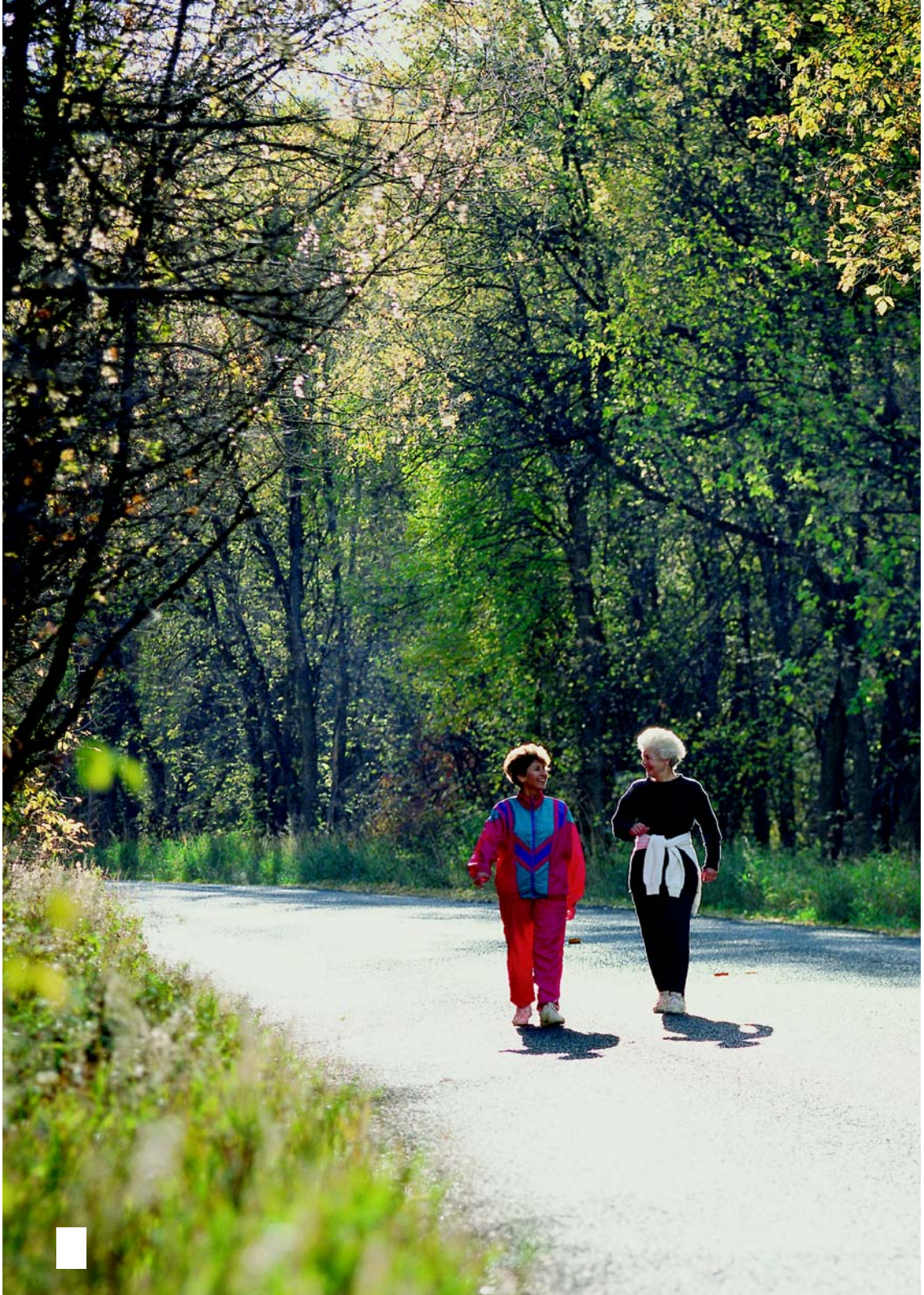
GUIDELINES FOR GOOD MANAGEMENT OF DIABETES

By Dr Matti Tolonen and Dr Pentti Raaste



It takes years to get accustomed to lasting life style changes. The first step is to abandon the idea of temporariness because the changes have to be life-long. A life-style change is not too late as long as one breathes.

Claes Andersson
(Finnish psychiatrist, writer, musician, ex-minister, and diabetic)

- Diabetes has become a world wide epidemic. The number of diabetics is steadily increasing and it will probably double during the next 10 to 15 years, worldwide. There would appear something fundamentally wrong with our dietary habits causing this, as genetic changes are not this rapid in humans.
- Diabetes is usually defined as either type 1 or type 2. Type 1 is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas, leading to a deficiency of insulin. Genetically disposed children and youngsters tend to get type 1 diabetes, but some environmental factors are causing it to appear earlier in the life span. Type 2 is due to insulin resistance or reduced insulin sensitivity, combined with reduced insulin secretion. Nowadays there is also a third, uncertain type, sometimes called type 1.5.
- The costs of diabetes are expanding rapidly as type 2 is contracted by younger and younger people. At least 2/3 of the costs are caused by preventable complications. Reducing the reading of HbA1C (for short A1C) by 10 per cent would lower the costs by 40 per cent.
- Increased blood sugar concentration damages tissues in very early stages, often years before the diagnosis of diabetes is set. Once the organ damages have started, they are not reversible; it is possible only to slow down their progress. Therefore the prevention of complications is of utmost importance.
- The treatment of diabetes has to rely on four pillars: Healthy nutrition, regular physical exercise, necessary medication and dietary supplements.
- Application of the advice given by this guide helps the diabetic treat him or herself so that minimal or no medication should be needed. Changing the life style for the better can reduce the risk of complications and slow down their development.

