

A STUDY ON PREVENTING AND MITIGATING COMPLICATION OF DIABETES

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Abstract

Diabetes is a metabolic disorder accompanied by complications of multiple organs and systems. Diabetes has become one of the largest public health problems to date. Decreased physical activity, overnutrition, and nutrition transitions caused by changes in lifestyle contribute to the increasing incidence of chronic metabolic diseases as well as deaths related to them. The shift from undernutrition to overnutrition indicates that chronic diseases of affluence have become a public health problem; hence, sustainable health-related goals have been developed for the prevention of these diseases. Environmental factors and the gut microbiota influence metabolism in the human body. Several studies have proven that lifestyle interventions can effectively deter the progression of diabetes in individuals with impaired glucose tolerance.

Introduction

There are many different types of diabetes. How they are treated differs, but the end goal is the same: achieving adequate blood sugar control to prevent or delay complications of diabetes. These range from vision loss to kidney damage.

Blood glucose control requires diligence, but you *can* help manage and prevent common diabetes complications by setting personal goals with your healthcare team—and sticking to them. Routine checkups with specialists can gauge your progress and ensure you're on track.

Complications of Diabetes

The complications of diabetes fall into two categories:

- Microvascular complications: Complications of the small vessels
- Macrovascular complications: Complications of the large vessels

These types of complications typically occur as a result of chronically elevated blood sugar (hyperglycemia).

Elevated blood sugar can also cause an acute condition, such as diabetic ketoacidosis (most common in people with type 1 diabetes) or hyperglycemic hyperosmolar nonketotic syndrome (HHNS). These complications can occur at any point. However, they are often associated with illness, insufficient insulin dosing, or insulin omission, and they can be prevented.

Hypoglycemia (low blood sugar) is also an acute condition that can be prevented and treated. Treating low blood sugar promptly will prevent a potentially dangerous situation.

Hypoglycemia typically presents as shakiness, sweatiness, and confusion, and should be treated promptly with a fast-acting carbohydrate, such as 4 ounces of juice, glucose tablets, or gel. Severe hypoglycemia can result in coma and, in severe instances, death. Therefore, understanding the signs, symptoms, and treatment of hypoglycemia is especially important.

Low blood sugar can be caused by insufficient carbohydrate intake, exercise, too much insulin, or inadequate medication timing. If you or someone you know is experiencing low blood sugar often, talk to your physician.

The risk of developing chronic complications of diabetes will depend on the duration of the disease and the severity of hyperglycemia. Long-term complications of diabetes can be managed and prevented, but sometimes if complications are too advanced, they may develop into another chronic condition.

Microvascular Complications of Diabetes

Damage can occur in the eyes, kidneys, or nerves from high blood glucose levels.

Retinopathy

Retinopathy occurs when the vessels in the eyes become damaged. Diabetic retinopathy is a general term for all disorders of the retina caused by diabetes.

There are two different kinds of retinopathy—nonproliferative and proliferative. Extreme proliferative retinopathy can cause blindness if it is not

detected and treated. People with diabetes are also at increased risk of developing glaucoma and cataracts.

With regular screenings, early detection, and adequate blood sugar control, problems of the eyes can be prevented. Also, advancements in treatments have made treating eye disease in people with diabetes successful.

The American Diabetes Association recommends that all people newly diagnosed with type 2 diabetes receive an eye exam shortly after diagnosis and every year thereafter. People with type 1 diabetes should receive a dilated eye exam within five years of diagnosis and every year after that.²

Nephropathy

Nephropathy (or kidney damage) can occur when blood glucose levels have been elevated for an extended period. People with diabetes who develop kidney disease may have a genetic predisposition to kidney disease and blood pressure issues.³

When diabetes damages the kidneys, it can cause protein to spill over into the urine (known as microalbuminuria).

When kidney disease is identified early, further complications can be prevented. However, people may need dialysis or a kidney transplant to stay healthy when kidney disease is discovered in later stages.

Keeping blood sugars in tight control can prevent kidney disease and, in some instances of mild kidney disease, even reverse it.

Neuropathy

Chronically elevated blood sugars can cause damage to the nerves. Different types of neuropathy include peripheral neuropathy (which is the most common, affecting the feet, hands, legs, and arms) and autonomic neuropathy.

Peripheral neuropathy can lead to numbness, burning, pain, tingling, loss of feeling, difficulty in wound healing, and susceptibility to infections and ulcers in the extremities. Autonomic neuropathy refers to nerve damage that can affect the stomach (as in gastroparesis, which is when the stomach cannot properly empty itself) and sex organs.

