National University of Pharmacy

Department of chemistry of natural compounds and nutriciology

NUTRICIOLOGY

LECTURE on NUTRICIOLOGY

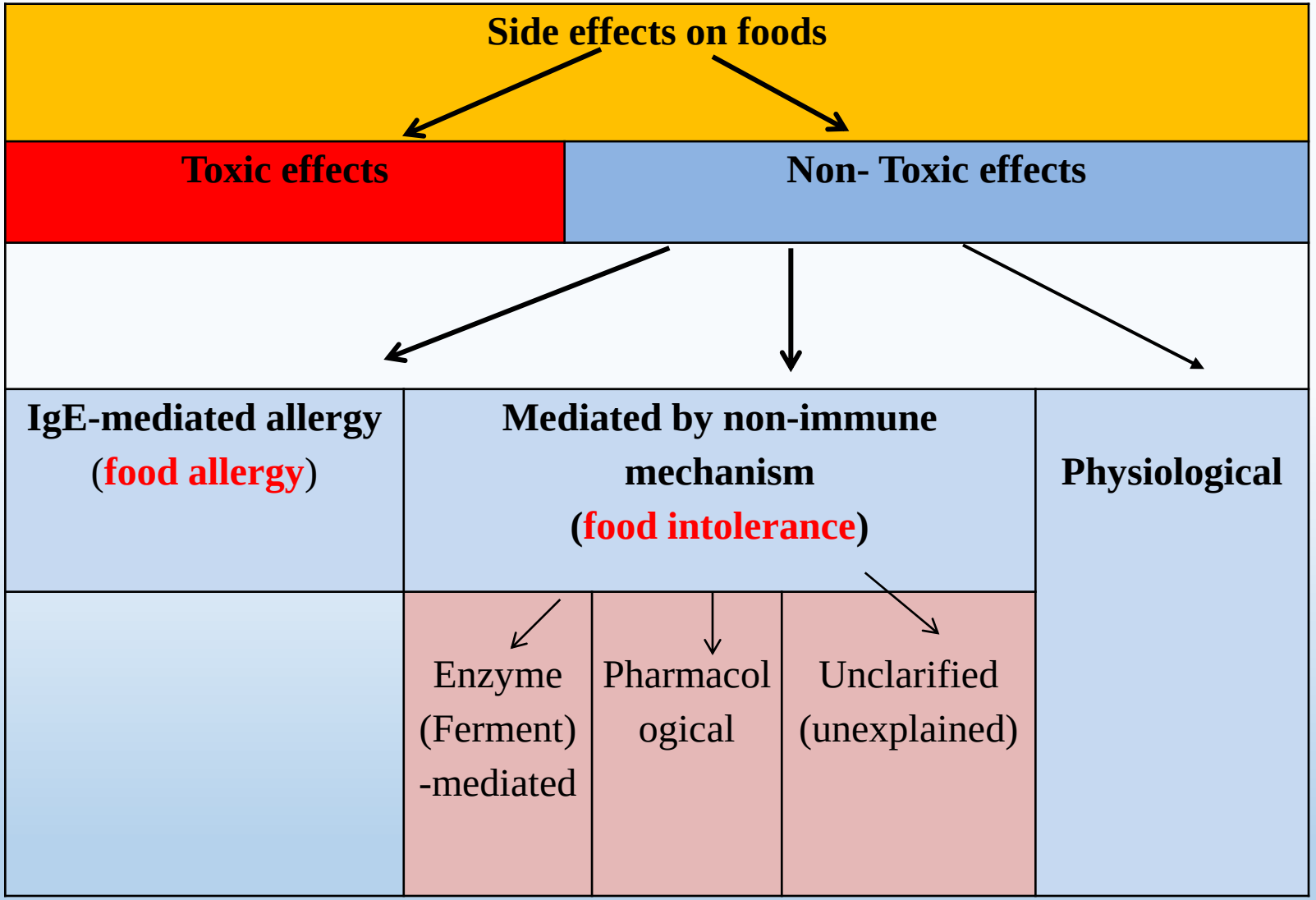
FOOD ALLERGY FOOD INTOLERANCE

Kharkov 2020

Plan Food allergy and food intolerance

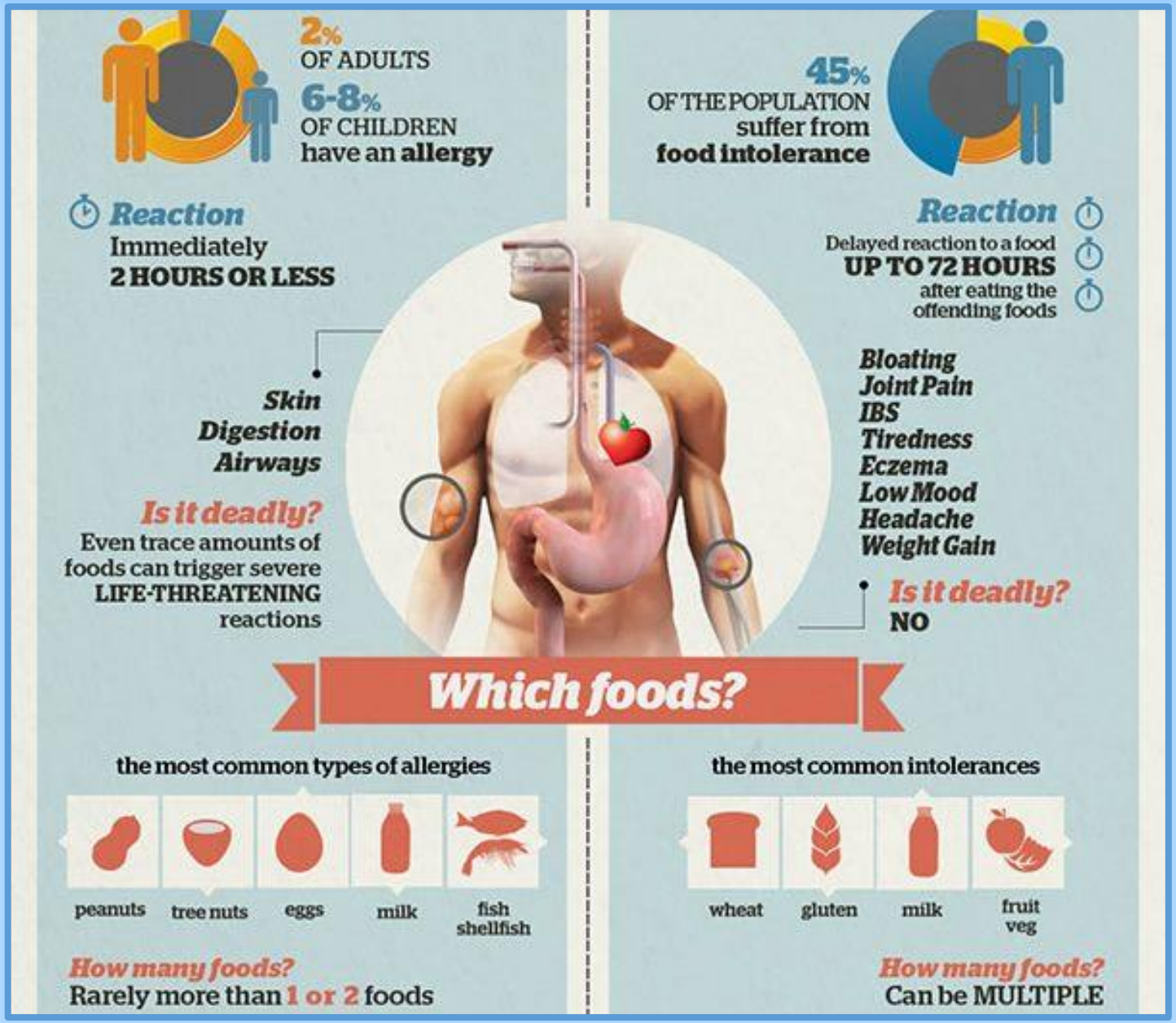
1. Dangerous effects of food
2. Allergy
3. The value of allergens
4. Food allergy
5. Skin tests
6. Food allergy treatment
7. Allergens
8. Nutrition with food allergies
9. Legal requirements