WHAT YOU SHOULD KNOW ABOUT DIABETES

Diabetes is a group of different conditions in which the concentration of the sugar (glucose) in the blood increases to a too high level. Diabetes does not appear by itself, but rather as a combination of genetic and life style factors. The reason for increasing glucose concentration in the blood is the cessation or inadequate excretion, or the diminishing influence of the pancreatic hormone, insulin. The latter condition is called insulin resistance. Elevated blood glucose leads to glycation (caramelisation) of proteins and fats in the tissues, which in turn causes pathologic changes in the micro and macro arteries, eyes, nerves and kidneys. In other words diabetes reduces and limits the quality of life, causes comorbidity and increases the risk of mortality. Comorbidity refers to other diseases an individual might have other than the primary disease. In addition to the generally known complications (eye, blood vessel, nerve and kidney damages), diabetes has been found to increase the risk of depression and some cancers, such as pancreas and colon cancers. Smoking, some medications (cortisone, beta blockers and antidepressants) may weaken the effect of insulin and thus trigger on diabetes.

PRE-DIABETES

Before people develop type 2 diabetes, they almost always have "pre-diabetes", i.e., blood glucose levels that are higher than normal but not yet high enough to be diagnosed as diabetes. Pre-diabetes is more common than generally recognised. In a healthy person, the fasting reading of glucose in whole blood varies between 4 and 5.6 millimoles per litre (mmol/l), or 72 and 100 mg/dl. The person is considered to be pre-diabetic when at least two fasting blood measurements yield readings between 5.6 and 7.0 mmol/l (100–126 mg/dl) and in a two hour glucose tolerance test (GTT) one or more readings are 7.8–11.1 mmol/l (126–200 mg/dl). Then the person has “impaired glucose tolerance”, and consequently an elevated risk of contracting diabetes in the future. Many of the present diabetics have been pre-diabetics for 5–10 years before getting the diagnosis “type 2 diabetes”. That is why many of them already have alterations in the arteries and the eyes at the time of diagnosis. Pre-diabetes can best be observed by measuring the blood glucose about one hour after a meal – instead of just fasting blood glucose (before meal).

Pre-diabetes is a serious medical condition, which has significant risk of tissue damage. The good news is that people with pre-diabetes can prevent the development of type 2 diabetes by making changes in their diet and increasing their level of physical activity. The risk could be reduced up to 60% by slimming 5 to 10% off their weight and walking or jogging daily ½–1 hours. Pre-diabetics should begin changing their life style already at this stage, according to the advice given in these guidelines. All adults who are overweight should be tested for diabetes or pre-diabetes.

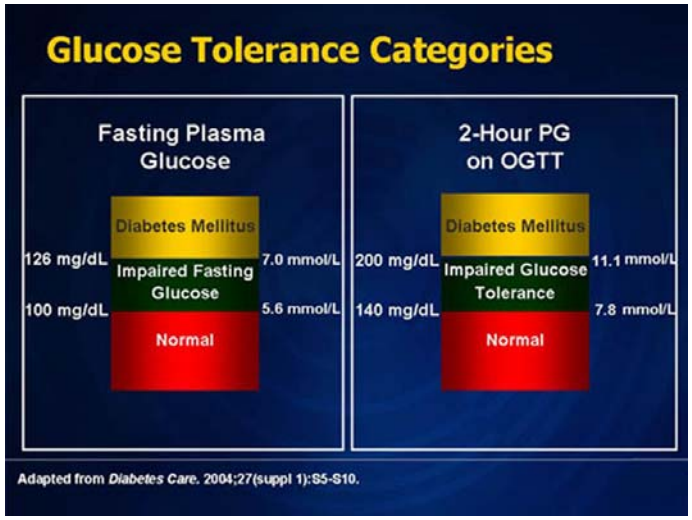


Figure 1. Diagnosis of diabetes is based on the blood glucose values, both fasting blood glucose (left) and glucose tolerance test (right). In the UK the readings are given as mmol/l, while in Spain and USA the values are mg/dl. The co-efficient is 18. Between the health and diabetes there is a grey area, called pre-diabetes.

GESTATIONAL DIABETES (OCCURRING DURING PREGNANCY)

In healthy women, the pancreatic beta cells (which excrete insulin) multiply during pregnancy, and produce insulin adequately to meet the need for both mother and foetus. In women who contract pregnancy diabetes, the beta cells do not multiply enough. The cause is probably over expression of a protein called menin. It may also be the reason behind type 2 diabetes in overweight and obese people. Gestational diabetes may harm the normal development of the child. Pregnancy diabetes typically resolves with delivery of the child, but unfortunately the mother may contract diabetes type 2 later in her life. As a matter of fact, half of the women who have had pregnancy diabetes will become diabetic later on. They may reduce the risk by weight control, regular exercise and taking certain dietary supplements, which prevent, suppress and extinguish oxidative stress and chronic low-grade inflammation.

SELF-MONITORING OF BLOOD GLUCOSE

It is an essential part of proper treatment. The aim of life style changes is to get the blood glucose readings as close to those of non-diabetics as possible, in other words the fasting (before meal) plasma glucose to less than 6 mmol/l (105 mg/dl). Glucose readings are often at highest about 30 to 60 minutes postprandial (after meal), and then the readings start to decline. Glucose monitoring after meals aims to discover those top readings, so it is advisable to analyse blood sugar after about 45 minutes postprandial. The readings should not exceed 8 mmol/l (145 mg/dl). Self-monitoring helps you to choose your meals so that the blood sugar levels are under control.

For diabetics who do not need medication (i.e., who are in nutritional therapy only), the A1C should stay under 6%. Otherwise the treatment needs amendment. For those under medication the A1C should stay under 6,5% and for those using insulin, in general, under 7,0%, but the individual goal may be tighter, e.g., 6.5%. For those using metformin or glitazone A1C aim may be as low as below 6.0%. A1C readings should be taken 3 to 6 months intervals for those under good glucose balance. Otherwise we recommend testing A1C every 2 to 4 months, or even more frequently. According to research, only one out of three diabetics is in good glycaemic control, i.e., A1C is under 7%. In two out of three diabetics, the balance is so poor that they run a considerable risk of complications.

