.
- Test for ketones. Since blood sugar is generally higher during sick days, there is a fair chance that the sugar in the blood is not being utilized for energy and that fat is being broken down instead. This will lead to an accumulation of ketones, which may start to appear in the urine. It is vital to check urine for ketones when checking blood sugar levels by using the easy to use “dip and read” ketone strips. The color of the test pad will change, indicating the presence of ketones. The color on the test pad compares to those given on the strip bottle that indicate the

amount of ketones in the urine. Tests should be conducted more often if blood sugar is greater than 240 mg/dl, or if vomiting or symptoms of ketoacidosis occur.

- Rest as much as possible.
- Drink plenty of fluids. The body loses fluids during illness if there is a fever or vomiting. Therefore, it would be advisable to drink at least 1/2 cup of water or any other calorie free, caffeine-free liquid every half hour. It may be easier to take in liquids in small sips.
- Continue with the usual meal plan if the stomach is not affected by the illness. However, if there is a loss of appetite, soft foods and liquids can be eaten in exchange for usual food.
- It is important that the carbohydrate balance is not upset by a change in food intake. Liquids or soft foods should be taken to provide 60g of carbohydrate if replacing a meal and 15g of carbohydrate if replacing a snack. This is a time when regular sodas and ice cream can be consumed. A few examples of foods that would give 15g of carbohydrates are as follows:
 

• Fruit juice	1/3 to 1/2 cup
• Soda (with sugar)	1/2 cup
• Ice cream (vanilla)	1/2 cup
• Broth based soup	1 cup
- Keep in touch with the healthcare team and inform them if the illness lasts more than a day, includes running a high fever, a ketone test is moderate to high, or if one is unable to retain food, pills or liquids.
- Keep a record of blood sugar levels and ketone test results, a record of the amount of food and liquid consumed, and a record of body temperature for the health care team to have the best understanding of the illness.



Beyond  
the  
Basics

## Vitamin/Mineral Supplementation

Vitamins and minerals have multiple roles in the body, functioning primarily as coenzymes or “helpers” for the body’s metabolism. Small amounts may be all that are needed for preventing deficiency, but larger amounts may be indicated for better health.

Supplements that are hypoallergenic with no fillers are preferable. Generally, nutritional supplements are not toxic. Those that are toxic at excessive doses are the fat soluble ones: A, D, K and E. Since doses will vary, one should consult a nutritional advisor.

The following supplements are among those that have been suggested by research studies and used by some nutritionally-oriented practitioners.

**Vitamin B-6** - B-6 is essential to protein metabolism, antibody production, and immune functions. Sensory neuropathy has been reported at high doses, but is not observed with ultra pure forms of B-6 that are properly balanced with nutrients such as magnesium and zinc.

**Biotin** - Biotin is involved in carbohydrate metabolism. It may assist in lowering blood sugar levels, and is usually well tolerated by the body.

**Vitamin C** - This antioxidant is well known for a variety of positive effects including immune enhancement and tissue healing. It is best absorbed in a buffered form. Although excessive doses are not reported to be harmful, they may cause gas and loose stools.

**Chromium** - Chromium enhances the activity of insulin in the cells and a 2004 study showed Chromium supplementation may lower cardiovascular risk in type 2 diabetes<sup>1</sup>. Data from a study funded by Diabetes Action in 1998 also demonstrated that steroid-induced diabetes can be reversed by chromium supplementation<sup>2</sup>.

**Coenzyme Q (Co-Q-10)** - This supplement may improve oxygen use at the cellular level, help stabilize blood sugar, and help protect against heart disease<sup>3</sup>. If statin drugs are

being used, it is especially important to take supplemental Co-Q-10 since the statin drugs deplete levels of Co-Q-10 in body tissues.

**Conjugated linoleic acid (CLA)** - CLA has been found to be helpful in reducing body fat — especially abdominal fat — and preserving muscle mass<sup>4</sup>.