10. Food intolerance and its types
11. Enzymopathy

Food allergy and food intolerance



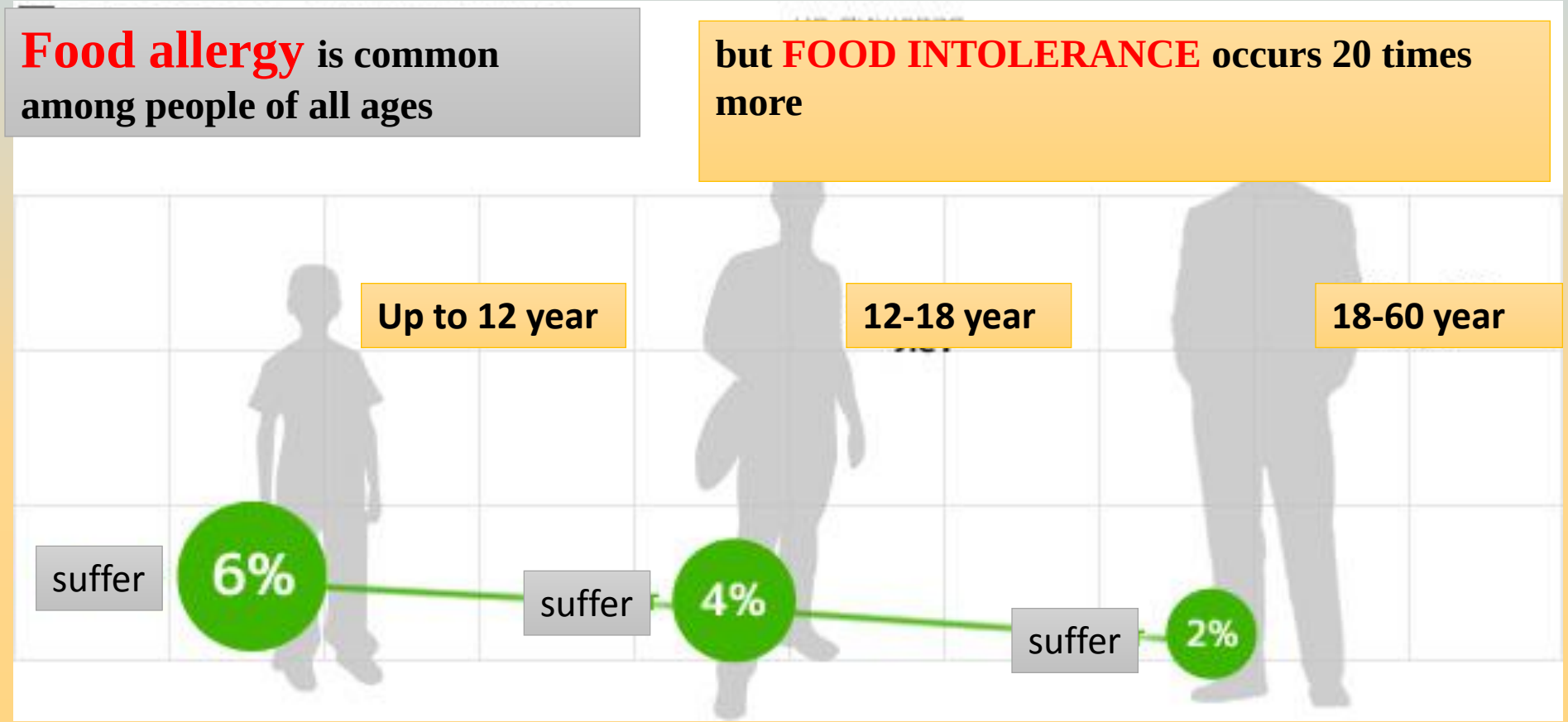
Food allergy is different with food intolerance although both can show similar symptoms

Food allergy and food intolerance



Food allergy is common among people of all ages

but **FOOD INTOLERANCE** occurs 20 times more



Food allergy is a food hypersensitivity associated with abnormal immunological responses, which in most cases develop in violation of immunoglobulin synthesis of IgE.