Blood sugar levels may be monitored according to various strategies, for instance once or twice a day. If you measure once a day, you may take the reading on alternative days from fasting and postprandial blood samples. We recommend that you take postprandial readings sometimes after breakfast, sometimes after lunch, sometimes after dinner, in order to get familiar with the effect of different meals on your blood sugar levels, and you thus learn how to avoid and reduce the intake of food items detrimental to yourself. In addition, you should take four readings or more on consecutive days, once or twice a month. If you are on insulin, you should monitor frequently the effect of different meals, exercise and mood fluctuations on your blood sugar levels and learn from the readings. It is known from experience that the more often a diabetic monitors his or her blood sugar readings, the better the glycaemic control, and A1C stays below 7%. This is a good way to prevent the toxic effect of elevated glucose concentration on the beta cells of the pancreas as well as other vulnerable cells in the body.

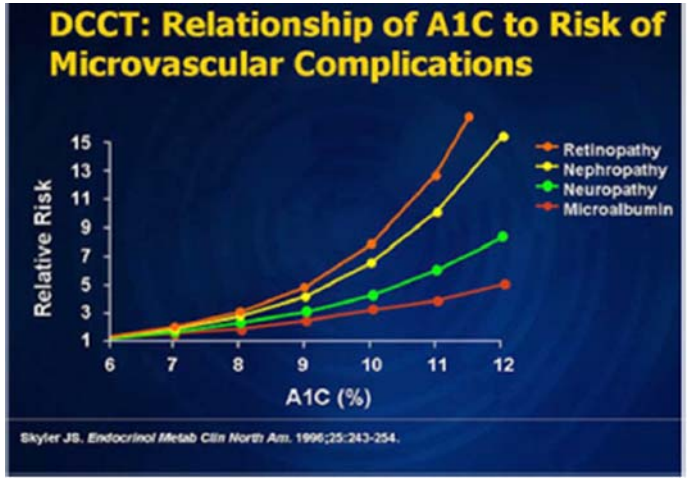


Figure 2. The higher the A1C reading, the greater the risk of diabetic complications.

WHAT DOES A1C TELL US?

A1C is formed when glucose reacts non-enzymatically with amino acids on haemoglobin in the red blood cells. A1C represents an integrated measure of glucose concentration during haemoglobin´s lifespan, which is about 2–3 months. Because A1C concentration predicts the risk for diabetic complications (Fig 2), it is used in the clinical setting to assess longer-term glycaemic control among people with diabetes. Generally, A1C concentrations under 7% are regarded as acceptable. Regrettably, only one diabetic in three complies with this reading. In non-diabetics the reading is usually 5–6% (33–40 mmol/mol).

A1C values over 7% increase the risk of complications and visa versa: lowering of elevated A1C reduces the risk and slows down the progress. Lowering A1C from 9 to 7 reduces the risk of retinopathy by 60%, nervous and kidney damage by 50% and arteriosclerosis by 40%. A1C can be controlled by healthy eating habits, medicines, exercise and dietary supplements, as explained in this guide.

ADVANCED GLYCATION ENDPRODUCTS (AGES)

These are the main culprits for diabetic complications. AGEs are formed when glucose forms irreversible bindings with other substances, like proteins, fats and nucleic acids. Many foods and drinks contain AGEs. They are present in Cola drinks, mayonnaise, butter, donuts, cookies and pastries, and they form in high-temperature cooking of meat (like broiling, frying, roasting, and grilling). Caramel is a typical example of AGE products. Smokers have high levels of AGEs in the blood due to the AGEs that are added in the processing of tobacco.

AGEs are produced also internally (endogenously) in the body, when the blood sugar concentration increases, long before clinical signs of diabetes complications have started. At present no routine method for measuring AGEs in the blood has yet been developed.

AGEs are brown, gluey substances which damage the endothelium of the arteries leading to stiffness and constriction of the blood vessels. AGEs also produce cross-linking of the proteins thus causing wrinkles in the skin and other ageing changes. Furthermore, AGEs oxidise the "bad" LDL cholesterol, which in turn damages the arteries. That is the bad news. The good is that benfotiamine and carnosine, as dietary supplements, are able to block totally the dietary and endogenous AGEs and their harmful effects.

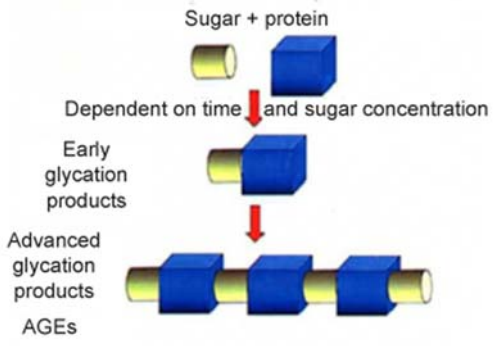


Figure 4. Dietary and endogenous AGEs are built when glucose reacts irreversibly with proteins, fats and nucleic acids. One of the results is the glycated haemoglobin A1C. The greater the A1C reading, the more AGEs are formed in the body, and the greater the need for anti-AGE-agents, such as benfotiamine and carnosine.

INSULIN RESISTANCE

Every overweight type 2 diabetic is insulin resistant. It means that the effect of insulin has become weaker. The disposition to insulin resistance is partly hereditary, but it may be worsened by smoking, drinking, long-term stress, hypertension, pregnancy, fast, and use of cortisone and antidepressive drugs. The reason of insulin resistance may be a disturbed binding of insulin to the cellular receptor or its function, disturbance in the glucose transporter proteins. The problem lies in the uptake of glucose into the cell or in the glucose metabolism inside the cell.

The pancreas of an insulin resistant person may produce insulin in excess and thus the blood glucose may stay within normal limits. However, every fourth insulin resistant individual does not excrete insulin enough, or its effects in the cell are inhibited, so that the fasting and postprandial blood glucose readings will rise. Extra blood sugar levels are toxic to the pancreatic beta cells, which then consequently reduce the insulin excretion. The less the pancreas produces insulin, the more fat cells liberate toxic free fatty acids, which again damage the beta cells. Free fatty acids also accumulate in the liver, where they fight the effects of insulin leading to increasing blood sugar concentrations.

Insulin resistance can be detected by making an insulin loading test at the same time with glucose tolerance test. It will show whether the person excretes insulin at all, normally, or in excess. Pathological values in a type 2 diabetic may be normalised simply by avoiding excess intake of starch. If you are insulin resistant, we recommend that you start applying the guidelines given in this leaflet.

