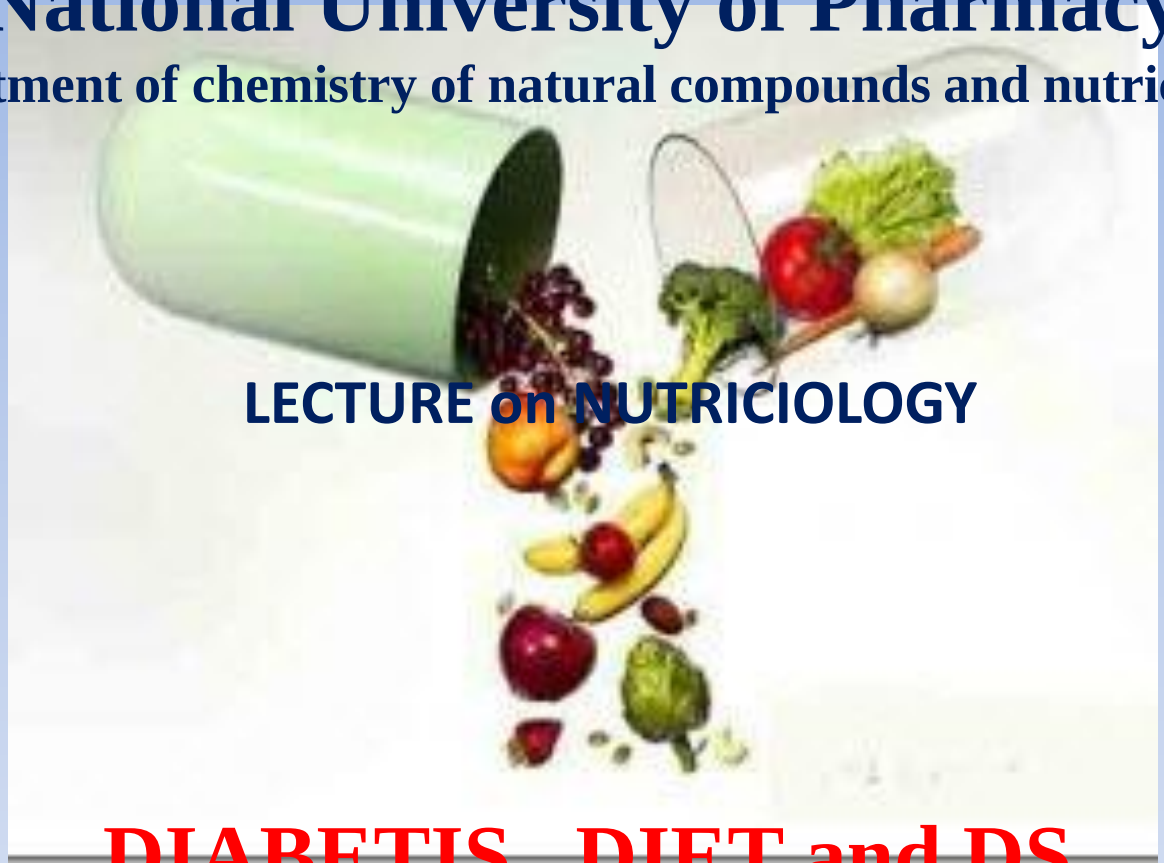
National University of Pharmacy

Department of chemistry of natural compounds and nutriciology



LECTURE on NUTRICIOLOGY

DIABETIS , DIET and DS

Kharkov 2020

Plan DIABETIS , DIET and DS

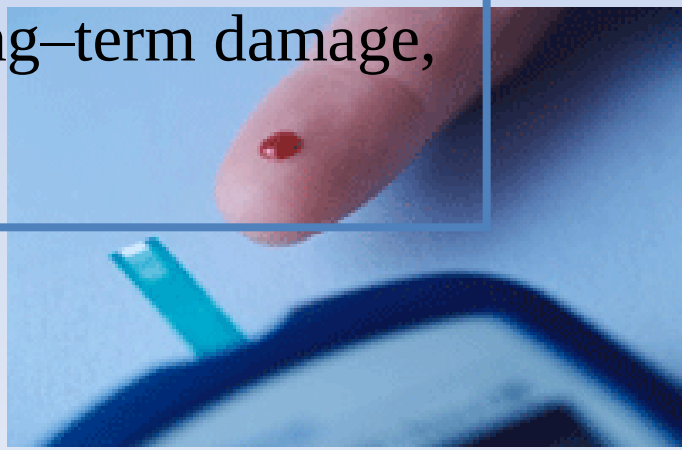
- Definition of Diabetes mellitus
- Symptoms
- Management of Diabetes mellitus
- Diet
- Glycemic index
- Bread units
- Carbohydrates
- Sweeteners

What is diabetes?

- Diabetes mellitus (DM) is a group of diseases characterized by high levels of blood glucose resulting from **defects in insulin production, insulin action**, or both.

- The term diabetes mellitus describes a **metabolic disorder** of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.

- The effects of diabetes mellitus include long–term damage, dysfunction and failure of various organs.



DIABETES MELLĪTUS

Diabetes mellitus - a group of endocrine diseases, developing due to ABSOLUTE or RELATIVE (violation of interaction with target cells) deficiency of the hormone insulin, resulting in hyperglycemia develops - a persistent increase in blood glucose.

The disease is characterized by a chronic course and a violation of all types of metabolism:

carbohydrate,
fat,
protein,
mineral and water and salt.

Types of Diabetes

There are several types of diabetes:

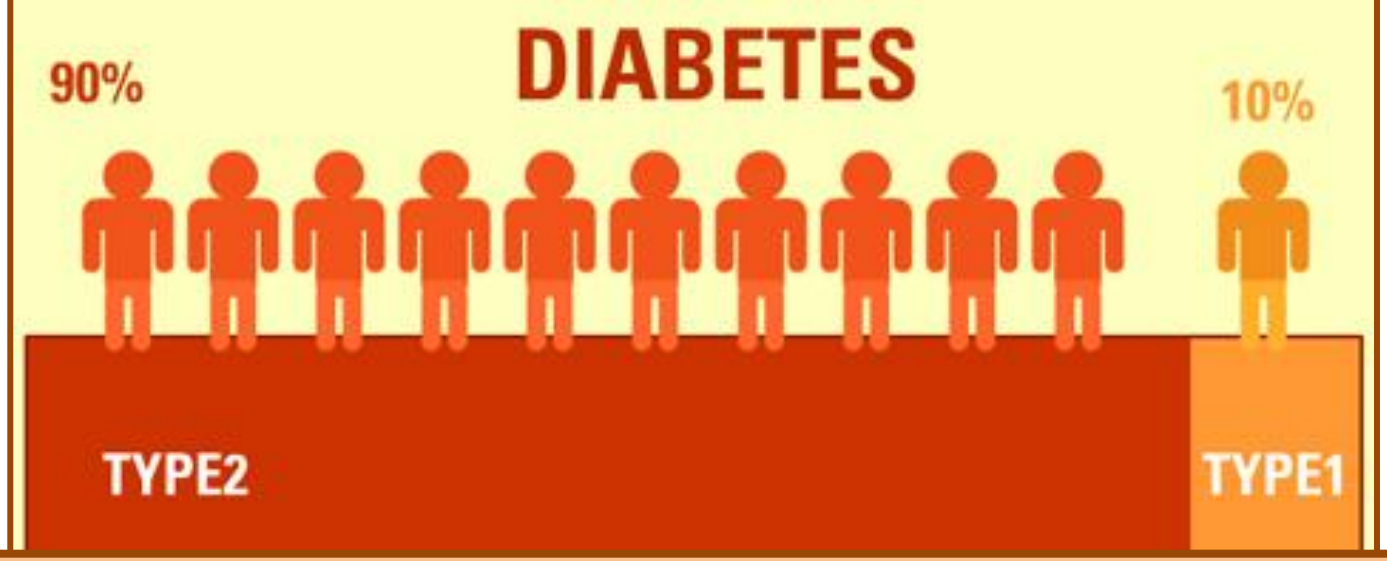
- Type I - body does **not produce any insulin**.