Medical observations suggest that food allergy occurs in **6-8%** of children up to 2 years (60-94% of cases occur in the first year of life), followed by a decrease in its prevalence to **2%** in the adult population.

What is food allergy?

- **Food allergy** is an abnormal response to a food triggered by the body's immune system.
- The symptoms of an allergic reaction are **caused by biologically active chemicals produced by the immune system in its attempt to protect the body from a foreign invader.**
- Allergic reactions to food can cause serious illness or even death.
- Food allergy is different with food intolerance although both can show similar symptoms.

Types of food allergy

- **IgE-mediated food allergy** (immediate hypersensitivity)
  - e.g. peanut allergy, cows' milk allergy
- **Cell-mediated food allergy** (delayed hypersensitivity)
  - involving sensitized immune cells in the small intestine, usually lymphocytes, that are sensitized to the specific substance that triggers the reaction → inflammation on certain sites, symptoms appearing 24 hours or more after ingestion
  - e.g. celiac disease

How do allergic reactions work?

An immediate allergic reaction involves two actions of our immune system:

1. Our immune system produces immunoglobullin E (IgE) – a type of protein that works against a specific food – antibody.

2. IgE attaches basophils (white blood cells) and to mast cells – cells found in all body tissues. The typical sites of allergic reactions **include nose, throat, lungs, skin and GI tract.**

Food allergy

- Allergy: ***immune*** system involved in this the process.

- Food allergy occurs when the immune system ***mistakenly begins to block the proteins*** contained in the food.

- For example, cells of the immune system "***confused***" *orange with infection*, and began to produce antibodies to fight it. The next time when orange fall into this organism, antibodies instantly recognize and mobilize the immune system to respond.

Prevalence of food allergy

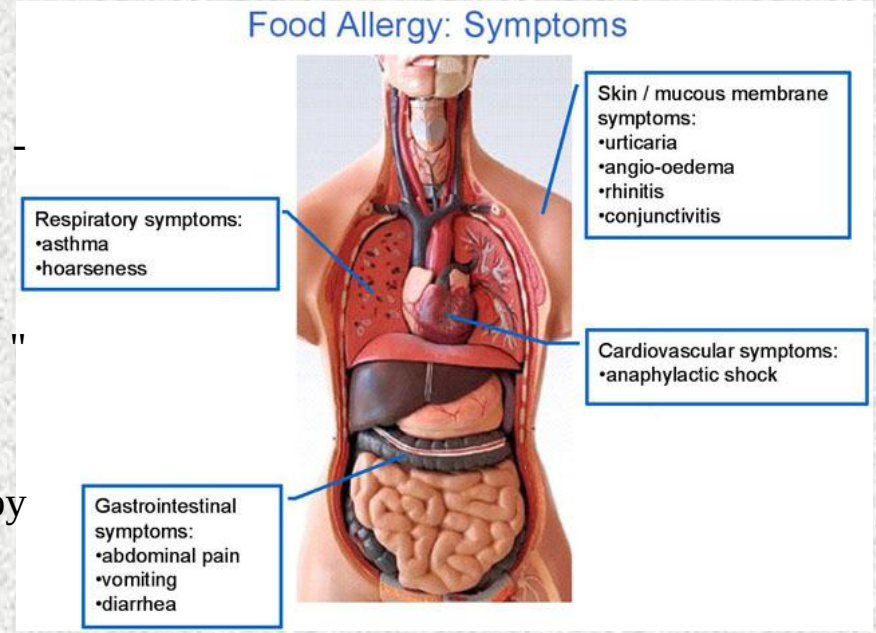
Precise prevalence is unknown, but estimates are:

- ***Adults*: 1.4% - 2.4%**
- ***Children* < 3 years: ~ 6%**
- ***Atopic* dermatitis (mild/severe): ~35%**
- **Asthmatic children: 6 - 8%**
- **Prevalence depends on: Genetic factors, age, dietary habits, geography and diagnostic procedures**

Food allergy in children: international map

Development of food allergic symptoms

Moving through the body, the antigen is an alternating sequence of reactions:
-***burning in the mouth,***
-vomiting,
-abdominal pain,
-diarrhea, etc.,
when entering into the bloodstream - the ***pressure drop, skin - rash*** or eczema light - bronchospasm.



Isolated systemic allergic reactions after exposure to food allergen and skin.
Systemic manifestations include ***dermatitis, itching, numbness*** and / or a feeling of " fullness" of the language, ***swelling*** of the oral mucosa.

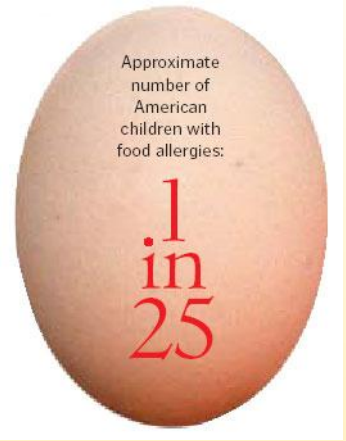
The most severe manifestation of food allergy is **anaphylactic shock** - characterized by very severe, including death.

Systemic manifestations also include a drop in ***blood pressure, urticaria, angioedema, vomiting, colic, constipation , diarrhea , allergic enterocolitis, allergic rhinitis***.