COMPLICATIONS

Diabetes can cause many pitfalls and we feel that it is important that you know the facts. Acute complications (hypoglycemia, ketoacidosis or non-ketotic hyperosmolar coma) may occur if the disease is not adequately controlled. Serious long-term risks include heart and arteriosclerosis (cardiovascular disease), and micro-vascular damage, which may cause retinal damage (which can lead to blindness), nerve damage, chronic renal failure, impotence and poor wound healing. Smoking, elevated cholesterol levels, obesity, high blood pressure, and lack of regular exercise contribute to the complications. Different people are more or less susceptible to developing these complications, probably due to genetic reasons. In the past, diabetics who developed heart disease or kidney damage had about 12 years shorter lifespan than others. Nowadays, complications may be controlled due to better ways to treat diabetes.

HOW DO THE COMPLICATIONS DEVELOP, AND HOW CAN YOU REDUCE THE RISK AND SLOW DOWN THEIR DEVELOPMENT?

There is still some uncertainty about the reasons behind complications that develop after many years of diabetes. However, it is known that glucose causes pathological alterations in certain cells, which do not tolerate elevated glucose content. These cells – situated in the arterial walls, eye retinas, brain, nerves, adrenal glands, kidneys – take in glucose without the help of insulin, in direct proportion to the level of glucose in the blood. Glucose will bind within these cells to form AGEs which have the potential to damage the cells very early, in a few days or weeks. It is therefore these organs which are especially vulnerable. The younger you are when diabetes is diagnosed, the more serious will the complications get.

One of the reasons for the organ damage is that a diabetic person burns glucose via a wrong way, called hexosamine pathway. It produces toxic free radicals, especially super-oxide (O_2^-), in the small cellular power plants called mitochondria. Free radicals cause damage to the mitochondrial membranes which begin to leak, just like oxidised batteries. This leakage causes pathological changes in the arteries, heart, eyes, nerves and kidneys. Free radicals cause damage to the mitochondrial membranes which begin to leak, just like oxidised batteries.

CARDIAC CHANGES

The heart and arteries are most vulnerable to elevated blood glucose. External and internal AGEs cause hardening, narrowing and eventually blocking of the blood vessels. Over 80% of diabetics contract cardiovascular disorders and die from them – although they are treated by the current guidelines issued by medical organisations. Therefore we feel that the guidelines should be updated, as we propose in this guide.

Actually, diabetes and cardiovascular disorders belong to the same family of diseases. Diabetes causes myocardial infarctions (heart attacks) and infarctions cause diabetes. Elevation of blood pressure increases the risk of diabetes, as well as myocardial infarction (heart attack) and stroke. The reason behind all these conditions is disturbed glucose and fat metabolism and latent deficiency of some vitamins, minerals, trace elements, biologically active peptides and omega-3 fatty acids.

Increasing blood glucose destroys cardiolipin (literally "heart fat"), a special fat present in the heart. This destruction begins already during pre-diabetes. Cardiolipin is essential for the cardiac mitochondria, which produce energy for the heart pump. When the mitochondria begin to leak, their ability to produce sufficient energy for the heart muscle declines. This weakens the pumping capacity of the heart and simultaneously the free radicals continue to damage the heart cells. This vicious circle may lead to a heart attack, insufficiency and degeneration of the heart (cardiomyopathy). Certain dietary supplements can help break the vicious circle.

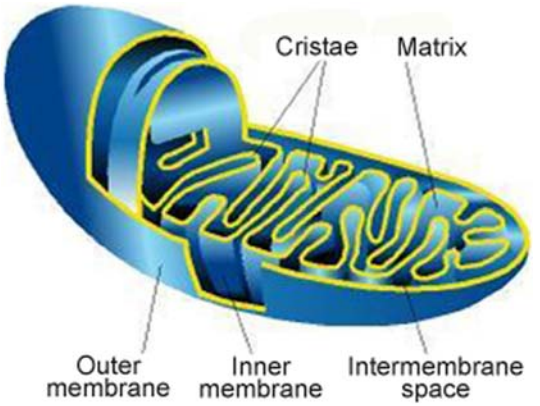


Figure 3. Mitochondria are tiny organelles, which produce energy in the cells. An organelle is a specialized subunit within a cell that has a specific function, and is separately enclosed within its own lipid membrane. Elevated blood glucose and glucose burning the hexosamine pathway produce toxic free radicals which damage the mitochondrial membranes. Benfotiamine, carnosine, E-EPA and other dietary supplements protect the mitochondria.

DIABETIC RETINOPATHY – DAMAGE TO THE BLOOD VESSELS IN THE RETINA

Elevated blood glucose damages insidiously the retinal micro-vessels without giving any symptoms until too late. Almost all type 1 diabetics develop retinal changes during the first 20 years of disease. Those who contract diabetes before puberty get retinal changes sooner than those who are diagnosed diabetics later. Every third type 2 diabetic has signs of retinopathy at the time of diabetic diagnosis. Diabetic retinopathy is the most common cause of visual impairment in those of working age and the third most common cause in people over 65 years. The risk of retinopathy can be reduced and its progress can be slowed down by careful glycaemic control, laser treatment and dietary supplements.

DIABETIC NEUROPATHY

The nerves are damaged partly because of arterial changes. Sugar enters also directly to the peripheral and central nervous system, where it turns into alcohols (sorbitol and polyols). They cannot per se come out of the nerve cells, which are then damaged. The higher the A1C, the greater the risk of neuropathy (Fig. 2).

About 8% of type 2 diabetics have symptoms and signs of neuropathy at the time when the diabetes diagnosis is established. After 10 years about 40% and after 15 years over 50% of diabetics experience neuropathy. The symptoms include tingling, numbness, sensory loss and pain. Also the muscles may atrophy.