- Type II- body is **not making enough** or is losing sensitivity to insulin made.

•Secondary - a consequence from another disease. For example, pancreatitis or cystic fibrosis.

•Gestational Diabetes- diabetes during pregnancy.

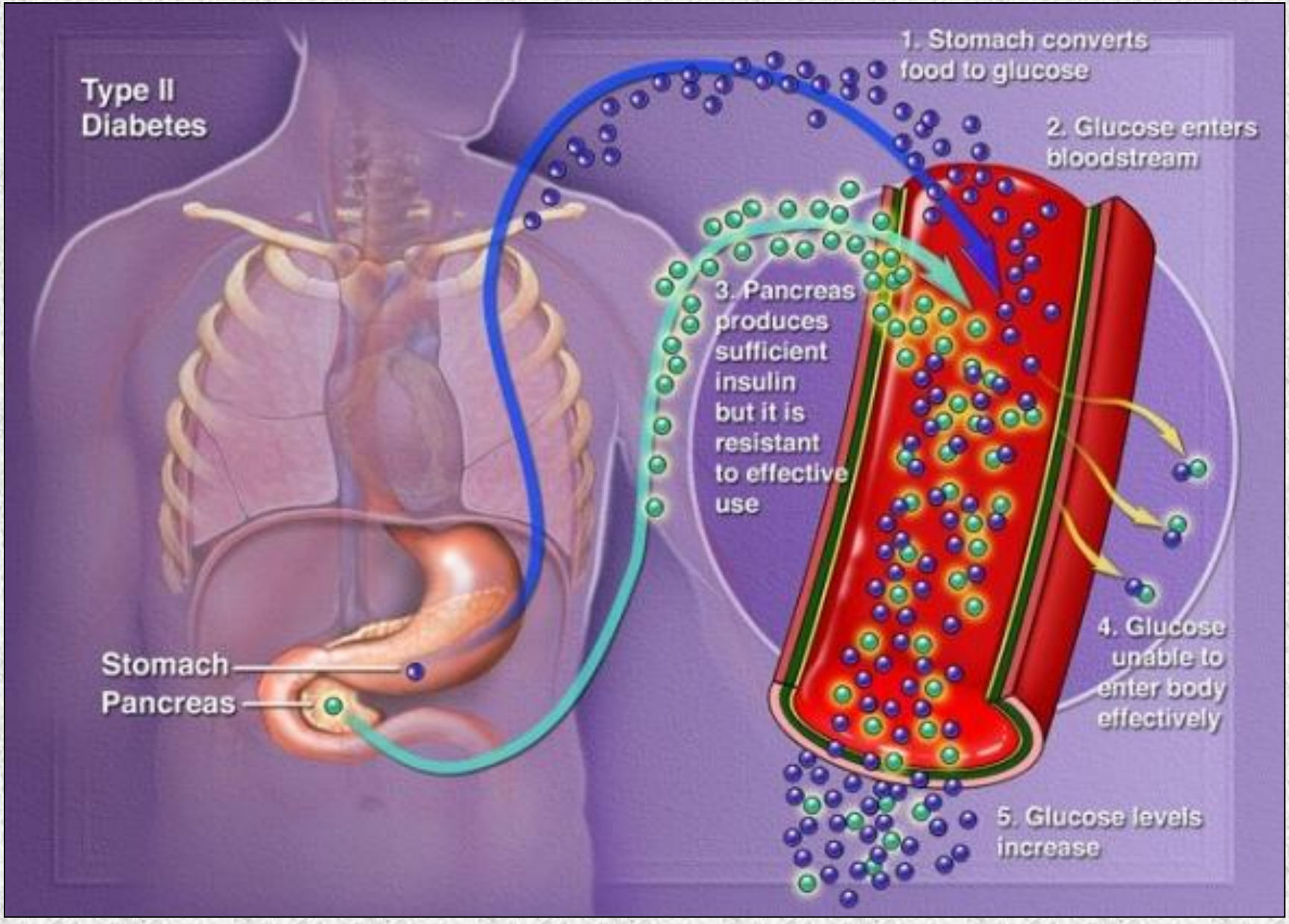
•Impaired Glucose Tolerance- an intermediate between normal and diabetes.



The term **"diabetes type 1 "** is used to describe a group of diseases that develop as a result of the progressive destruction of the ***beta cells of the pancreas***, which leads to a deficiency of proinsulin synthesis and hyperglycemia require hormone replacement- therapy.

The term **"diabetes type 2 "** refers to a disease which develops in individuals with an excessive accumulation of adipose tissue with insulin resistance, whereby there is excessive synthesis of proinsulin, insulin and amylin from the beta cells of the pancreas, there is a so-called "**comparative deficiency".**

The latest revision of the classification of diabetes by the American Diabetes Association in January 2010. Since 1999, according to the classification approved by WHO, isolated type 1 diabetes, type 2 diabetes, ***diabetic pregnant women*** and "other specific types of diabetes." Also secrete term **latent autoimmune diabetes in adults** (LADA, «diabetes type 1.5") and a number of rare forms of diabetes.


Type II
Diabetes
1. Stomach converts
food to glucose
2. Glucose enters
bloodstream
3. Pancreas
produces
sufficient
insulin
but it is
resistant
to effective
use
4. Glucose
unable to
enter body
effectively
5. Glucose levels
increase
Stomach
Pancreas