Cutaneous manifestations of food allergy - the most common, both in adults and in children. Infants under one year, the first signs of food allergy can be **diaper rash**, despite the meticulous care of the skin, dermatitis and itching.

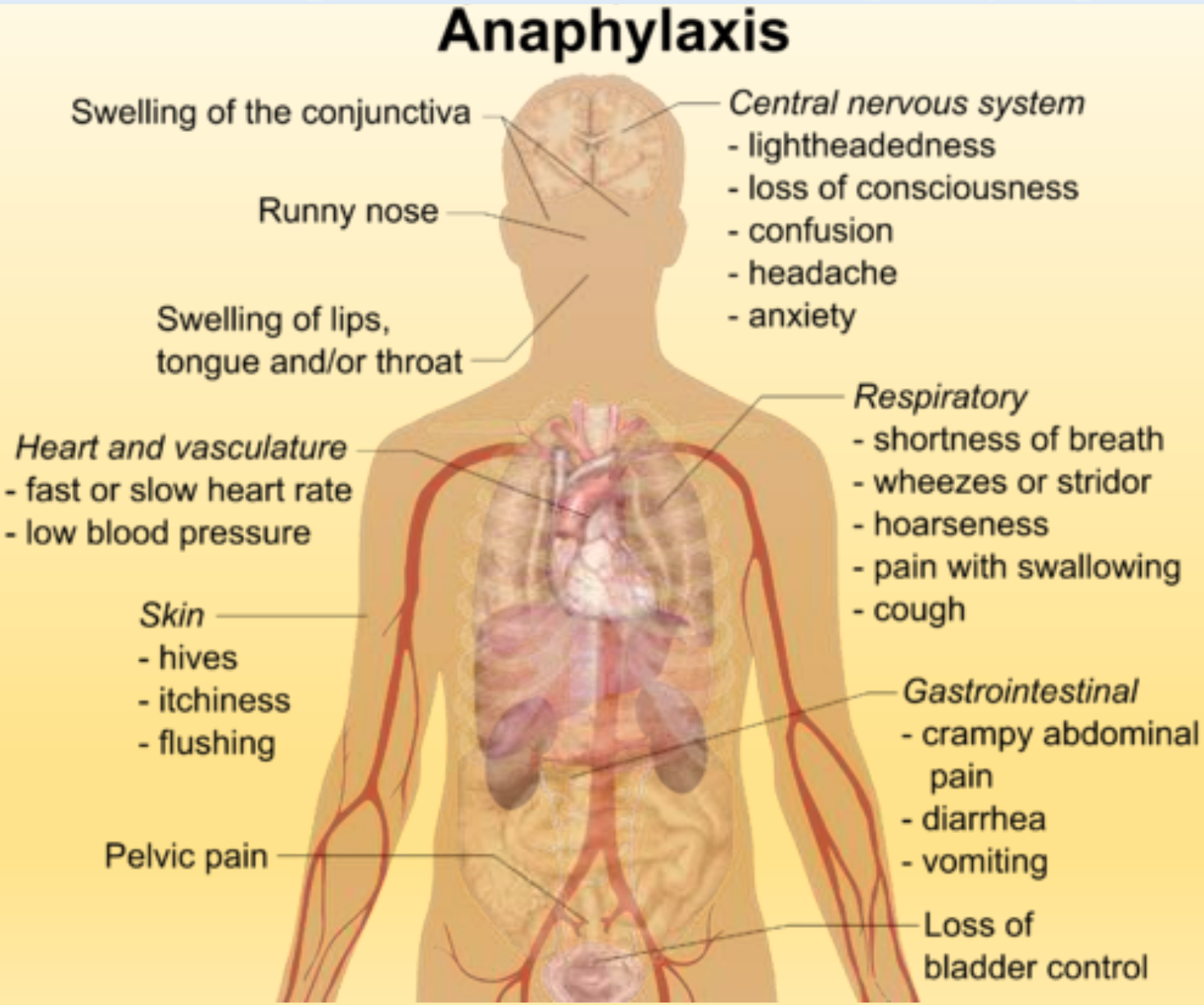
For a true food allergy most characteristic skin manifestations are **urticaria and atopic dermatitis** .

The allergic symptoms



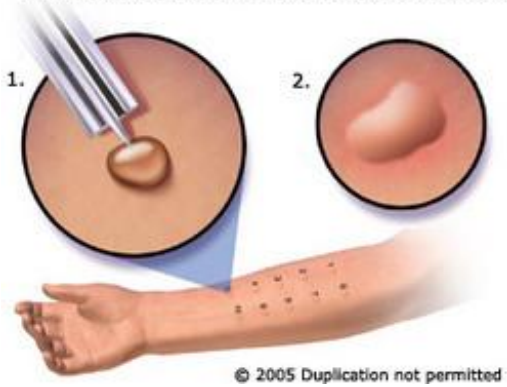
- Itching in mouth as we start to eat the food.
- GI symptoms such as vomiting, diarrhea or abdominal pain after the food is digested in stomach.
- When the food allergens enter and travel through the bloodstream, they may cause the **blood pressure to drop.**
- As the allergens reach the skin, they can cause **hives or eczema.**
- When the allergen reach the lungs, they may cause **asthma**.

Development of food allergic symptoms



Skin Test

1. Several allergens are introduced to the skin
2. The test is positive if the skin shows a reaction.



Introducing

The all new **Agitest™**

Food Allergen Rapid Test.

We've taken convenience to a whole new level.

Food Allergy Tests

- **Skin tests**

  Identifying the type of IgE that is fixed to the skin mast cell.
  For example: scratch test.