Problems with the nerves can affect most organ systems and present differently depending on the organ they have damaged. Some of these symptoms include gastroparesis, constipation, diarrhea, bladder control issues, problems with sex organs (such as erectile dysfunction), lightheadedness, and irregular heartbeat.

Cardiovascular autonomic dysfunction is associated with an increased risk of silent myocardial ischemia and mortality.

Macrovascular Complications

Cardiovascular Disease

Diabetes is one of the leading causes of cardiovascular disease (heart disease), the leading cause of death in people with diabetes. In fact, the American Diabetes Association suggests that two-thirds of deaths in people with diabetes are from heart disease.⁷

Some different types of cardiovascular disease are atherosclerosis, arrhythmias, and heart failure. People with poorly controlled diabetes who are overweight, have a family history of heart disease, and have high blood pressure, elevated cholesterol, and high triglycerides are at increased risk of developing heart disease.

Heart disease can cause heart attacks and strokes. Weight loss (if indicated), a healthy diet, exercise, and blood glucose control can reduce the risk of developing heart disease in the first place. Having thorough checkups can also help prevent disease through early detection and treatment.

Peripheral Vascular Disease

Peripheral arterial disease (PAD) occurs when the vessels in the legs become thick with plaque. Similar to how the arteries in the heart can be affected by elevated blood sugar, so can the arteries in the legs.

Symptoms of PAD include intermittent claudication (cramping or pain when walking that stops at rest), weakness in the lower extremities, pain, lack of pulses in the legs and feet, cold toes, sores, or ulcers in the legs or feet that don't heal.

If you are having any of these symptoms, you should contact your healthcare provider. You may need to be seen by a vascular practitioner to determine the next steps.

Stroke

A stroke occurs when blood flow to the brain is interrupted. People with diabetes

are almost twice as likely to have a stroke as those who do not have diabetes.

You can take steps to reduce your risk. Keeping your blood sugar in good control, quitting smoking (if you smoke), and keeping blood pressure stable are just some of the things that can reduce your risk.

Steps to Take to Prevent Complications

People with diabetes can live a long, healthy life. In some instances, people with prediabetes or type 2 diabetes can put their diabetes in remission by practicing healthy habits. Although certain types of diabetes, such as type 1 diabetes, cannot be cured, it is still possible to live a healthy life with diabetes.

The primary objective is good blood sugar control. But it is important to understand that many factors contribute to good blood sugar control. Getting educated, finding support, and having a trustworthy medical team to help you set and achieve goals are important to living a healthy life with diabetes.

7 Ways to Use Technology for Diabetes Management

Keep Blood Sugars in Good Control

Controlling blood sugars is the number one objective of diabetes management, but it involves many layers. Your blood sugar targets will depend on your age, activity level, the risk for hypoglycemia, and other medical conditions.

If you are not sure what your blood sugar targets are, it's important to have a

discussion with your medical team. For most people with diabetes, fasting blood sugars should be around 80 to 130 mg/dL; two hours after a meal they should be less than 180 mg/dL.

These numbers will be different if you are pregnant. Also, children with type 1 diabetes and older adults often have different target blood sugars. Many factors contribute to blood sugar control, such as diet, exercise, stress, sleep, and medication management.

Follow a Healthy Diet

When you have diabetes, healthy eating is an important part of treatment. People with diabetes should understand how carbohydrates (a macronutrient the body needs for fuel) impact blood sugar.

It is important to learn how to integrate healthy and safe eating patterns that are sustainable, ensure that you maintain the pleasure of eating, and help you reach your health goals. Both the Academy of Nutrition and Dietetics (AND) and the American Diabetes Association support an evidence-based approach to individualized meal planning.

Registered dietitian nutritionists (RDNs) can help people with diabetes focus on macronutrient quality while taking in cultural considerations, food preferences, metabolic goals, and eating patterns.

Some people with diabetes may benefit from counting carbohydrates, while others will take an interest in a low-carbohydrate or ketogenic diet. In some instances, simply following the plate method and eating more

plants (a Mediterranean-style diet) can help blood sugar management.

Understanding where carbohydrates come from, reading food labels, measuring portions, and accurately counting carbs will be valuable tools for achieving dietary goals.

There is no “one-size-fits-all” eating plan. What works for you may not work for someone else.

Exercise

Physical activity helps to lower blood sugar by making cells more sensitive to insulin and reducing insulin resistance.¹¹ Exercise is also associated with cardiometabolic health, increased energy, better sleep, and reduced inflammation.

Many adults struggle with consistent exercise due to perceived lack of time, lack of enjoyment, or inability to ease into it. Sometimes, people burn out if they start at too high of an intensity.