Diabetes

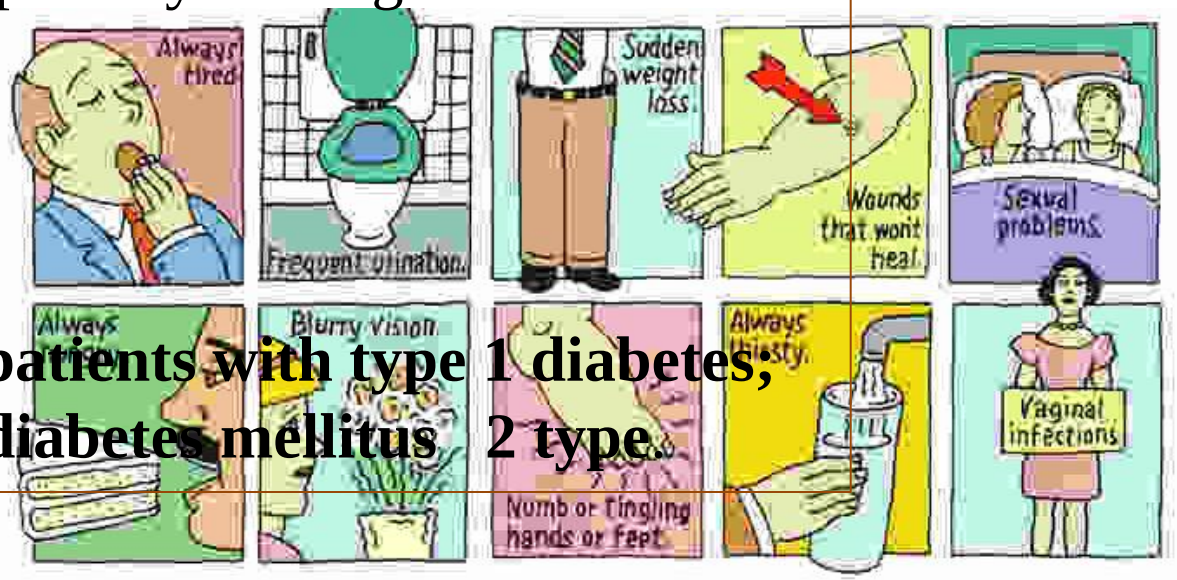
Diabetes mellitus may present with characteristic symptoms such **as thirst, polyuria, blurring of vision, and weight loss**

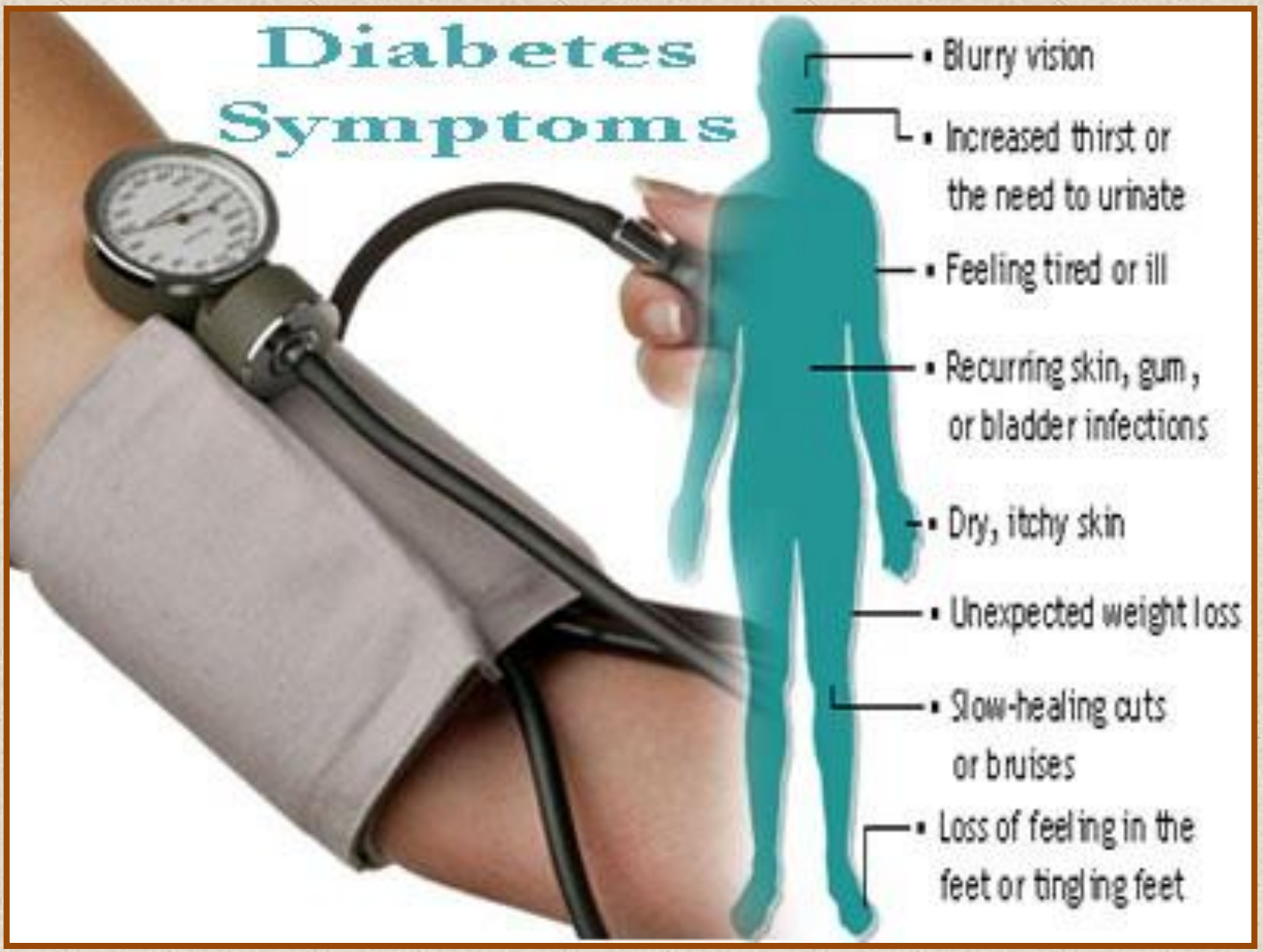
- In its most severe forms, **ketoacidosis** or a non–ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death.

- Often symptoms are not severe, or may be absent, and consequently hyperglycaemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made.

Symptoms: Diabetes

- thirst (the patient may drink **3-5 LITERS** or more of fluid per day);
- frequent **URINATION** (both day and night);
- **dry mouth**;
- and general **MUSCLE WEAKNESS**;
- increased **APPETITE**;
- **ITCHING** of the skin (especially in the genital area in women);
- **drowsiness;**
- **fatigue;**
- **poorly healing wounds;**
- **dramatic weight loss in patients with type 1 diabetes;**
- **obesity in patients with diabetes mellitus 2 type.**




Diabetes Symptoms
• Blurry vision
• Increased thirst or the need to urinate
• Feeling tired or ill
• Recurring skin, gum, or bladder infections
• Dry, itchy skin
• Unexpected weight loss
• Slow-healing cuts or bruises
• Loss of feeling in the feet or tingling feet

What Is Type 2 Diabetes?

This disease strikes people of all ages, and early symptoms are subtle. In fact, **about one out of three people with type 2 diabetes don't know they have it.** It’s a chronic condition that thwarts your body's ability to use the carbohydrates in food for energy. The result is elevated blood sugar. Over time it raises your risk for heart disease, loss of vision, nerve and organ damage, and other serious conditions.