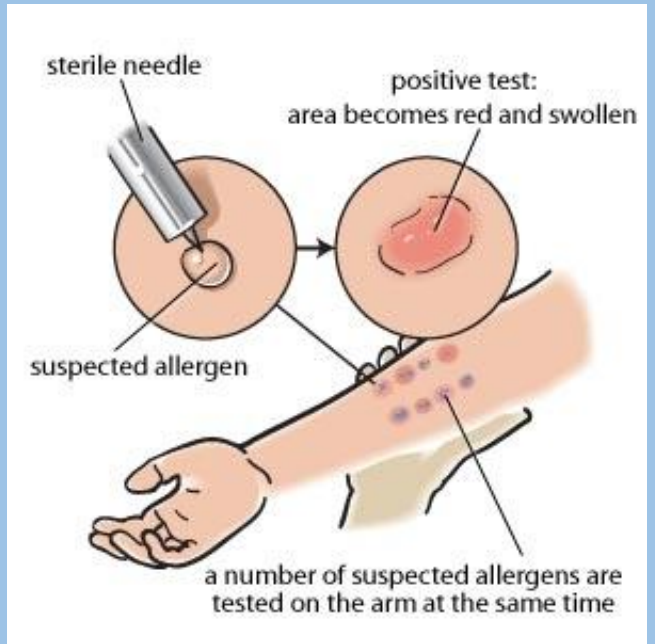
- **Blood tests** → analyze blood or blood serum

  RAST (radioallergosorbent test) or ELIZA (enzyme-linked immunosorbent assay).

  These tests measure the presence of

  food-specific IgE in blood and

  the total IgE level in blood.



Cross - Reactivity

- If we have a life-threatening reaction to a certain food, our body will show how to avoid similar foods that might trigger this reaction.

- For example: if someone has a history of allergy to shrimp, he/she will also show allergic reactions to crab, lobster and crayfish.

Pathophysiology: allergens

- **Proteins** (not fat/carbohydrate)
  - 10-70 kD glycoproteins
  - Heat resistant, acid stable
- Major allergenic foods (>**85% of allergy**)
  - **Children**: milk, egg, soy, wheat, other depending on geographical area
  - **Adult**: peanut, nuts, shellfish, fish
- Single food (or related) > many food allergies
- Characterization of epitopes underway
  - Linear vs conformational epitopes
  - B-cell vs T-cell epitopes

To HIGH-ALLERGIC FOOD products which often cause sensitizing effect and allergies belong:	Food Products with MODERATE ALLERGENICITY:	Food Products with LOW ALLERGENICITY:
- whole milk; - eggs; - fish (fresh, salted, smoked, ear); - seafood (shrimp, crab, shellfish), caviar; - wheat, rye; - strawberry, mango, persimmon, melon, bananas; - carrots, tomatoes, celery, bell pepper; - chocolate; - coffee, cocoa; - nuts (hazelnut, almonds, walnuts, etc.); - honey; - mushrooms.	- beef, chicken, chicken broth, and other poultry; - buckwheat, oats, rice; - peas, beans , soybeans; - potatoes, beets , turnips; - apricots, peaches; - cranberry, blueberry; - cherry, black currant, wild rose.	- dairy products; - rabbit meat, turkey, lean pork , lean lamb; - barley, corn , millet; - color and cabbage, broccoli; - zucchini, squash, cucumbers; - parsley, dill; - white and green varieties of apples and pears; - yellow varieties of plums; - white currants; - white and yellow cherries.

If Allergic to:	Risk of Reaction to at Least One:	Risk:
A legume* peanut	Other legumes peas lentils beans	5%
A tree nut walnut	Other tree nuts brazil cashew hazelnut	37%
A fish* salmon	Other fish swordfish sole	50%
A shellfish shrimp	Other shellfish crab lobster	75%
A grain* wheat	Other grains barley rye	20%
Cow's milk*	Beef hamburger	10%
Cow's milk*	Goat's milk goat	92%
Cow's milk*	Mare's milk horse	4%
Pollen birch ragweed	Fruits/vegetables apple peach honeydew	55%
Peach*	Other Rosaceae plum pear apple cherry	55%
Melon* cantaloupe	Other fruits watermelon banana avocado	92%
Latex* latex glove	Fruits kiwi banana avocado	35%
Fruits banana kiwi avocado	Latex latex glove	11%

How to treat food allergy?

- **Avoiding** to eat foods which can trigger allergic reaction.
- Exercised- induced food allergy

  The allergic symptoms may appear as exercise increases and body temperature rises. Therefore, it is required to avoid eating for a couple of hours before exercising.
- Taking medicine such as **antihistamines** to relieve GI symptoms, hives, sneezing and runny nose or taking bronchodilators to relieve asthma symptoms.

Diagnosis: elimination diets and food challenges

- **Elimination diets (1 - 6 weeks):**
  - Eliminate suspected food/s, or
  - Prescribe limited “eat only” diet, or
  - Elemental diet

- **Oral challenge testing:**
  - Physician supervised
  - Emergency room medications must be available

Basic elimination diet: ALLOWED foods

- **Rice**
- **Fruit:** ***Pear, Apple, Grape***
- **Meat:** ***Lamb, Chicken***
- **Vegetables:** ***Asparagus, Beetroot, Carrots, Lettuce, Sweet potatoes, Butternut Squash***
- **Other:** ***Black Tea, Rooibos***
- **Olive oil, Sunflower oil, Sugar, Salts**