DIABETIC NEPHROPATHY – KIDNEY DAMAGE

Fifteen years after the diagnosis of type 1 diabetes, 20–30% of the patients have developed damage to the walls of blood vessels which cause increased leakage of protein into the urine, called micro-alburinuria, as a sign of early kidney damage. One in two with the condition proceeds into kidney disease. One in five type 2 diabetics has albumin in the urine already at the time of diagnosis; after ten years the figure is 30. The conditions may be reversible. Annually, thousands of diabetics need dialysis treatment and kidney transplant.

WOUNDS IN LEGS AND FEET

Wounds heal badly in diabetics due to poor blood circulation and zinc and carnosine deficiency. Poor healing of wounds, particularly of the feet, can lead to gangrene, which may require amputation. We strongly recommend dietary supplements as in the subsequent section of this guide.

ERECTIL DYSFUNCTION AND IMPOTENCE

When a male has diabetes, the main risk factors for developing erectile dysfunction are nerve damage (neuropathy), blood vessel damage and poor blood sugar control. As many as 80% of men with diabetes develop erectile dysfunction, compared to about 25 percent of men without diabetes. Erectile dysfunction most frequently develops after age 65. In men with diabetes, however, it tends to occur 10 or 15 years earlier, on average. Men in their 30s and younger with diabetes have also experienced erectile dysfunction. The longer you've had diabetes and the more severe it is, the more likely you are to develop erectile dysfunction or impotence. Carnosine forms nitric oxide in the body, which is needed for erection. Therefore carnosine has become an increasingly popular dietary supplement amongst men with diabetes.

SELF-MANAGEMENT OF DIABETES

The goal is to find a way of treating your diabetes effectively. The ultimate goal is to prevent, or at least slow, the rate of development of diabetic complications: micro- and macro-vascular changes, nerves and kidney damage, depression and memory impairment. There may be more than one way of reaching this goal. Good glucose balance reduces significantly the risk of complications, but it alone is not sufficient to prevent the complications totally. Glucose balance is monitored by analysing blood glucose values and A1C but it is necessary to monitor other risk factors, like C-reactive protein (CRP), cholesterol, triglycerides, homocystein, vitamin B1, magnesium, zinc, liver enzymes, creatinine, and urinary albumin. Plasma fatty acid analysis gives valuable information of the person´s omega-6/omega-3 ratio. Annual or biannual eye examination is also appropriate.

NUTRITION

Healthy nutrition is important in preventing diabetes as well as managing existing disease. The goal of these recommendations is to make people with diabetes and health care providers aware of beneficial nutrition interventions. This requires the use of up-to-date scientific evidence while taking into account treatment goals, strategies to attain such goals, and changes individuals with diabetes are willing and able to make. Achieving nutrition-related goals requires a coordinated team effort that includes the person with diabetes and involves him or her in the decision-making process.

In 2008, the American Diabetes Association (ADA) voiced its support of low-calorie or low-carbohydrate diets, which are equally effective in helping people lose weight over a year, according to the association. The recommendations are intended to help physicians guide their patients in diabetes prevention and management.

Carbohydrates: Starch v cellulose

Carbohydrate intake needs to be managed to control your blood sugar levels. For this purpose, we endorse the orthoglycaemic diet for all diabetics and other people alike (http://tinyurl.com/2dnpb9).

Most of our carbohydrates come from cereals and grains, both products of the agricultural revolution. Also milk contains sugar, lactose (5 g/100ml). Half a litre (one pint) a day of milk is recommended for children for its calcium content.

Our bodies are not genetically designed to thrive on large helpings of fibreless complex carbs, starch. With the popularity of cereal-based and grain-based diets, carbohydrate metabolism has been upset in approximately 3/4 of the population, including all diabetics, which simply cannot handle this large load of carbs. A big portion of starch is stored as fat resulting in obesity. We endorse avoidance of starchy meals, such as potatoes, corn, rice, banana, squash and all cereals and grains (therefore bread and porridges), cakes, and other pastries. Pizza meal will usually contain more bread than traditional meal; therefore we advise you not to eat much of the crust.

Most people know how to avoid excess simple sugars, which are easily identified by their taste: sweet. The same alarms do not go off when consuming potatoes or white bread, although they should since these items







Photos: Osmo Lehtinen

convert to simple sugar within minutes of consumption. Potatoes and rice are not very different in that respect. Pasta gives slower rise in blood glucose than potatoes, which makes pasta more suitable for people with diabetes. Macaroni gives a quicker blood glucose response than spaghetti, which increases the blood glucose just as quickly as white bread and ordinary sugar. The starch in vegetables increase the blood sugar content more slowly than other types of starch, as vegetables are high in dietary fibre. We recommend you to increase your fruit and vegetable intake along with the “cellulose line”. It is more effective, also for weight control, than low-fat starchy diets. The “cellulose line “can help people with type 2 diabetes get their blood sugar under control when standard dietary changes and drug treatment have failed.

We will explain the rational as follows:
When we eat starch, an enzyme that occurs in saliva and in the intestines, called amylase, breaks the bonds between the repeating glucose units, thus allowing the sugar to be absorbed into the bloodstream. Amylase is secreted by the salivary glands, which empty into the mouth, and by the pancreas, which empties into the head of the duodenum. Once absorbed into the bloodstream, the human body distributes glucose to the areas where it is needed for energy or stores it as its own special polymer – glycogen, another polymer of glucose. Excess glucose is bonded together to form glycogen molecules, which we store in the liver and muscle tissue as an "instant" source of energy. Both starch and glycogen (animal type starch) are polymers of glucose. Excess glucose turns into fat, which builds on the waist and bottom. That is why we recommend avoiding starchy foods. If you cannot stand the temptation, you may use Kilo-Stop capsules, which inhibit the activity of amylase, thus preventing the absorption of glucose molecules into your blood stream.

Complex carbs come in two varieties: high fibre and low fibre. The main item in high-fibre, complex carbs, is cellulose. It cannot be digested by human beings; therefore cellulose passes through the digestive tract without being absorbed into the body. Despite the fact that it cannot be used as an energy source, cellulose fibre is essential in the diet because it helps exercise the digestive track and keeps it clean and healthy.