THE NORMAL BLOOD GLUCOSE LEVEL

- The **blood glucose level** is the amount of glucose (sugar) present in the blood of a human or animal. The body naturally tightly regulates blood glucose levels as a part of metabolic homeostasis.
- The mean normal blood glucose level in humans is about 5.5 mM (5.5 mmol/L or 100 mg/dL, i.e. milligrams/deciliter)
- Glucose levels are usually lowest in the morning, before the first meal of the day (termed "the fasting level"), and rise after meals for an hour or two by a few millimolar. The normal blood glucose level (tested while fasting) for non-diabetics, should be between 70 and 100 milligrams per deciliter (mg/dL)

Complications

- **Heart and blood vessel disease.** Diabetes dramatically increases the risk of heart disease, stroke, high blood pressure and narrowing of blood vessels (atherosclerosis).
- **Nerve damage (neuropathy).** Excess sugar can cause tingling, numbness, burning or pain that usually begins at the tips of the toes or fingers and gradually spreads upward. Eventually, you may lose all sense of feeling in the affected limbs.
- Damage to the nerves that control digestion can cause problems with nausea, vomiting, diarrhea or constipation. For men, erectile dysfunction may be an issue.
- **Kidney damage.** Diabetes can sometimes lead to kidney failure or irreversible end-stage kidney disease, which may require dialysis or a kidney transplant.
- **Eye damage.** Diabetes increases the risk of serious eye diseases, such as cataracts and glaucoma, and may damage the blood vessels of the retina, potentially leading to blindness.

Complications

- **Slow healing.** Left untreated, cuts and blisters can become serious infections, which may heal poorly. Severe damage might require toe, foot or leg amputation.
- **Hearing impairment.** Hearing problems are more common in people with diabetes.
- **Skin conditions.** Diabetes may leave you more susceptible to skin problems, including bacterial and fungal infections.
- **Sleep apnea.** Obstructive sleep apnea is common in people with type 2 diabetes. Obesity may be the main contributing factor to both conditions. Treating sleep apnea may lower your blood pressure and make you feel more rested, but it's not clear whether it helps improve blood sugar control.
- **Alzheimer's disease.** Type 2 diabetes seems to increase the risk of Alzheimer's disease, though it's not clear why. The worse your blood sugar control, the greater the risk appears to be.

Prevention or delay of diabetes: Life style modification

- Research studies have found that lifestyle changes can prevent or delay the onset of type 2 diabetes among high-risk adults.
- These studies included people with IGT and other high-risk characteristics for developing diabetes.
- Lifestyle interventions **included diet and moderate-intensity physical activity** (such as walking for 2 1/2 hours each week).
- In the Diabetes Prevention Program, a large prevention study of people at high risk for diabetes, the development of diabetes was reduced **58% over 3 years.**

Management of DM

The major components of the treatment of diabetes are:

A

- **Diet and Exercise**

B

- **Oral hypoglycaemic therapy**

C

- **Insulin Therapy**

A. Diet

- **Diet is a basic part of management in every case. Treatment cannot be effective unless adequate attention is given to ensuring appropriate nutrition.**

- **Dietary treatment should aim at:**
  - ensuring **weight** control
  - providing **nutritional** requirements
  - allowing good **glycaemic control** with blood glucose levels as close to normal as possible
  - correcting any associated blood lipid abnormalities

A. Diet (cont.)

The following principles are recommended as dietary guidelines for people with diabetes:

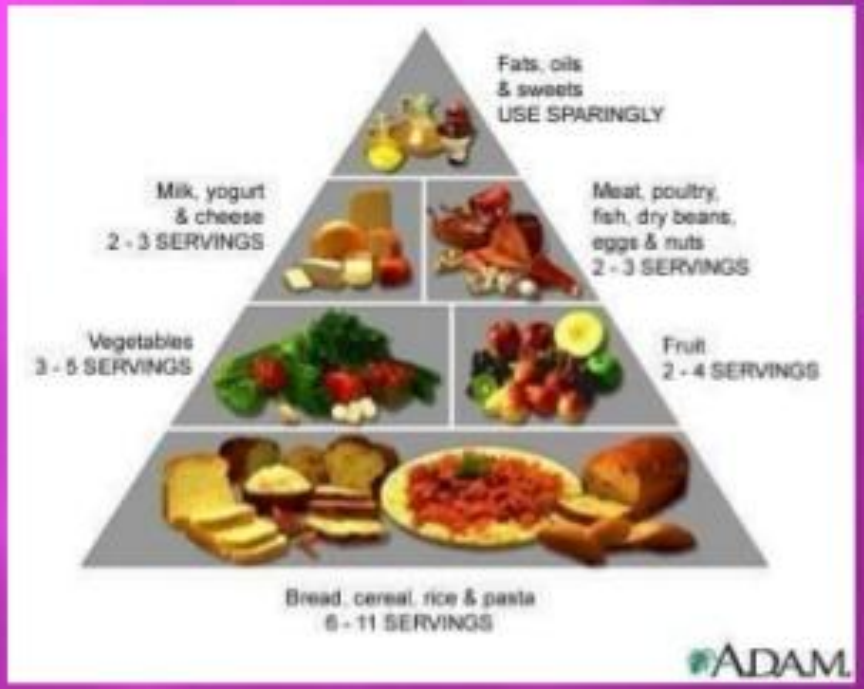
- Dietary **fat** should provide ***25-35%*** *of total intake of calories but saturated* ***fat intake*** should not exceed **10% of** total energy.
- **Cholesterol** consumption should be restricted and limited to **300 mg** or less daily.

- **Protein** intake can range between **10-15% total energy** (0.8-1 g/kg of desirable body weight). Requirements increase for children and during pregnancy. Protein should be derived from both animal and vegetable sources.

- **Carbohydrates** provide ***50-60%*** *of total caloric content of the diet.* **Carbohydrates should be complex and high in fibre.**

- **Excessive salt intake is to be avoided**. It should be particularly restricted in people with hypertension and those with nephropathy.

NORMAL FOOD PYRAMID



DIABETES FOOD PYRAMID

Glycemic index GI

GLYCEMIC (GLYCAEMIC) INDEX *GI, 1981, (was proposed by* Dr. David Jenkins) - an indicator of the influence of food after their use on blood sugar levels.

The glycemic index reflects the body's response to the comparison with the reaction product of an organism to pure **glucose**, which has a **glycemic index is equal to 100.**

The glycemic index of all other products are compared with the glycemic index of glucose, depending on how quickly they are digested.

Glycemic index GI

When the product is assigned to a low glycemic index, which means that when it is used the blood sugar level rises slowly.

The higher the glycemic index, the faster rising blood sugar levels after consumption of the product and the higher will be a one-time blood sugar levels after eating the food.

The glycemic index of the product depends on several factors:

types of *carbohydrates*

amount of *fiber* in food,

heat treatment process,

content of *protein* and *fat*.

Other researchers have taken as the standard for measuring not glucose, and white bread. So was received "**bread unit**".

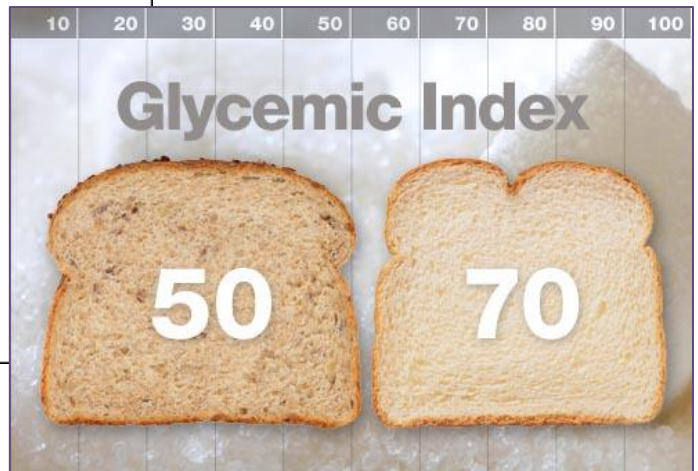
All carbohydrate foods according to speed and ease of exposure are divided into two groups:

"It's hard digestible" - cucumbers, tomatoes, cabbage, lettuce, greens, zucchini, squash, eggplant, foods high in fiber, gluten - bread from wheat flour with added bran.