NB: No Preservatives, no tinned or packet foods

Vitamins and minerals which will be affected by restricted diet

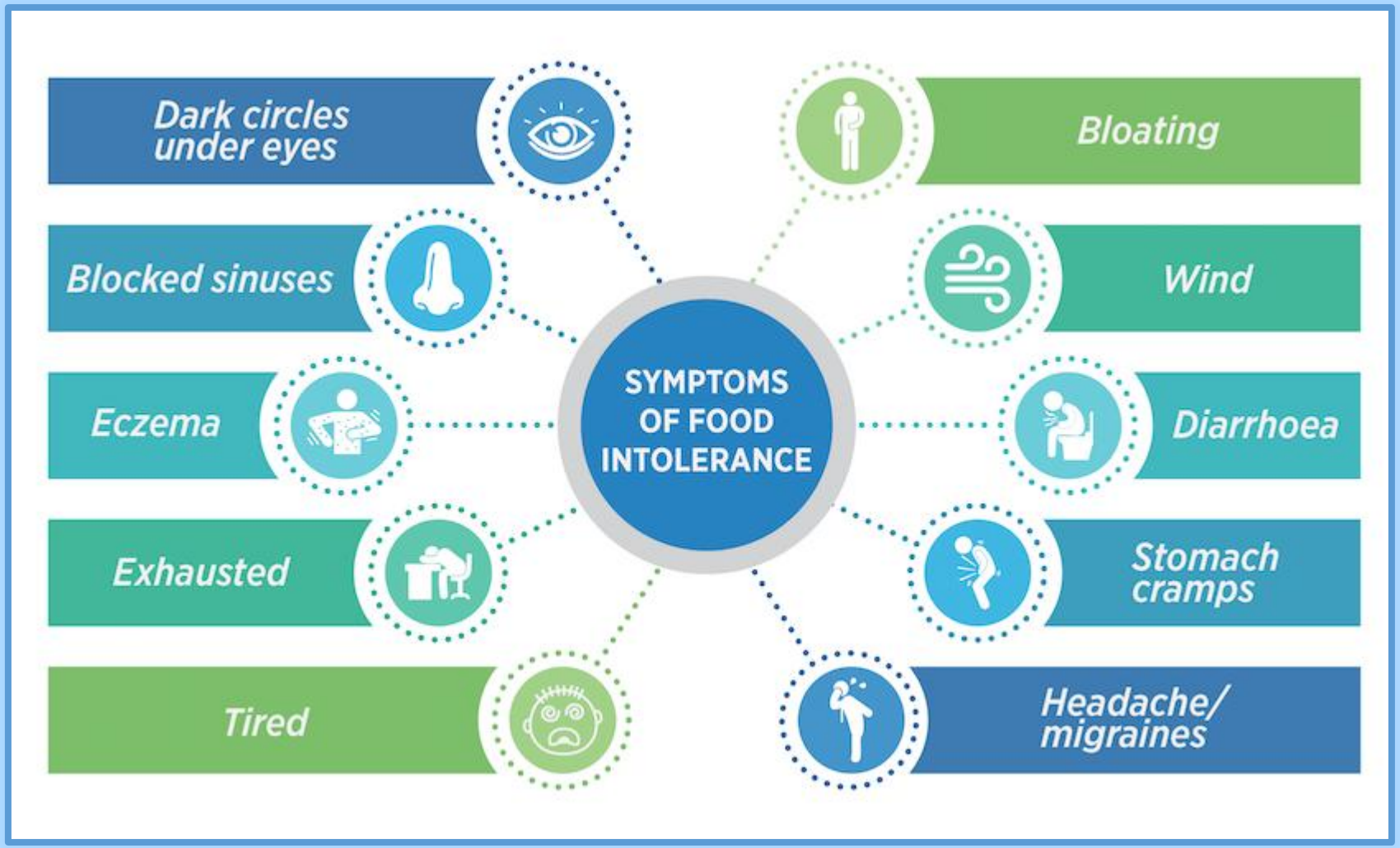
Allergen	Vitamin and Minerals
Milk	Vitamin A, vitamin D, riboflavin, pantothenic acid, vitamin B_{12}, calcium, & phosphorus
Egg	Vitamin B_{12}, riboflavin, pantothenic acid, biotin, & selenium
Soy	Thiamin, riboflavin, pyridoxine, folate, calcium, phosphorus, magnesium, iron, & zinc
Wheat	Thiamin, riboflavin, niacin, iron, & folate if fortified
Peanut	Vitamin E, niacin, magnesium, manganese, & chromium

FOOD INTOLERANCE

Food intolerance - it is a negative reaction to the products used in the diet, accompanied by inflammatory and immune disorders.

Food intolerance is often caused by the body's INABILITY to digest certain foods or increased sensitivity to certain chemicals.