High-cellulose (high-fibre) vegetable foods are the healthiest choices for human nutrition, and the ingestion is associated with lowered incidences of diabetes, hypertension, cancer, arthritis, etc. Examples are lettuce, broccoli and berries. Eat your fruits, do not juice them and drink them, unless you are on a juice fast. Eating the whole fruit results in the inclusion of natural fibre, which allows proper absorption of sugars.

PROTEIN

Meat, poultry, fish and eggs are examples of good sources of protein. Protein keeps hunger at bay. Protein does not directly increase blood glucose, but it stimulates the release of glucagon, which – in a process called gluconeogenesis – helps to convert protein into glucose. If there is not enough insulin, the blood glucose may slowly increase as a result.

It is important to understand that excess protein can be nephrotoxic. It increases AGEs in the blood through an excessive dietary AGE content and an increased amino acid load. This enhances AGE formation in the body. We recommend protein daily 0.8 g/kg with an emphasis on protein that has high biologic value and is low in AGEs. Dietary AGE load can be minimised by consuming non-meat proteins (e.g., chicken, fish, eggs) and prepare the food by steaming, poaching, boiling and stewing instead of frying, broiling, roasting or grilling.

FATS

Our diet contains a complex mixture of fats and oils whose basic structural components are fatty acids. We generally consume at least 20 different types of fatty acids, which are classified as saturated, monounsaturated and polyunsaturated. They do not directly affect blood glucose, but indirectly fats slow down the absorption of carbohydrates by slowing the rate at which the stomach empties. Consequently, the blood glucose level rises more slowly. Therefore it is a good idea to include several weekly servings of oily fish in your diets or to take omega-3 capsules with your meals.

Not all dietary fatty acids are created equally. People with diabetes should minimise the intake of saturated and trans fats. Foods that contain large amounts of saturated fat include dairy products and red meats. Trans fat is present for instance in margarines, pastries, cookies, ice creams and in most restaurant foods.

Even among dietary polyunsaturated fatty acids (PUFA), there are different families of compounds, and this is at the heart of the

difference between omega-3 fatty acids and other dietary lipids. Omega-3 fatty acids generally account for a small fraction of the total daily consumption of fatty acids in Western societies. Fish such as tuna, trout and salmon are especially rich sources of these fatty acids. Fish-oil supplements are also a rich source. Small quantities of omega-3 fatty acids are naturally present in meats like beef, pork and poultry. Despite containing small quantities of omega-3 fatty acids, meats contribute to the overall intake of these fatty acids simply because of the large amounts consumed.

The most important consideration when considering PUFAs is the ratio between omega-3 and omega-6 fatty acids. Vegetable oil is rich in omega 6 and fish oil in omega-3. Some vegetable oil contains also omega-3 (alpha-linolenic acid, ALA), but its biological activity is far inferior to fish oil omega-3 (EPA and DHA). Because omega-6 and omega-3 compete with each other, the proper ratio between them is extremely important. The ideal omega 6:omega 3 ratio is 1:1 to 2:1. This ratio is prevalent in Japan, where people eat a lot of seafood. The standard Western diet, in contrast, is high in omega 6 and provides an omega-6:omega-3 ratio of between 6:1 and 30:1. That means that the effects of omega-6 outweigh the beneficial effects of omega-3s. Mediterranean diets contain a better ratio of the omegas. Fish-oil supplements is an effective way to increase omega-3 fatty acid intake without changing dietary habits; however, 1–3 capsules must be taken daily to achieve the recommended intake. Omega-3 fatty acids may lead to a general increase in the overall health and well-being

When changing your dietary habits, remember to frequently self-monitor your blood sugar values. Reducing the glycaemic load of your meals may require reduction of your medication, in order to avoid hypos.

DIETARY SUPPLEMENTS

Your doctor may have said that you do not need any dietary supplements. As a matter of fact, the average doctor has not had much education in nutrition or dietary supplements. A doctor is usually so busy prescribing medicines, which of course take priority with them, that they do not have time to study preventive medicine, including the use of dietary supplements. Average doctors do not actually know a great deal about them and consequently do not advise them.

As a matter of fact, what is recommended daily for the healthy average population does not apply to risk groups and diabetics, because their need may be much higher! The reason is that diabetics excrete urine more than non-diabetics and with the urine they also excrete abnormal amounts of nutrients, such as vitamin B1. If you are serious about managing your diabetes to the best of your ability, you cannot afford to do so without dietary supplements. They prevent deficiencies, help balance blood sugar and prevent glycation, thus reducing the risk of complications. Supplements of special importance for diabetics include omega-3-fatty acids, carnosine, vitamins B, C and E, chromium, magnesium, selenium and zinc.

Omega-3-fatty acids and carnosine suppress expression of genetic flaws, oxidative stress and chronic low-grade inflammation. Some supplements, like alpha lipoic acid, benfotiamine, carnosine and vitamin B6 prevent glycation of proteins and fats (e.g., LDL cholesterol). Folic acid and vitamins B6 and B12 prevent accumulation of homocystein. Uniquinone (Q10) and E-EPA prevent the damages in mitochondria caused by cholesterol lowering medication (statins). The outlook for someone who takes supplements is much brighter.

Benfotiamine

Benfotiamine is a lipophilic analog of vitamin B1 (thiamine), which reduces the risk of pathological changes in the arteries, eyes, nerves and kidneys. Recently, researchers led by Professor Paul Thornalley at Warwick Medical School, University of Warwick, have shown conclusively that diabetic patients are thiamine (Vitamin B1) deficient and that the decreased availability of thiamine in vascular cells is linked to micro-and macro-vascular complications. The decreased plasma thiamine concentration in clinical diabetes is not due to a deficiency of dietary thiamine. Rather it is due to 15 times the normal rate of removal of thiamine from the blood into the urine. Professor Paul Thornalley said: "Supplementing diets could be an effective way of minimising the risk of these complications."
The most effective and safe thiamine is called benfotiamine. Professor Jaime Uribarri, at Mount Sinai Hospital Renal Center (NY), suggests that diabetics take benfotiamine daily about 300 mg in long term use, as benfotiamine is an excellent anti-AGE agent, able to block totally the harmful effects of AGE products on the arteries.