**Vitamin D** - Studies over the past decade have shown that, in addition to bone health, vitamin D is important for normal immune function, blood vessel health, and organ function (including the pancreas)<sup>5</sup>. New research shows that low Vitamin D levels increase the risk for developing both Type 1 and Type 2 diabetes<sup>6,7</sup>.

**Vitamin E** - This antioxidant stabilizes cell membranes, reduces blood clotting risks, enhances immune function, inhibits glycosylation of proteins, among other protective functions<sup>8</sup>. When using vitamin E supplements, it is important to use one which includes mixed tocopherols (alpha, beta, and gamma). Concerns about a link between increased risk of heart failure and vitamin E supplements announced in 2005 were related to the use of only high dose alpha tocopherols<sup>9</sup>.

**Lipoic Acid** - Another potent antioxidant, this may lessen the damage of retinopathy, neuropathy, and arteriosclerosis. In Germany, alpha lipoic acid has been used for more than 30 years to treat diabetic neuropathy. Beneficial effects have been confirmed at doses of 300-600 mg<sup>10</sup>.

**Magnesium** - This important mineral is often deficient in insulin-resistant individuals, especially those with type 2. Magnesium may improve glucose tolerance<sup>11</sup> and prevent certain complications of diabetes. It also plays a role in reducing high blood pressure, which is common in people with diabetes. One study found that a combination of magnesium with vitamins C, E and Zinc was more effective in reducing blood pressure than using magnesium alone<sup>12</sup>.

**Niacin** - Niacin is involved in energy metabolism and is a precursor to glucose tolerance factor (GTF). Although standard niacin can lower cholesterol, large doses (over 1000mg) may raise blood sugar levels and produce side effects. One study found a once-daily extended release niacin was well tolerated and effective for improving lipid levels in type 2 diabetes but that large doses should be used only under medical guidance<sup>14</sup>.



**NAC** - n-acetylcysteine is a potent antioxidant which has shown to be effective in improving endothelial dysfunction and in reducing blood pressure and LDL cholesterol especially when combined with the amino acid L-Arginine<sup>13</sup>.

**Nitric Oxide** – L-arginine is a precursor to nitric oxide which plays a key role in promoting arterial health<sup>15</sup> and enhancing exercise performance<sup>16</sup>.

**Vanadium** - Vanadium may improve glucose metabolism<sup>17</sup>. More research is needed to determine safe levels.

## Plant Pharmacology for Diabetes

Throughout history, many cultures have relied heavily on plants and herbs for medicinal purposes. Modern medicine is now looking at how these traditional sources can be used to treat and manage diabetes either along with conventional medications or on their own. The source and purity of an herb is crucial for effectiveness and to minimize any possible side effects. Professional guidance is always advised when using herbal remedies. Research has been conducted on many sources of medicinal herbs including the following:

**American ginseng (*Panax quinquefolium*)** - American ginseng appears to lower blood glucose levels by enhancing insulin secretion<sup>1</sup>. One study found that people with type 2 diabetes who took American ginseng before or with their meal experienced a moderate reduction in glucose levels after the meal<sup>2</sup>.

**Bay (*Laurus nobilis*)** - Bay leaf is demonstrated to help the body use insulin more efficiently at levels as low as 500 mg which is less than half a teaspoon. Other spices like cinnamon, cloves, turmeric, coriander, and cumin are also good at controlling blood sugar levels<sup>3</sup>.

**Bitter Gourd (*Momordica charantia*)** - This particular plant, also known as bitter melon, has attracted considerable interest for its ability to regulate blood sugar<sup>4</sup>.

**Cayenne (*Capsicum frutescens*)** - This is another herb used in alleviating pain associated with diabetic neuropathy. It is commonly called chili pepper and is used in the form of an external cream.