It is not desirable for diabetes products containing the same time a **lot of fats and carbohydrates**: **chocolate, ice cream, cream cakes and pies.** Them from the diet is better to exclude all.

Glycemic index GI

Low Glycemic Foods List 0 - 55	Medium Glycemic Foods List 56 - 70	High Glycemic Foods List 70+
Most non starchy vegetable <15	Canned kidney beans 52	Bagel 72
Peanuts <15	Kiwifruit 52	Corn chips 72
Low-fat yogurt, no sugar<15	Orange juice 52	Watermelon 72
Tomatoes 15	Banana 53	Honey 73
Cherries 22	Potato chips 54	Mashed potatoes 73
Peas 22	Special K 54	Cheerios 74
Plum 24	Sweet potato 54	Puffed wheat 74
Grapefruit 25	Brown Rice 54	Doughnuts 75
Pearled barley 25	Linguine 55	French fries 76
Peach 28	Oatmeal cookies 55	Vanilla wafers 77
Can peaches, natural juice 30	Popcorn 55	White bread 79
Soy milk 30	Sweet corn 55	Jelly beans 80
Baby lima beans 32	Muesli 5	Pretzels 81
Fat-free milk 32	White rice 56	Rice cakes 82
Low-fat yogurt, with sugar 33	Pita bread 57	Mashed potatoes, instant 83
Apple 36	Blueberry muffin 59	Cornflakes 84
Pear 36	Bran muffin 60	Baked potato 85
Whole wheat spaghetti 37	Hamburger bun 61	Rice, instant 91
Tomato soup 38	Ice cream 61	French bread 95
Carrots, cooked 39	Canned apricots, light syrup 64	Parsnips 97
Apple juice 41	Macaroni and cheese 64	Dates 100
All-Bran 42	Raisins 64	
Canned chickpeas 42	Couscous 65	
Custard 43	Quick-cooking porridge 65	
Grapes 43	Rye crisp-bread 65	
Orange 43	Table sugar (sucrose) 65	
Canned lentil soup 44	Instant porridge 66	
Macaroni 45	Pineapple 66	
Pineapple juice 46	Taco shells 68	
Banana bread 47	Whole wheat bread 68	
Long-grain rice 47		
Bulgur 48		
Canned baked beans 48		
Grapefruit juice 48		
Green peas 48		
Oat bran bread 48		
Old-fashioned porridge 49		



Dietary recommendations for diabetes

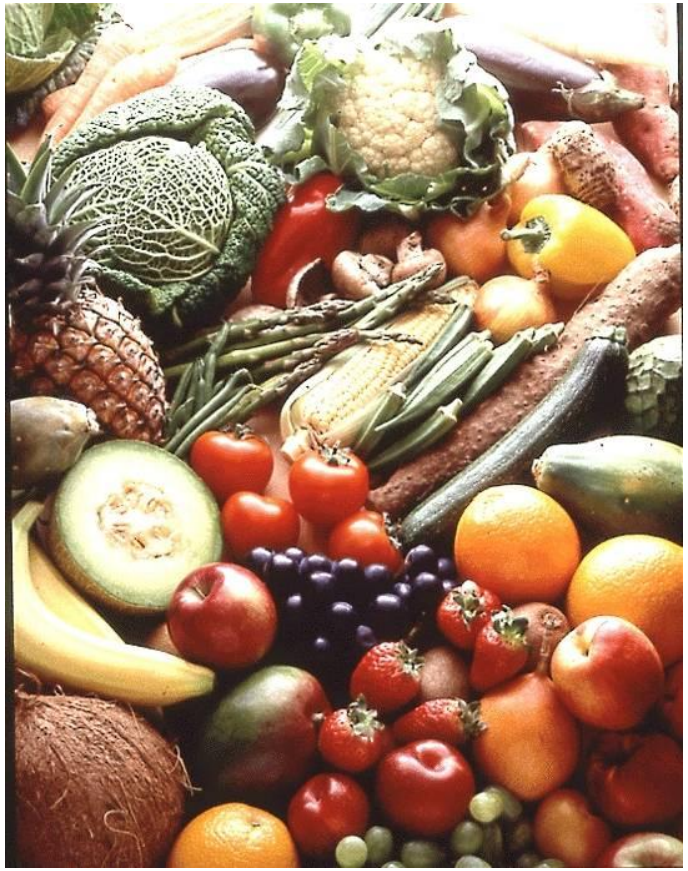
- **Eat starchy foods regularly**
- **Eat more fruit and vegetables**
- **Reduce animal or saturated fat**
- **Cut down on sugar**
- **Reduce salt**

Eat starchy foods regularly

- **Bread**
- **Potatoes**
- **Rice**
- **Pasta**
- **Cereals**
- **Plantain**
- **Chapatis**

Eat more fruit and vegetables

- **Fresh**
- **Frozen**
- **Tinned**
- **Dried**
- **Juice**



Choose more high fibre foods

To help maintain blood glucose levels and cholesterol levels

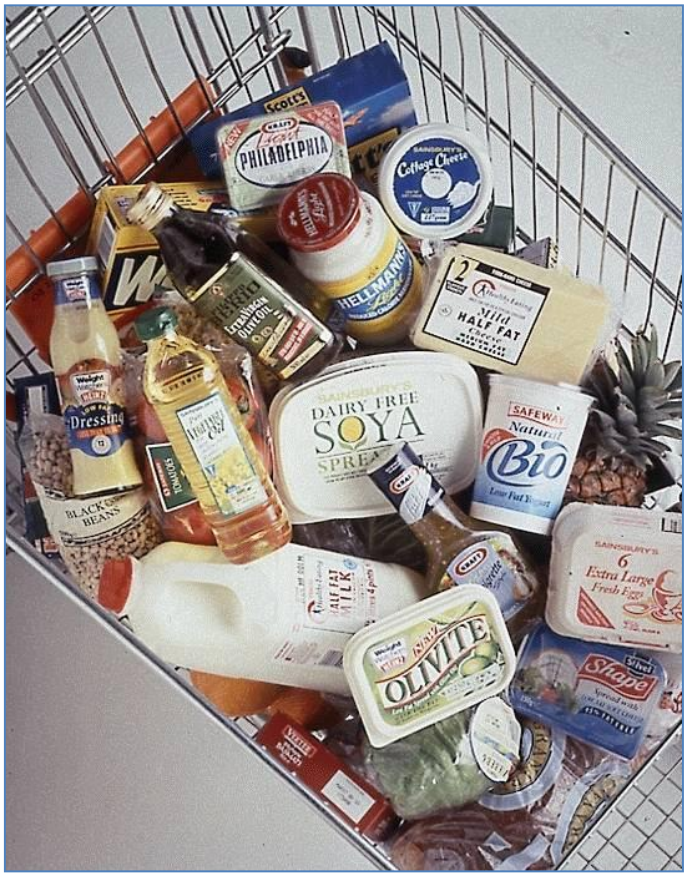
- **Fruit**
- **Vegetables**
- **Pulses**
- **Oats**