FOOD INTOLERANCE, symptoms

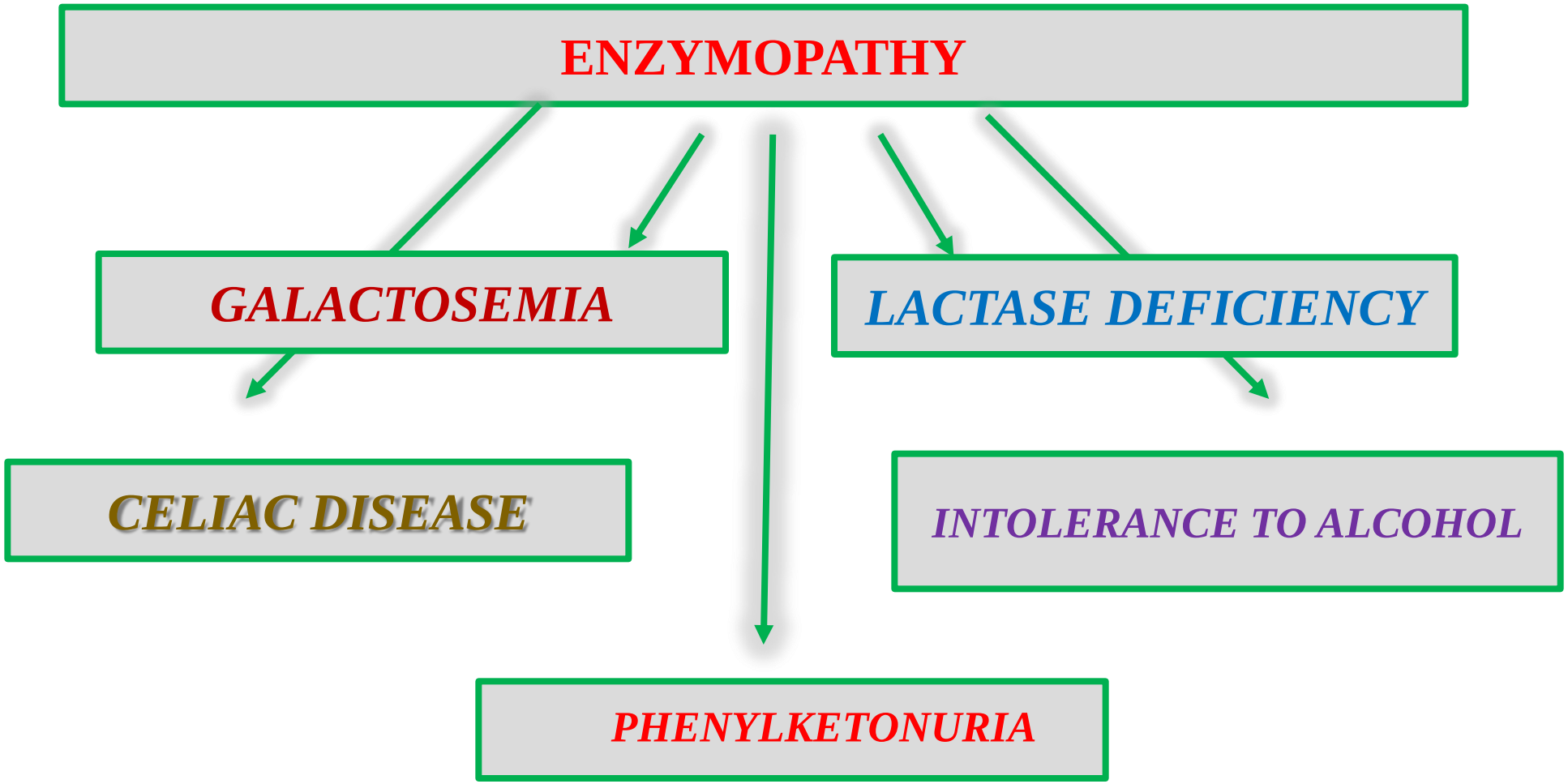


There are the following TYPES OF FOOD INTOLERANCE:

- **Enzimopaty associated with congenital or acquired deficiency of enzymes involved in digestion and absorption of nutrients.**
- **Symptoms of food intolerance associated with acute and chronic diseases of the digestive system.**
- **Intolerance to the product due to the negative psychological mood.**
- **Intolerance due to the physiological activity of the product components.**

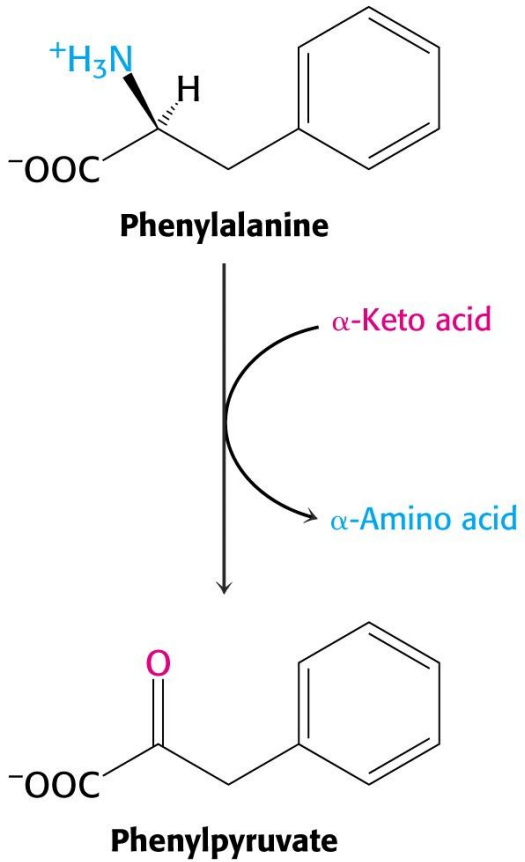
FOOD INTOLERANCE

- When food intolerance immune system is working properly, but it is **broken processes of digestion.**
- Typically, this is due to **diseases of the gastrointestinal tract**, and other neuroendocrine systems.
- Sometimes the use of a food product that causes an exacerbation of existing disease in humans.
- Food intolerance milk is **insufficient lactase enzyme** needed to break down milk sugar. There is pain in the stomach and indigestion.


ENZYMOPATHY
GALACTOSEMIA
LACTASE DEFICIENCY
CELIAC DISEASE
INTOLERANCE TO ALCOHOL
PHENYLKETONURIA

Phenylketonuria is caused by an absence or deficiency *of* ***phenylalanine hydroxylase*** or of its **tetrahydrobiopterin cofactor**.

Phenylalanine accumulates in all body fluids and converts to phenylpyruvate.



- *Defect in myelination of nerves*
- *The brain weight is below normal.*
- *Mental and physical retardations.*
- *The life expectancy is drastically shortened.*

Diagnostic criteria:

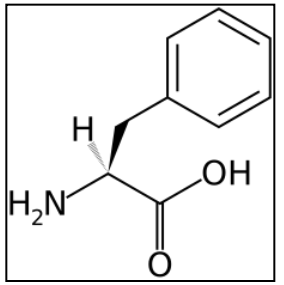
- phenylalanine level in the blood
- $FeCl_3$ test
- DNA probes (prenatal)

Phenylketonuria

In most cases (classical form), the disease is associated with a sharp decrease or total absence of activity of the hepatic enzyme PHENALANIN-4-HYDROXYLASE, which normally catalyzes the conversion of phenylalanine to tyrosine.

Up to 1% of cases of phenylketonuria are represented by atypical forms associated with mutations in other genes responsible for the coding of enzymes providing synthesis of the co-factor phenylalanine hydroxylase - tetrahydrobiopterin (BH4).