Other barriers to starting exercise include fear of low blood sugar, particularly for people who take insulin or other glucose-lowering medications, as well as other related health conditions. If you have diabetes, consult with your healthcare team before starting a new activity.

Find something you love to do and set short-term and long-term goals to keep you motivated and focused. Simply doing a few minutes daily and working your way up can have a big impact.

Lose Weight, If Needed

Researchers have found that a 5% weight reduction can improve insulin secretion and insulin sensitivity, with larger relative weight losses leading to improvements in fat tissue distribution.¹²

A 5% to 10% reduction from starting weight is associated with clinically meaningful improvements in obesity-related metabolic risk factors.

If you have diabetes and struggle with your weight, losing weight will help improve blood sugars. In some instances, significant weight loss can help to reduce or stop medications. If you also struggle with elevated cholesterol, triglycerides, or blood pressure, losing weight can also help to improve those numbers.

Weight loss can be difficult, especially for people who have tried different “diets” and regained weight. The key to sustainable weight loss is to have continued support and education, and change behaviors slowly and steadily without feelings of deprivation and hunger.

Strategies such as carbohydrate counting, individualized meal planning, the plate method, and portion control can all be effective in weight loss. Losing weight doesn't look the same for everyone; sometimes, medical nutrition therapy should focus on maintaining weight loss or preventing weight gain.

If you haven't met with a registered dietitian, now might be the time to get started.

Take Medication As Prescribed

Medication management in combination with diet and exercise is often an essential part of reaching therapeutic goals. Timing, dosing, frequency, and specifications of use are important factors to consider when taking a medication.

If you are skipping medication dosages because of inconvenience or financial issues, it is important to raise your concerns with your medical team. Today, there are so many different classes of diabetes medications that clinicians can take an individualized approach to diabetes care.

The best medication regimen is one that is simple, effective, and minimizes side effects. Share your thoughts and concerns with your healthcare team so they can provide you with education, help you overcome barriers, or prescribe a new medication to help control blood sugar.

If you are taking your medication as prescribed and notice that your blood sugar levels are above goal for a few days in a row despite your efforts to take your medicine, exercise, and eat healthily, you may need a medication change. Never stop taking anything you've been prescribed without first checking with your provider.

Test Your Blood Glucose

Monitoring your blood sugar can help you pattern and identify triggers that can cause blood sugar to fluctuate. For example, if your blood sugar is elevated two hours after dinner, you may be able to reduce your portion of carbohydrates at that meal to help reduce your blood sugar next time.

Blood glucose testing and logging, whether you use an app or a continuous glucose monitor, can help you tighten your diabetes control.

Get Preventive Care and Screenings

Knowing your blood glucose, blood pressure, and cholesterol levels can be an effective way to prevent complications of diabetes that are related to your heart, eyes, nerves, and kidneys. Your hemoglobin A1C (a three-month average of blood sugar), blood pressure, and cholesterol are important numbers that you should understand.

Keeping these numbers in a healthy range can help protect you from developing diabetes complications.

People with diabetes should have their blood pressure checked at every clinical visit. Depending on your risk factors, doctors may also screen you for heart failure using blood tests or PAD by measuring blood flow at your ankle.

Meet With a Certified Diabetes Care and Education Specialist

Certified diabetes care and education specialists (CDCES) are experts in all aspects of diabetes self-management education and support (DSMES).

Diabetes self-management education may lower the risk of diabetes complications as well as reduce costs. It does this by reducing or eliminating medications and emergency room visits, and helping people access cost-saving programs.

The American Diabetes Association notes four critical timepoints when the medical care provider and/or multidisciplinary team should evaluate the need for DSMES

- At diagnosis
- Annually and/or when not meeting treatment targets
- When complicating factors develop (medical, physical, psychosocial)
- When transitions in life and care occur

CDCESs can help people make behavior modifications that are necessary for having good diabetes control and health.

If you haven't met with one of these specialists, ask your medical team for more information or contact your insurance company for a list of referrals. Many CDCESs offer virtual sessions, so you might be able to receive your education in the comfort of your own home.

Consider Intermittent Fasting

Intermittent fasting alternates times of eating and times of fasting. There are many different intermittent fasting approaches: some people alternate fasting days, while others restrict food for a certain number of hours per day.

Modified fasting includes limiting calories on fasting days to roughly 20% to 25% of your daily needs. Because there is no clear, universal definition of fasting, this type of dietary strategy is not meant for everyone.

The research is still emerging, but some studies suggest that intermittent fasting may help to improve insulin sensitivity and have

other beneficial health effects. However, long-term research is lacking, and many of the studies are done on animals, small groups, and for short periods of time.