**Cinnamon** - This popular spice has demonstrated an ability to increase insulin sensitivity and reduce both blood glucose and cholesterol levels in people with Type 2 diabetes<sup>5,6</sup>. Diabetes Action funded research by Dr. Richard Anderson's lab discovered that a new water-soluble polyphenol type-A polymer was the most effective and safe ingredient<sup>7</sup>. Because whole cinnamon includes fat soluble components such as coumarin, which may be toxic at high doses, only the water soluble extract with patented names such as Cinnulin PF or CinnSulin should be used. Additional studies funded by Diabetes Action found this same cinnamon extract has shown neuroprotective effects on the brain which can lead to improved prevention and treatment of Alzheimer's disease<sup>8</sup>. Many researchers are now calling Alzheimer's Type 3 Diabetes.

**Curcumin (Turmeric)** – A commonly used food spice has been traditionally used for pain and wound healing but also appears to inhibit autoimmune diseases by regulating inflammatory cytokines<sup>9</sup>.

**Evening Primrose Oil (Gamma linolenic acid or GLA)** - Defective fatty acid metabolism in diabetes may lead to impaired nerve function and can contribute to the development of peripheral neuropathy. Initial studies suggest that evening primrose oil, which is rich in gamma linolenic acid, improves blood flow and nerve function<sup>10</sup>.

**Fenugreek (*Trigonella foenum-graecum*)** – Fenugreek, a common ingredient in Indian and Middle Eastern cuisine, has been shown to help regulate blood sugar levels and increase good (HDL) cholesterol while lowering total cholesterol<sup>11</sup>. In addition, fenugreek seeds are a good source of soluble fiber.

**Flax (*Linum usitatissimum*)** - Flax seed is one of nature's richest sources of soluble fiber. Research has shown a significant improvement in glucose values by the intake of flax fiber<sup>12</sup>. In addition, flax oil is an excellent source of alpha linolenic acid (omega-3 fatty acid). Either ground flax seed or its oil can be used in bread or muffins.

**Ginger (*Zingiber officinale*)** - Most commonly used as a flavoring for food, ginger may also be taken orally in higher amounts for various kinds of digestive relief. Limited studies in animals with diabetes show that ginger may reduce blood levels of sugar and cholesterol<sup>13, 14, 15</sup>.

**Gurmar (*Gymnema sylvestre*)** – In a 2000 study conducted by Diabetes Educators, 65 patients showed a significant reduction in A1C levels when they took a commercial supplement that contained 400 mg of gymnema sylvestre leaf extract<sup>16</sup>.

**Hydroxycitric Acid (HCA)** - This herbal compound found naturally in the brindle berry, *Garcinia Cambogia*, may play an essential role in weight reduction by improving the body's response to insulin<sup>17</sup>.

**Lagerstoemia speciosa** - This plant is commonly called Banaba in the Philippines, also known as Crepe Myrtle, Queen's Flower or Pride of India. It has been shown to regulate blood glucose levels by increasing insulin action<sup>18</sup>.

**Nopal (*Opuntia fuliginosa*)** - Nopal, also called the prickly pear cactus, is a popular food in Latin America. Numerous studies regarding its role in controlling and lowering blood sugar have been conducted. An Austrian study showed that opuntia decreased blood lipids, blood glucose, and increased insulin sensitivity in people without diabetes<sup>19</sup>.

**Onions and Garlic (*Allium cepa* and *Allium sativum*)** - The use of onions and garlic to reduce blood sugar levels has been popular in Asia, Europe and the Middle East. These plants contain the sulfur compounds allicin and allyl propyl di sulphide which have chemical structures similar to insulin, and therefore are believed to reduce blood sugar.

**Pomegranate (*Punica granatum*)** - This delicious fruit contains many beneficial substances such as polyphenols, that have antioxidant, anti-viral, and anti-tumor properties. Its clinical role is being explored now with encouraging initial results in lowering lipid levels in people with diabetes<sup>20</sup> and improving blood flow to the heart<sup>21</sup>.

**Pycogenol** – This extract of pine bark has been used in some countries to treat diabetic retinopathy and diabetic ulcers. A German study showed a positive effect on lowering glucose levels<sup>22</sup>.