Helps to maintain a healthy gut

- **Wholegrain cereals**
- **Wholemeal bread**
- **Wholewheat pasta**
- **Brown rice**

Reduce animal or saturated fat intake

- Use low fat milk
- Use low fat spread instead of butter
- Use oil high in unsaturated fat, eg olive oil, rapeseed oil



Use less fat in cooking

- **Grill**
- **Dry-roast**
- **Microwave**
- **Steam**

Choose the right sort of fat

SATURATED

- **Full fat dairy produce (eg cheese, butter, full cream milk)**
- **Pies**
- **Biscuits**
- **Savoury snacks**
- **Lard**
- **Hard vegetable fat**

MONO-UNSATURATED

- **Olive oil**
- **Rapeseed oil**
- **Groundnut oil**

POLY-UNSATURATED

- **Sunflower oil (products)**
- **Oily fish**

Cut down on sugary foods

- **Not a sugar free diet**
- **Cut out sweets**
- **Cut out sugary drinks**

Choose low sugar products

- Use diet or low calorie, sugar free drinks

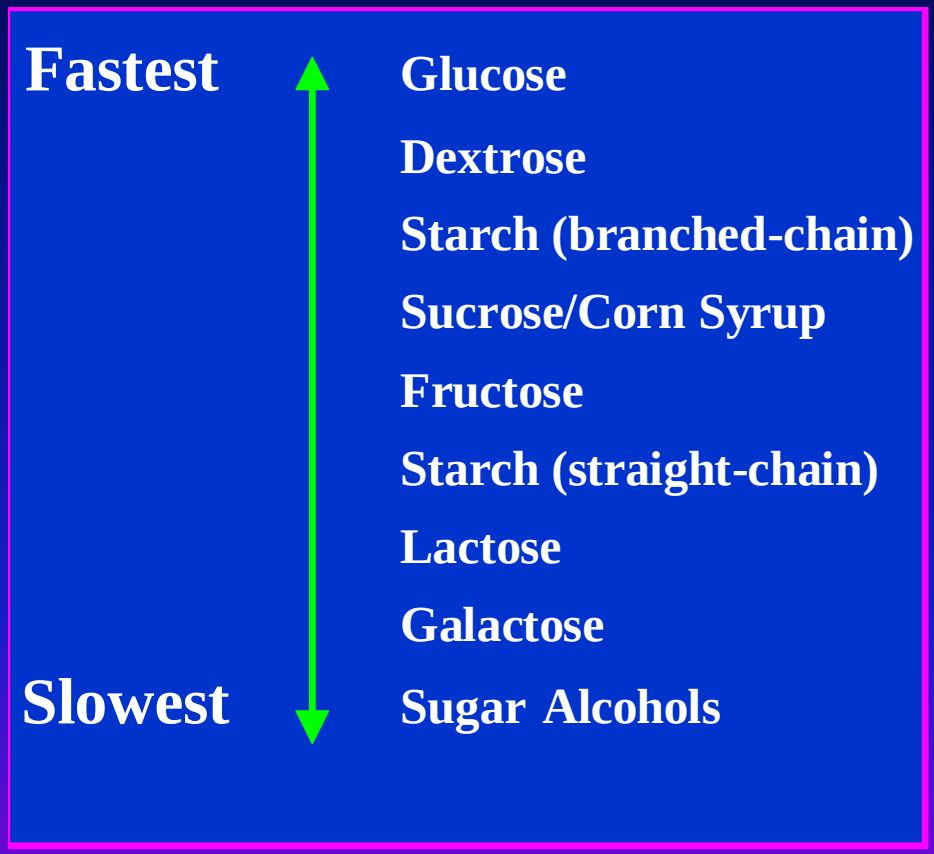
Does the Type of Carbohydrate Matter?

Glycemic Index = GI

- **All carbs (except fiber) convert to blood glucose eventually**
- **G.I. Reflects the magnitude of blood glucose rise in the first 2 hours**
- **G.I. Number is % of rise relative to pure glucose (in dextrose form)**

Factors that lower G.I.

- ↑ Fiber
- ↑ Fat
- ↓ Temperature
- Solid (vs. liquid)
- Acidity
- Non-Processed
- Type of carb



BREAD EXCHANGE UNIT-A GUIDE FOR DIABETICS

- People who suffer from diabetes mellitus, and therefore require insulin, can use this measurement unit to compare the blood-sugar-effectiveness of carbohydrates in different foods.
- According to German dietary regulations, one bread exchange unit (1 BEU) corresponds to a quantity of food that contains 12 grams of digestible and, therefore, blood-sugar-effective carbohydrates – present in different forms of sugar and starch.
- The carbohydrate exchange unit is also used alongside the bread exchange unit. This, however, refers to 10 grams of carbohydrates. So-called carbohydrate exchange tables allow people with diabetes to check how many grams of food (containing carbohydrates) correspond to one bread exchange unit or one carbohydrate exchange unit.
- They can then use this to determine the necessary quantity of insulin or to create their own individual dietary plan. One BEU can correspond, for example, to the carbohydrate content of the following foods: 25g bread, 65g potatoes, 100g apples, 250g milk.

What is the **Bread Unit** and who needs to consider it?

- For those who suffer from diabetes, and especially - receives treatment with the introduction of insulin from the outside, the **amount of carbohydrates eaten is estimated in "bread units".**

For people with diabetes and normal body weight, the recommended number of bread units is **20-22 BU per day,**
With a body weight deficit of 25-30 BU,
Excess body weight and obesity - no more than 14-16 BU per day.

It is important to distribute BU to 3 main and 2 additional meals.
This contributes to a good control of blood sugar levels and improves the effect of drug therapy.

Self-Care

- **Patients should be educated to practice self-care. This allows the patient to assume responsibility and control of his / her own diabetes management. Self-care should include:**

  - **Blood glucose monitoring,**
  - **Body weight monitoring,**
  - **Foot-care,**
  - **Personal hygiene,**
  - **Healthy lifestyle/diet or physical activity,**
  - **Identify targets for control,**
  - **Stopping smoking.**

Exercises

- Physical activity promotes weight reduction and improves insulin sensitivity, thus lowering blood glucose levels.
- Together with dietary treatment, a programme of regular physical activity and exercise should be considered for each person. Such a programme must be tailored to the individual’s health status and fitness.
- People should, however, be educated about the potential risk of hypoglycaemia and how to avoid it.

Sweeteners and diabetes

- If sugar should be excluded or its consumption is minimized (6 teaspoons per day - sugar, or honey, or jam at 8-10 tsp sugar), sweet and still want to?
- There are two types **of sweeteners**:
- - Synthetic (*aspartame*, *cyclamate*): a definite plus - they do not contain calories, but their deep negative - they still are synthetic compounds, and when used in large quantities can be toxic;
- **Natural** (*fructose*, *sorbitol*): safe in terms of toxicity, but also a lot of calories.
- Diabetic Products "- most of them contain fructose, sorbitol and therefore very high in calories - do not be fooled (!)

Sweetener.