Carnosine

Carnosine is an endogenous protein (dipeptide), another anti-AGE agent, which reduces the risk of diabetic complications, such as kidney damage and erectile dysfunction. The content of carnosine in the body declines with age, but it is possible to restore the concentrations by taking carnosine as a dietary supplement. It increases the beta cell mass in the pancreas and fights oxidation and carbonylation, two pathologic biochemical reactions characteristic to diabetes. Carnosine prevents the glycation of LDL cholesterol thus keeping it in a harmless state. Carnosine also speeds up wound healing. An adult diabetic needs carnosine 800 to 1200 mg a day. The dosage may be doubled during the time of wound healing. Zinc and Vitamin E enhance the beneficial effects of carnosine.

E-EPA (ethyl EPA)

E-EPA is highly purified fish oil (omega-3), which is recommended for diabetics, heart and mental patients (1000 to 2000 mg a day). E-EPA prevents the break down of cardiolipin in the heart and it protects the arteries against stiffness and hardening. E-EPA enhances the

positive effects, and prevents the side-effects of statins, and it improves the lipid profile in the blood (lowering triglycerides and improving the omega-6/omega-3-ratio). E-EPA is an excellent anti-inflammatory agent. It also balances stress hormones (cortisone and cortisol) and it fights insulin resistance. E-EPA reduces visceral fat, and it enters the brain better than traditional omega-3s, thus preventing memory impairment, depression and dementia.

Chromium (Cr)

The daily intake recommendation for healthy people is 50–200 micrograms, but diabetics need at least double, because insulin needs chromium as a co-factor. In a recent study, 63% of the subjects with type 2 diabetes responded positively to the Cr treatment (1000 mcg/day) as compared with 30% with placebo. Adequate chromium supplementation may lower A1C by one per cent. In addition, chromium prevents cravings for sweets. Organic chromium – e.g., as chromium trinicotinate or picolinate – also reduces the risk of depression.

Magnesium (Mg)

Diabetics excrete magnesium in the urine more than non-diabetics, and consequently, up to half of diabetics are magnesium-deficient. Unfortunately, doctors do not analyse the magnesium content in red blood cells, and therefore the deficiency remains mostly unnoticed and untreated. The deficiency increases the risk of arrhythmias, hypertension, myocardial infarction and stroke. Diabetics need daily 350 to 700mg extra magnesium. B vitamins improve the absorption and effect of magnesium.

Zinc (Zn)

Diabetics need extra zinc for prevention of oxidative stress and inflammation. According to research, many diabetics are deficient in zinc, and the deficiency is an independent risk factor of heart attack. Zinc deficiency is also known to reduce the synthesis of testosterone, which may contribute to erectile dysfunction and impotence. Zinc is known to improve the lowered testosterone levels and immune system against infections, degeneration and ageing itself. Diabetics need 15 to 30 mg extra zinc on a daily basis.

Selenium (Se)

Selenium is a versatile water soluble antioxidant which protects the body against oxidative stress. Organic selenium is more effective than inorganic. We recommend for diabetics a daily dose of 200 micrograms.

Vitamins C and E

These vitamins, too, protect the cells against oxidative stress, which prevails in the body of a person with diabetes. One can safely consume vitamin C 500mg and vitamin E 200 to 500mg daily, long-term. These anti-oxidant vitamins fight oxidative stress, prevent arteriosclerosis and ameliorate cardiac failure caused by elevated blood sugar. These vitamins intensify the beneficial effects of other supplements mentioned in these guidelines.

Folic acid, B6 and B12 vitamins

Diabetics build up homocystein, a toxic sulphur containing amino acid, which increases the risk of retinopathy, arteriosclerosis, heart attack, memory impairment, depression, dementia and osteoporosis. The laboratory reference values for homocystein are 5–15 µmol/l, but the risk of diabetic complications increase already from 7 µmol/l upwards. A combination of folic acid, and vitamins B6 and B12 prevent accumulation of homocystein.

Nicotinic acid (Niacin)

Nicotinic acid, another B vitamin, is the most effective agent currently available for increasing levels of the "good" HDL cholesterol. This is pertinent, as low HDL and high triglyceride levels are particularly problematic in diabetic patients. Niacin lowers blood levels of triglycerides and the bad clotting factor, Lp(a), that may cause heart attacks. Combining nicotinic acid with a statin will produce a greater reduction in cardiovascular risk than statin monotherapy alone. Nicotinic acid is safe for use in patients with diabetes, with no evidence of clinically relevant deterioration in glycaemic control at recommended doses (less than 2g/day). On review of the available evidence, the European Consensus Panel recommends the combination of nicotinic acid and a statin, together with lifestyle modification, as a useful strategy to lower CHD risk in patients with diabetes and metabolic syndrome. Furthermore, niacin may improve A1C significantly. Some dietary supplements contain benfotiamine and niacin-bound chromium (Cr trinicotinate). This triple combination might improve patient compliance when compared with the three substances administered separately. However, some individuals are unable to tolerate niacin.

Alpha lipoic acid

Alpha lipoic acid has been prescribed successfully for diabetics in Germany since 1966, the daily dose being 200 to 600mg. It has many actions similar to carnosine.

Ubiquinone (Q10)

Ubiquinone is a vitamin-like substance, which participates in production of energy in the intra-cellular mitochondria. Q10 also acts as an antioxidant, like vitamin E. Q10 is used to prevent heart attack, myocardial insufficiency and cardiomyopathy. Q10 also fights side effects of statins, e.g., muscular fatigue.

All the aforementioned dietary supplements can be taken continuously on a daily basis, and if need be, together with any medication. These supplements do not cause any side effects, when used according to the guidelines given here.

PHYSICAL EXERCISE

If you are not used to regular exercise we recommend that you start easily and add the intensity and time gradually so that you will not get any strain or damage (muscles, joints). Regular fitness motion improves your mood, improves and keeps up your physical condition, promotes cardiovascular health and burns energy (calories) thus helping in weight control. Exercise also fights insulin resistance, and it releases carnosine from your muscles thus preventing glycation of proteins and fats. Regular exercise may prevent type 2 diabetes in persons with impaired glucose tolerance. Diabetics have to learn to monitor the effects of exercise, meals and medication on blood sugar readings, in order to prevent hypoglycaemia. The increased activity will often require lowered insulin doses, especially at bedtime.