**Red Yeast Rice (*monascus purpureus*)** – Although many doctors prescribe statin drugs to lower LDL cholesterol levels, research has shown similar anti-inflammatory and lipid lowering effects from taking red yeast rice. However, this should only be taken under medical supervision as the red yeast rice extract does contain the same chemicals as the prescription drug lovastatin<sup>23</sup>.

**Resveratrol** – This polyphenolic compound is found in various plants such as grapes and berries. There has been compelling evidence on the strong anti-inflammatory potential of Resveratrol as an anti-aging agent<sup>24</sup>.

**Tea (*Camellia sinensis*)** - Due to its high antioxidant polyphenol content, in traditional Chinese and Indian medicine, green tea has been used successfully in promoting digestion, wound healing, lowering blood glucose, and improving heart health. Research shows that black, green, and oolong teas increase insulin sensitivity<sup>25</sup>. However, herbal teas were not effective because they do not contain *Camellia sinensis*.

## Natural Ways to Manage Diabetes

**Acupuncture** – Many people experience side effects from taking traditional drugs to alleviate the pain and symptoms of neuropathy. Research is showing that acupuncture may be an alternative treatment for neuropathic symptoms. Animal studies have suggested that acupuncture may provide anesthetic and nerve regeneration capacity but more research is needed<sup>1</sup>. Diabetes Action funded a study at Harvard Medical School where Dr. Andrew Ahn evaluated the effectiveness of three different types of acupuncture.

**Chiropractic procedures** - The principles of chiropractic methods revolve around the vertebrae of the body. The theory behind this practice is that nerve impulses flowing normally through the body correspond with the different organs and produce normal physiological functions.

**Homeopathy** – The theory of homeopathy involves using highly diluted amounts of plant derivatives or chemical and animal substances to produce symptoms similar to an ailment. Doses of these remedies are used to help the body begin the healing process.

**Oxygen Therapy** - Many people with diabetes develop injuries, or leg and foot ulcers that do not heal. One method used to treat these problems is hyperbaric (high pressure) oxygen therapy. Hyperbaric oxygen therapy involves exposing a person to 100 percent oxygen while sitting inside a special chamber. The oxygen promotes growth of blood vessels, which increases blood supply to the wound, thereby promoting healing<sup>2</sup>.

**Stress Management Techniques** – Although the potential therapeutic benefit of stress management on blood sugar control has not been widely studied, a study funded by Diabetes Action found that the use of a meditation technique called Mindfulness-Based Stress Reduction (MBSR) helped people cope with daily living, stress, pain, and illness.

Other techniques that can be helpful in reducing stress and may help manage diabetes include biofeedback<sup>3</sup>, breathing therapy, yoga<sup>4</sup>, and massage therapy<sup>5</sup>.

## Food, Environmental, and Chemical Sensitivities

### What are sensitivities?

Foods and poor air quality may contribute to a feeling of tiredness, joint pains, poor metabolism, or a host of other conditions. These sensitivity reactions may occur with or without the usual allergic reactions of rashes, hives, or itchy, watery eyes.

### What causes sensitivities?

In a “perfect” digestive system, foods are broken down into all the building blocks from which the body derives energy. Continued overuse of medications, such as antibiotics and non-steroidal anti-inflammatory drugs, processed foods, and speed eating, can contribute to poor absorption of nutrients. Digestive juices, especially hydrochloric acid and pancreatic enzymes tend to diminish with age, further contributing to undigested food particles, toxins, and bacteria “leaking” through enlarged spaces between the cells of the intestinal lining. The leaking of these unwanted materials causes the immune system to produce antibodies which can lead to sensitivity reactions.

### How are sensitivities corrected?

Foods, chemicals, and other environmental elements that cause sensitivity reactions must be identified, and then eliminated for periods of at least 3—6 months. Best results are achieved when a gut repair process is put into place so that the same symptoms will not reappear once foods and other items are reintroduced. Appropriate vitamin and mineral supplements, low-impact exercises, and eating as organically as

possible are all elements of this repair process.