- Sweetener. This group of substances are **polyhydric alcohols**. The most widely used as a sweetener (sweeteners)

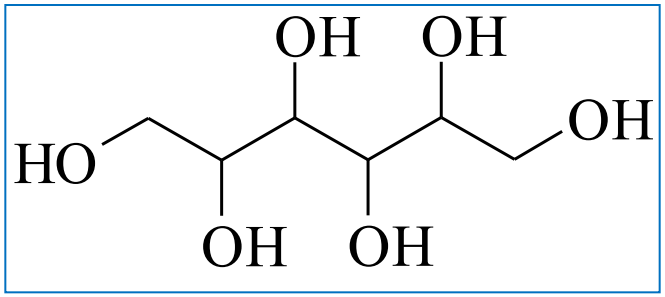
➢ Xylitol E 967,

➢ Sorbitol E 420

➢ Lactitol E 966 .

Terms of use of sugar substitutes

- ❑ Xylitol and sorbitol should be employed in **small doses** (from 10 g to 15 g per day).
- ❑ Must take into account **calorie** sugar substitutes.
- ❑ If **side effects** occur when using sugar substitutes (such as nausea, heartburn, bloating or) the dosage necessary to reduce, and in some cases, the drug should be canceled (or replaced).
- ❑ Observe diet food physiological type, ie. E. In the diet should be sufficient normal (physiological) components.

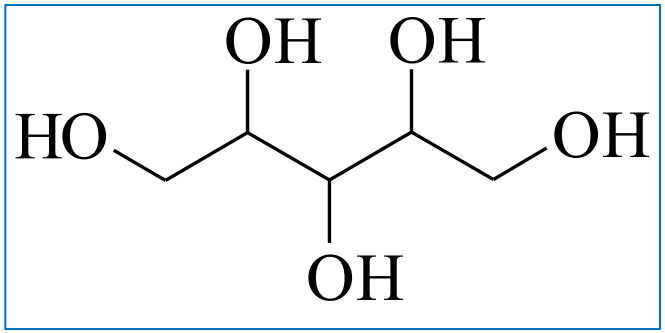


Sorbitol E 420 - *hexahydroxyalcohols, crystalline substance, sweetness close to glucose, is well absorbed by the human body and has a caloric value:*

- Coefficient sorbitol sweetness compared to sucrose **is 0.6.**
- Very **slowly absorbed from the intestine and does not affect the change in blood glucose level.**
- When boiling sorbitol retains the flavor.
- RDA sorbitol - no more than '30
- Calorie sorbitol is similar to sugar, so you should be **sure to take it into account in the preparation of diet.**

Sweetener Xylitol E 967

Xylitol E 967 *- pentahydric alcohols obtained by reduction of xylose.*
Contained in cotton shell,
corn cobs,
is of vegetable origin:



- Food xylitol - a white crystals, odorless, sweet-tasting, a cooling, readily soluble in water, well absorbed by the body, have a caloric value.
- It is used in the food industry as a substitute for sugar confectionery for diabetics and obese;
- Part of some toothpastes and chewing gum, ie. A. Positive effect on the teeth,
- because it is not a breeding ground for the development of pathogenic micro-organisms that destroy tooth enamel.

Sweetener Xylitol E 967

Calorie and sweetness are simple sugars, but has no biological value.

Xylitol is slowly penetrates the tissue and **does not affect blood sugar levels.**

Xylitol - Energy sweetener that the attenuated organism to a patient with diabetes mellitus is important.

Diabetics may consume xylitol without harm to health.

Increases the secretion of gastric juice and has a choleretic effect.

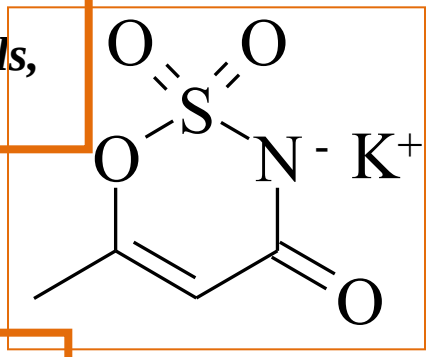
In large doses, xylitol exhibits laxative effect. **A safe dose - no more than 40-50 grams per day.**

Xylitol is recommended for use: as an emulsifier in the production of ice cream in order to improve its quality and taste; in the preparation of various desserts; for canning fruits; making jam, jams, sweets, chocolate, chewing gum and soft drinks, t. To. exhibits bactericidal activity

Sweeteners Acesulfame K

Intense artificial sweeteners.

Acesulfame K 950 E - sulfamide number sweetener, colorless crystals, readily soluble in water, the sweetness ratio of 200.

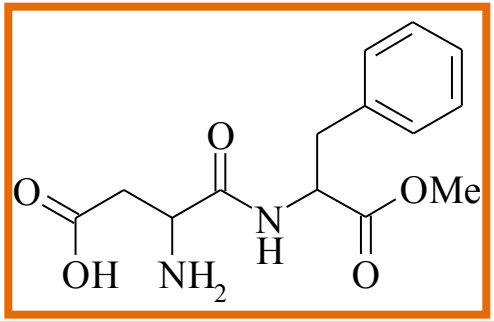


- Is an organic salt prepared in 1973 in Germany. Registered in more than 40 countries, **but prohibited for use in Canada and Japan.**
- Is **not absorbed by the body and is rapidly excreted, non-toxic, non-carcinogenic, mutagenic not found it, and teratogenic effects**.
- In high concentrations, has **bitter metallic taste**, so it is often used in combination with aspartame does not cause allergic reactions and no calories.
- Products with this sweetener **is not recommended to use for children, pregnant and lactating mothers.**
- A safe dose - not more than 1 g per day.
- Is used to sweeten soft drinks, in the manufacture of pastry, desserts, gelatin and gums, as well as a sweetener some dosage forms (syrups).

ASPARTAME E 951 (sanekta, nutrasweet, sladeks) - dipeptide composed of the amino acid residues asparagine and phenylalanine and methanol.

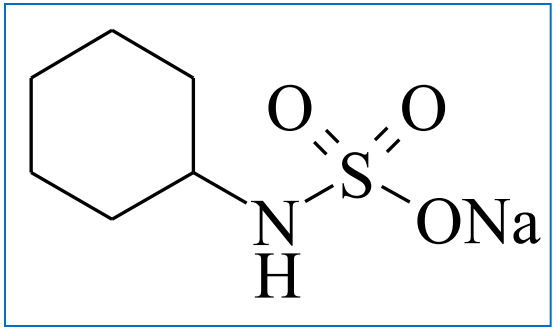
Coefficient of sweets 200.

Is also a flavor enhancer.



- Was discoveredby J. Schlatter in 1965. In the course of production of food products, in the presence of moisture and elevated temperatures, aspartame partially converted to diketopiperazine.
- He has been tested for toxicity, carcinogenicity and **is considered harmless**.
- Also, Aspartame decomposes to methanol and 2 amino acids. Methanol is harmful to humans, but its concentration in aspartame are very small, much more methanol in the body comes from the fruit and juices.
- Aspartame is **absolutely contraindicated for people suffering from phenylketonuria**.
- Contains methyl ester, which disrupts the SSS, and aspartic acid, which is a stimulant effect on the nervous system and may eventually be addictive.
- Caloric 4 kcal / g, but to create a sweet taste need a very small amount of aspartame, so its contribution to the caloric intake is not taken into account.
- As compared with the sweetness of sugar mouthfeel aspartame appears slower and longer stays.
- Aspartame is produced in the form of tablets and powder, included in the complex sweeteners. A safe dose - not more than 3.5 grams per day.
- Included in the approximately 6,000 different kinds of foods and beverages, often is used in diet beverages and sugarless chewing gums.