MONITOR YOUR BLOOD SUGAR

Adapted from Mayo Clinic.com

We suggest that you monitor and record your blood sugar before, during and after exercise. It can help you and your health care team see how your body responds to exercise. It can help prevent dangerous episodes of low blood sugar (hypoglycaemia), high blood sugar (hyperglycaemia) and high urine ketone levels (ketoacidosis).

Find out when it's safe for you to start exercising, when to check your blood sugar and what to do if you experience symptoms of low blood sugar. If you've been inactive or have a medical condition, talk to your doctor before you begin your exercise programme.

Before you exercise: Check your blood sugar twice. Your goal is to make sure that your blood sugar isn't too low before you begin exercising and that it doesn't drop too low during and after your workout.

To avoid swings in your blood sugar, test it 30 minutes before you start and then once again immediately before exercising. This can help you determine if your blood sugar level is stable, rising or falling before you start to exercise. Avoid problems by following these guidelines:

Less than 5.6 mmol/l (100mg/dl)? No matter what type of diabetes you have, eat a small carbohydrate-containing snack such as fruit or crackers before exercising.

5.6 to 13.9 mmol/l (100 to 250mg/dl)? For most people, this is a safe pre-exercise blood sugar range.

13.9 mmol/l (250mg/dl) or higher? Before exercising, test your urine for ketones. If the results show a moderate or high ketone level, don't exercise. Wait until your ketones test indicates a low level. The excess ketones indicate that your body doesn't have enough insulin to control your blood sugar and can lead to ketoacidosis.

16.6 mmol/l (300mg/dl) or higher? No matter what type of diabetes you have, don't exercise. You need to bring your blood sugar down before you can safely exercise because you risk an even greater increase in your blood sugar, which can lead to ketoacidosis.

During exercise: Check your blood sugar every 30 minutes. It's especially important to check your blood sugar during exercise if you're starting aerobic exercise for the first time, trying a new activity or sport, or increasing the intensity or duration of your workout. If you exercise for more than an hour, especially if you have type 1 diabetes, stop and test your blood sugar every 30 minutes.

If it's 3.9 mmol/l (70mg/dl) or lower, or if it's not that low but you have symptoms of low blood sugar – feeling shaky, weak, anxious, sweaty, or confused – eat a snack that serves as a fast-acting source of sugar.

Examples include:
Two or three glucose tablets
1/2 cup of fruit juice
1/2 cup of regular (not diet) soft drink
Five or six pieces of hard candy
Recheck your blood sugar 15 minutes after this snack. If it's still too low, have another serving and test again 15 minutes later, until your blood sugar reaches 3.9 mmol/l (70 mg/dl) or higher.

After exercise: Check your blood sugar at least twice. When you've finished exercising, check your blood sugar again. The more strenuous the workout, the longer your blood sugar is affected. Check your blood sugar a couple of times after exercising to make sure you aren't developing hypoglycaemia, which can occur even hours after you've stopped. Exercise draws on reserve sugar stored in your muscles and liver. As your body rebuilds those stores, it takes sugar from your blood, lowering your blood sugar level.

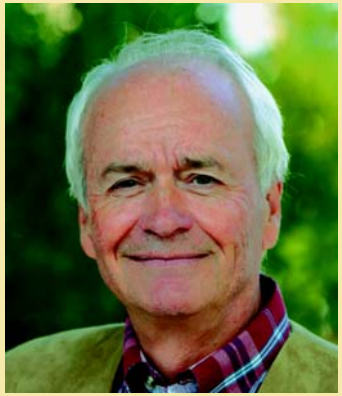
Be encouraged

You may think that testing your blood sugar before, during and after you exercise requires a lot of effort. Keep in mind that once you and your health care team know how your body responds to aerobic exercise, you can probably cut back on testing.

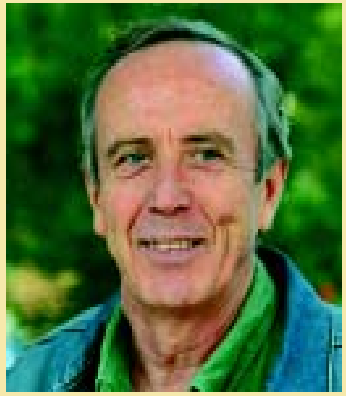
THANKS

We thank our friend Dr Timo Kuusela, a diabetic physician himself, for valuable advice in writing these guidelines. Dr Kuusela has long experience in management of his own type 2 diabetes following the ”cellulose line”, and avoiding intake of excessive starch.

Diabetes mellitus is a condition, which requires careful management in which the patient him/herself has to be the one who takes control. Although professionals in health and nutrition participate in the treatment, it is you who is mostly responsible for the outcome. It is only the diabetic person who can learn how to manage the conditions in the best possible way. You can control your diabetes rather than let your diabetes control you. It requires continuous observation, practising and recording the effects of the life style factors (exercise, nutrition and medication) on the blood sugar readings and well-being. Having diabetes means that you need to make yourself better informed than the average doctor. This leaflet has information you will not find anywhere else. Some of our ideas may not tally with those of some other doctors, but we would like to offer options to consider for those who must live with diabetes. We do not address the drug treatment, except briefly.



Dr Matti Tolonen is a medical doctor and Docent in Public Health at the University of Helsinki, Finland. He has more than 25 years experience of Nutritional Medicine as a scientist and practicing physician. www.biovita.fi/english/tolonen.html



Dr Pentti Raaste is a GP, and a diabetic himself. He has a consultancy in Fuengirola (Málaga), Spain tel 95247 5290

Photos: Osmo Lehtinen

Are you diabetic? Do you know someone who is?

La Cala de Mijas Lions Diabetic Support Group in Andalucia, Spain, invites you to call Anne Bowles on the Helpline 607 879 450. Regular meetings enable you to meet other diabetics and their families and help you to increase your diabetic awareness through informative lectures.