It's important to note that if you take glucose-lowering medication such as insulin or oral glucose medications, you should contact your healthcare providers before starting any fasting, as it could cause hypoglycemia.

Get Better Sleep

Poor sleep quality and inadequate sleep have been identified as risk factors for poor glycemic control or elevated blood sugar. Sleep-related issues are also associated with restless legs syndrome and sleep apnea. If you or someone you love is having issues sleeping, talk to your medical healthcare provider.

Helpful strategies you can start at home include avoiding technology or blue lights 30 minutes before sleep; keeping your room dark, cool, and quiet; sleeping in comfortable, loose-fitting clothing; and avoiding stimulants like coffee and chocolate before bedtime.

Most adults benefit from sleeping seven or more hours per night.

Encourage Good Gut Health

There is an association between gut dysbiosis and diabetes. Dysbiosis occurs when there is an unhealthy balance between good bacteria and bad bacteria.

Eating foods containing prebiotics and probiotics, including fibrous and fermented

foods such as fruits, vegetables, whole grains, fermented vegetables, yogurt, and kefir, may help balance gut bacteria.

Some people with diabetes benefit from taking a probiotic. There are also certain supplements geared toward gut health and diabetes. Ask your healthcare provider about the different probiotic strains and if they would be helpful to you.

Take Care of Your Feet

Practice good hygiene and inspect your feet regularly, checking between the toes.

Do not walk around barefoot, especially if you have neuropathy. Special footwear may be needed to properly support your feet.

Don't Forget About Mental Health

Stress can cause blood sugars to rise by stimulating counter-regulatory hormones such as cortisol which increase insulin resistance. Diabetes can be stressful on its own; if you have added stressors, anxiety, or depression, it can make it hard to manage your diabetes, which can also cause blood sugars to rise.

Taking care of your mental health is just as important as taking care of your physical health. Too much stress can lead to depression, and people with diabetes are at an increased risk of being depressed.

Some studies have shown that people who are insulin resistant may also have an increased risk of developing depression. If you are experiencing signs of depression—such as feelings of sadness, worthlessness, fatigue, lack of interest in doing the things

you love, or sleep disruption—it's important to contact your healthcare provider right away.

Simplify Your Regimen

Forgetting to take your medicines daily? Having trouble following your meal plan due to your work schedule? Skipping medication doses or a change in diet can influence your blood sugars.

If you are having trouble following your regimen, you may need to make some adjustments. It's important to know that you are supported. By expressing your needs, your medical team can help you achieve your goals and get your blood sugars in a good range.

Simplifying may mean sharing your blood glucose values with your medical team via technology or using certain applications to help you count carbohydrates. Others may define simplifying as something different.

Smoking Cessation

The Centers for Disease Control and Prevention (CDC) advise that, regardless of which diabetes type you've been diagnosed with, smoking will make your diabetes harder to control. So, if you have diabetes and you smoke, you are more likely to have serious health problems related to your diabetes.

Quitting may appear to be an exceedingly difficult task, but many healthcare providers and hospitals have access to smoking cessation programs that support the individual behaviorally, emotionally, and physically.

The CDC also offers free assistance. For free smoking cessation, call 1-800-784-8669 or visit the agency's website.

Keep Up With Appointments

Don't wait until something is wrong to have your annual exams. Complications of diabetes can begin before a diagnosis is even made. You may be able to prevent complications by catching symptoms early so that they may be treated.

Some healthcare providers should be seen routinely, and other types of practitioners may need to be seen when something in your health changes. Your primary care physician, certified diabetes care and education specialist, or your endocrinologist can help find specialists.

Some healthcare providers you might be referred to include:

Ophthalmologist: An ophthalmologist specializes in eye health. Early detection of eye disease can prevent complications of diabetes.

Podiatrist: A podiatrist can help by providing information on good diabetes foot care practices, and they can fit you for specialized shoes if you need them. Podiatrists can also assess and treat neuropathy of the feet. If you have a wound or an ulcer that isn't healing, a podiatrist can help you. If you are not seeing a podiatrist and have concerns about your feet, make sure you discuss this with your primary healthcare provider and take your shoes off at your next appointment.

Vascular specialist: If you have experienced peripheral arterial disease symptoms, you may be referred to a vascular specialist. They can examine you and conduct specific tests to assess your health.

Nephrologist: A nephrologist specializes in kidney disease. Most of the time, your primary healthcare provider will conduct tests to assess your kidney function, but a nephrologist may be recommended if there are any indicators of kidney disease. Early detection and treatment can prevent further complications.