Cyclamate acid and its sodium, potassium, calcium salts E 952. Coefficient of sweets 30-50:



Cyclamates taste good, without metallic and bitter taste, not calories, easy to dissolve in water and can withstand very high temperatures, so these sweeteners are suitable for sweetening food during cooking.

Usually administered in the complex tablet sweeteners (saccharin - 10 parts cyclamate and saccharin, 1 part).

Cyclamate is permitted in 55 countries (including the EU), but is banned in the US since 1969

According to some reports, cyclamate may be carcinogenic.

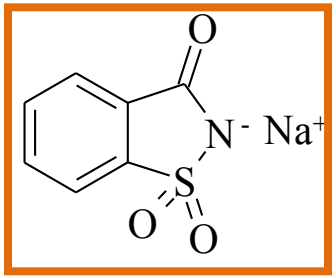
It can not be used in patients with renal insufficiency, as well as during pregnancy and breastfeeding.

A safe dose - not more than 0.8 grams per day.

Saccharin (sodium, potassium, calcium salts) E 954 - benzoic acid ortho-sulfamide - colorless crystalline substance of a sweet taste, slightly soluble in water.

It is usually used in the form of salts, which are 300-500 times sweeter than sugar.

Saccharin is not absorbed by the body, but is excreted in the urine, has a weak diuretic effect, is practically not caloric:



Saccharin is added only to ready-made food, since when boiling, it partially decomposes with the elimination of the imido group and the formation of ortho-sulfobenzoic acid, which has a phenol flavor (bitter).

This sugar substitute is included in tableted sweeteners. Some experts claim that saccharin contains **carcinogens**, so they do not recommend consuming drinks with its content on an empty stomach and without taking carbohydrate foods.

There is also a suspicion that saccharin leads to an exacerbation of gallstone disease. Banned in Canada. A safe dose is not more than **0.2 g per day.**

Saccharin has no nutritional properties and is a typical **xenobiotic**. Currently, the food use of saccharin is greatly reduced, although saccharin sweeteners are available, and mixtures of sweeteners are used in drinks and some other products.

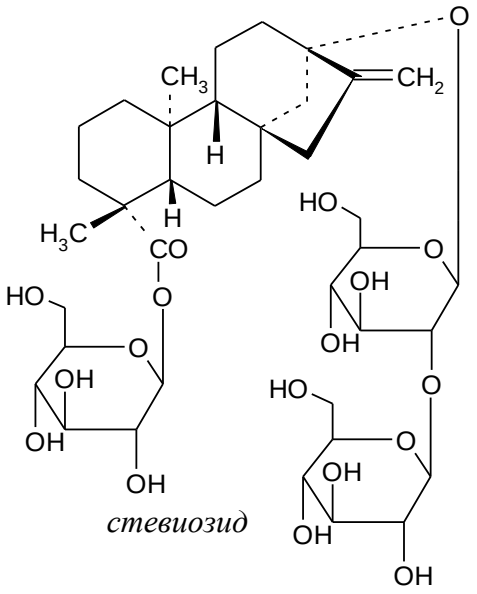
Stevia Rebo - Stevia rebaudiana Bertoni (Stevia mellifera or Eupatoriums rebaudiana) Synonyms: sweet bifolia, honey grass, kaa he.

Stevia leaves contain a complex of sweet ingredients, consisting of 8 substances that differ in sweetness.

The main substances of the group of diterpenic glycosides are steviobiside and rebaudioside A, the aglycon of which is steviol, which has no taste.

Stevioside is 300 times sweeter than sugar, and rebaudioside is 450 times sweeter.

Содержание гликозидов составляет 5-10%, ребаудиозида – 2-4%.



стевиозид

Hypoglycemia *(glucose less than 3,3mmol/l)*

How to treat Hypoglycemia:

- Quickest way to raise blood glucose is with some form of sugar.
- 3 glucose tablets, 1/2 cup of fruit juice, 5-6 pieces of candy.
- Wait 15-20 minutes and test blood sugar again. If still low retreat.
- If hypoglycemia goes untreated, patient could get worse and pass out!
- Stress the importance of a night time snack in older patients.

Glycosylated hemoglobin

- Glycosylated hemoglobin: Hemoglobin to which glucose is bound. Glycosylated hemoglobin is tested to monitor the long-term control of diabetes mellitus.

- The level of glycosylated hemoglobin is increased in the red blood cells of persons with poorly controlled diabetes mellitus. Since the glucose stays attached to hemoglobin for the life of the red blood cell (normally about 120 days), the level of glycosylated hemoglobin reflects the average blood glucose level over the past **3 months.**

- **The normal level for glycosylated hemoglobin is less than 7%.**
- Diabetics rarely achieve such levels, but tight control aims to come close to it.
- Levels above 9% show poor control, and levels above 12% show very poor control.
- **It is commonly recommended that glycosylated hemoglobin be measured every 3 to 6 months in diabetes.**

Glycosylated hemoglobin

- The Diabetes Control and Complications Trial (DCCT) showed that diabetics who keep their glycosylated hemoglobin levels close to 7% have a much better chance of delaying or preventing diabetes complications that affect the eyes, kidneys, and nerves than people with levels 8% or higher. A change in treatment is almost always needed if the level is over 8%. Lowering the level of glycosylated hemoglobin by any amount improves a person's chances of staying healthy.
- Glycosylated hemoglobin is also known as **glycohemoglobin** or as **hemoglobin A1**C (the main fraction of glycosylated hemoglobin).

DIET N 9

- **Indications: DIABETES OF; Patients with normal or slightly overweight do not receive insulin or receive it in small doses (20-30 units).**
- **General characteristics: diet with moderately reduced energy value due to digestible carbohydrates and animal fats.**
- **Proteins correspond to the physiological norm.**
- **Excluded sugar and sweets.**
- **Moderately limited content of salt, products containing cholesterol, extractives.**
- **Increased the content of lipotropic substances, vitamins, dietary fiber. Preferred boiled and baked products, at least - fried and stewed. For sweet dishes and drinks - sweeteners. The temperature of the dishes is normal.**

DIET N 9

- **The chemical composition and energy value of a daily diet:**
- **Proteins - 90-100 g;**
- **Fats - 75-80 g (30% of plant origin);**
- **Carbohydrates - 300-350 g (polysaccharides);**
- **The energy value is 2300-2500 kcal.**
- **Technology of cooking: • Cooked and baked products, less often - fried and stewed.**
- **Recommended: Bread products. Rye, protein-bran, protein-wheat, wheat from flour of the second grade, not flour products on average 300 grams per day.**
- **Milk and dairy products. Milk and sour milk products, curd cheese is bold and low-fat, sour cream is limited, unsalted and low-fat cheese.**
- **Meat dishes. Low-fat beef, veal, pork (edible, meat), lamb, rabbit, chicken and turkey after boiling, sausage and sausage diet, tongue. The liver is limited.**

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