In two Diabetes Action-sponsored pilot studies on type 1 and type 2 diabetes using the ELISA/ACT Program, improvements were seen in A1C levels, insulin and blood sugar levels, as well as self-reports of an overall feeling of improvement<sup>1</sup>. The ELISA/ACT Program tests for over 300 food, environmental, and chemical sensitivities via a single blood draw.

## Grain Alternatives

Wheat and other grains like, rye, barley, and oats contain a protein called alpha gliadin which can trigger an immune reaction in some people. The following is a list of alternatives for those who cannot consume grains with gluten or for those who wish to add variety to their meals.

**Whole grain brown rice** offers both nutrition and variety. White or polished rice should be limited since it is stripped of fiber and vitamins and tends to raise blood sugar quickly. Whole grain rice is a good substitute for wheat, and can be used in cereals, cakes, crackers, and as a complement to vegetables and soups.

**Millet** is highly alkaline in nature and high in vitamins and minerals. It is very nutritious, has a good amino acid balance, and is very easy to digest. Whole millet can be used as a cereal or as an ingredient in vegetable burgers. Millet flour can be used to make muffins and breads.

**Buckwheat** is not a grain at all, but the seed of an herb that somewhat resembles rice. It is a food staple in China and Russia, where roasted buckwheat is called kasha. Buckwheat is a good source of rutin which helps blood circulation. As a flour, it can be used to make griddle cakes, muffins or Japanese noodles. The coarse, ground version of this grain is known as groats.

**Teff** is a tiny grain that has been in use in Ethiopia for thousands of years to make the local flat bread called Injera. It is a very versatile grain, and can be used in recipes easily.

Teff is an excellent source of minerals and fiber. Cooked teff is gelatinous and is a good thickener for soups, stews, and sauces. It adds a mild, slightly molasses-like sweetness to any recipe.

**Quinoa** (pronounced keen-wah) is a grain from the Andes mountains that once nourished the ancient Incas. Quinoa is a good source of protein, calcium, and iron. It is also a good alternative to wheat, rice, or potatoes.

**Amaranth**, the “lost grain”, is also sometimes referred to as the “food of the Aztecs”. It has a good amount of protein, iron, calcium, B-vitamins, and fiber. Amaranth contains the amino acid lysine which is not plentiful in wheat. Amaranth grains are very small and cook very easily. It is also available as a ready-to-eat cereal.

**Soy flour** contains twice the protein as whole wheat flour, and though, because of its texture, it cannot completely replace wheat flour, it can be added to other flours.

**Potato flour** can be used as a wheat substitute in gravies and cakes, especially when combined with another flour.

## Dairy Alternatives

Many people need to avoid cow dairy products because they are allergic or sensitive either to the sugar lactose or the protein casein. In addition, some research has implicated cow's milk as a risk factor in type 1 diabetes<sup>2,3</sup>. Some alternatives to cow's milk and other dairy products are listed:

### Milk alternatives

- **Nut milk** - Almonds, cashew, sunflower and sesame seeds can be blended and strained to obtain milk that is dairy-free.
- **Soy milk** - This is a good substitute for cow's milk due to its high protein and mineral content. It is available in most stores in both liquid and powder forms.

- **Rice milk** - This is a good choice for those who are both soy and dairy sensitive. It is available in most grocery stores.

**Butter alternatives** - Butter is a fat with healthy properties and, contrary to the prevailing advice, butter is a healthier option than many processed margarines (see fat chapter). However, for those who cannot tolerate any dairy foods, a natural saturated vegetable fat alternative to butter is coconut oil, a stable fat with good baking and cooking properties. Coconut oil, which has been used for centuries and is a major source of lauric acid, has been prescribed for centuries as a medicinal food by Ayurvedic physicians in India<sup>4</sup>.

**Cheese alternatives** - Cheese and grass fed dairy products are another good source of lauric acid, but need to be avoided by those who cannot have dairy foods. Soy, sheep, and goat cheese are alternatives that can be eaten by people who have to avoid cow dairy foods.



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