Cardiologist: A cardiologist specializes in the heart. Because people with diabetes are at increased risk of developing heart disease, they are often referred to a cardiologist.

Endocrinologist: An endocrinologist is a healthcare provider that specializes in hormonal glands and the diseases that affect them. You may be referred to an endocrinologist for medication management or assessment of diseases related to diabetes.

Because endocrinology is such a vast and diverse field, some endocrinologists will choose to limit their practice to specific conditions, populations, or procedures. You may hear of an endocrinologist being referred to as a "diabetes healthcare provider."

If you are referred to an endocrinologist, it doesn't mean you've "failed" diabetes management. It may simply mean that you need some additional assistance in getting your blood sugar stabilized.

A Word From Verywell

Diabetes is a complicated disease that requires daily self-management to keep blood sugars at goal. While there are certain variables you may not be able to control, there are also many variables that you can.

Keeping your blood sugars at a healthy range will help to prevent or delay complications of diabetes. In some instances, getting control of your blood sugar can reverse certain complications. The key is getting into a routine that works for you and finding your support.

Steps that can help you take control of your health are within reach. Start with small, realistic, and tangible goals, and build on your progress over time.

Self-monitoring tips

Self-monitoring blood sugar levels is vital. Trusted Source for effectively managing diabetes. It helps regulate meal schedules, physical activity, and when to take medication, including insulin.

While self-monitoring blood glucose machines vary, they generally include a meter and test strip for generating readings. Self-monitoring also involves using a lancing device to prick the skin to obtain a small quantity of blood.

Precautions

People should refer to the specific instructions of a meter in every case, as machines will differ. However, the

following precautions and steps generally apply to many devices on the market:

- Make sure both hands are clean and dry before touching the test strips or meter.
- Use a test strip only once. Keep strips in their original canister to avoid any external moisture changing the result.
- Keep canisters closed after testing.
- Check the expiration date before use.
- Check whether the machine requires coding before use, which may apply to older varieties.
- Store the meter and strips in a dry, cool area.
- Take the meter and strips to doctors' appointments so healthcare professionals can check their effectiveness.

Tips

People checking their blood sugar levels with a blood glucose meter also use a device called a lancet to prick their finger.

While the idea of drawing blood might cause distress for some people, lancing the skin to obtain a blood sample should be a gentle, simple procedure. Many meters require only a teardrop-sized sample of blood.

A person may also find the following tips useful:

- Use fingertips to obtain a blood sample. While some meters allow samples from other test sites, such as the thighs and upper arms, the fingertips or outer palms produce more accurate results.
- Clean the skin with soapy, warm water to avoid food residue entering the device and distorting the reading.
- Choose a small, thin lancet for maximum comfort.
- Adjust the lancet's depth settings for comfort.
- Take blood from the side of their finger, as this typically causes less pain. Using the middle finger, ring finger, and little finger may be more comfortable.
- Tease blood to the surface in a "milking" motion rather than placing pressure at the lancing site.
- Follow local regulations for disposing of sharp objects, including lancets.

While remembering to self-monitor involves people making lifestyle adjustments, it does not need to be an uncomfortable process.

Conclusion

For nearly half a century, along with the social development and lifestyle changes, chronic metabolic diseases, mainly obesity, type 2 diabetes, abnormal lipid metabolism, and coronary heart disease, have become diseases that threaten human health and are now one of the biggest public health

problems. Statistics show that more than 2 billion people are overweight or obese, and nearly 400 million patients currently suffer from diabetes mellitus globally. Several studies have proven that lifestyle interventions can effectively deter the progression of diabetes in individuals with impaired glucose tolerance. If the window of prevention is shifted earlier, diabetes may become a fortuitous event. Effective prevention needs high attention from the government and the participation of all citizens. The influence of environmental factors on human metabolism can be observed throughout lifespan. A poor lifestyle of the mother during pregnancy may lead to early life chronic metabolic diseases in the child. Poor nutrition during the embryonic period may induce the formation of "thrifty" genes in the fetus; obesity and metabolic disorders will appear when the postnatal baby receives adequate nutrition. Excess intake or glucose metabolism disorder in the mother during pregnancy can cause fetal nutrition surplus and high insulin hematic disease, which are key factors contributing to macrosomia and obesity in children. In recent years, the fast growing incidence of gestational diabetes is an indicator of metabolic disturbances in the next generation. The adverse influence of modern lifestyle on child and adolescent health is more significant, with the young generation, during the early stage of China's reform and opening up, growing up exposed to western foods such as KFC, McDonald's, and Coca-Cola.

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