The prevalence of the disease varies in different population groups. For example, among American Caucasians, an average of 1 in 10,000 cases is found. The highest level is in Turkey: 1 in 2,600. In Finland and Japan, the level of phenylketonuria is extremely low: less than 1 case per 100,000 births. In a 1987 study in Slovakia, ultra high levels of phenylketonuria were detected among individual gypsy populations due to inbreeding: 1 case for 40 births.



phenylalanine

Due to the metabolic block, the side pathways of phenylalanine metabolism are activated, and the body accumulates **its toxic derivatives - phenylpyruvic and phenyl-lactic acids, which normally do not form**. Moreover, almost completely absent phenylethylamine and orthophenyl acetate are formed, the **excess of which causes a disturbance in the metabolism of lipids in the brain. Presumably, this leads to a progressive decline in intelligence in such patients right up to idiocy.**

Phenylketonuria

- ***The mental state of Phenylketonuria is accompanied by a deep degree of mental retardation, usually idiocy or imbecile.*** *There may be phenomena of echopraxia (repetition of the movements of others) and echolalia (repetition of speech). For patients with phenylketonuria, lethargy is characteristic with rare outbursts of anger and irritability.*

- *Treatment and prevention*
- *With the timely diagnosis of pathological changes can be completely avoided, if from birth and until puberty,* ***limit the intake of the organism of phenylalanine with food.***

- *Later on, the onset of treatment, although it gives a definite effect, does not eliminate the previously evolved irreversible changes in brain tissue.*

- *Some of the modern carbonated beverages, chewing gums and medicines contain phenylalanine in the form of a dipeptide (aspartame), which manufacturers are required to warn on the label. For example, on the labels of a number of soft drinks, after indicating the composition and nutritional value of 100 ml of the drink, the following warning is given: "Contains a source of phenylalanine. Contraindicated in the use of phenylketonuria.*

Phenylketonuria

When a child is born in maternity hospitals for 3-4 days, a blood test is taken and a neonatal screening is performed to detect congenital metabolic diseases. At this stage, the detection of phenylketonuria is possible, and, as a result, early treatment is possible to prevent irreversible consequences.

Treatment is carried out in the form of a **STRICT DIET** from detecting the disease to at least puberty, many authors are of the opinion that a lifelong diet is necessary. The diet excludes meat, fish, dairy products and other products containing animal and, partially, vegetable protein. Protein deficiency is compensated by amino acid mixtures without phenylalanine. Breastfeeding of children with phenylketonuria may and may be successful, subject to certain restrictions.

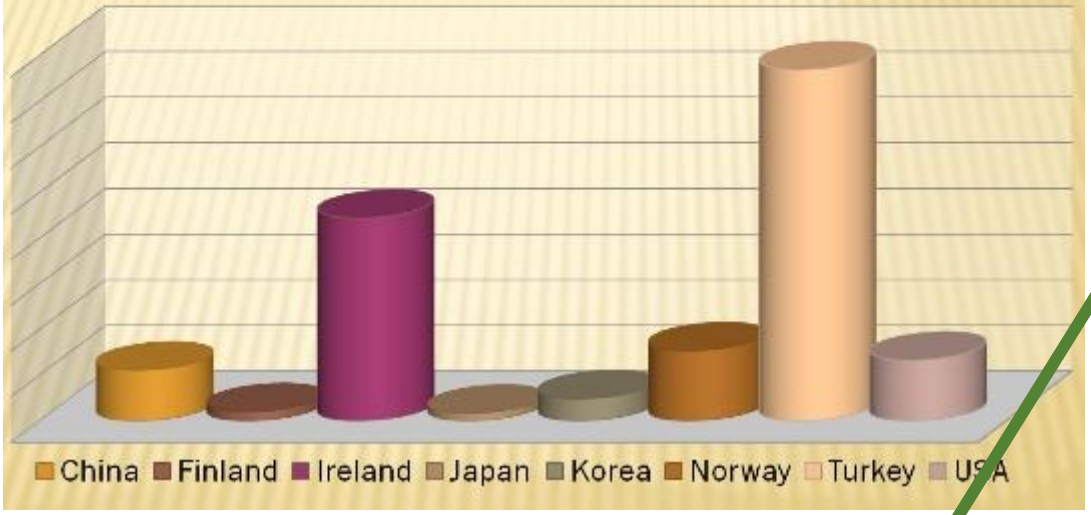
The calculation of the diet for a patient with phenylketonuria is carried out by a doctor taking into account the need for phenylalanine and its allowable amount.

Permissible amount of phenylalanine for patients with phenylketonuria

Children age	Daily amount of phenylalanine
Up to 2 months.	60
2—3 months.	60—55
3—6 months.	55—45
6—12 months.	45—35
1—1,5 year	35—30
1,5—3 years	30—25
3—6 years	25—15

INCIDENCE OF PKU

PKU by country



SCREENING TEST

All babies are screened for PKU by heel-prick test.

Blood tested for excess phenylalanine.

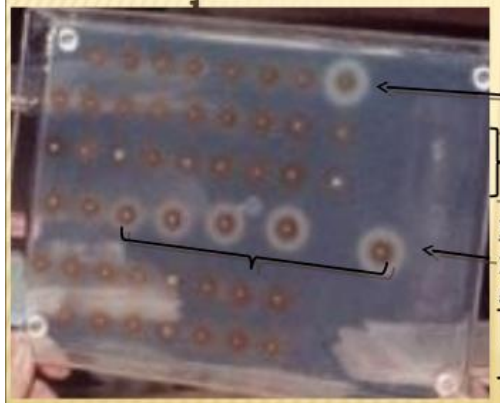
Blood placed on agar plate with bacteria that need phenylalanine to grow.

Healthy babies' blood doesn't have extra phenylalanine, so bacteria can't grow.

Babies with PKU have extra phenylalanine, so bacteria grow.

GUTHRIE TEST FOR PKU

Bacterial plate with newborn blood



Positive blood test results: bacterial halo = PKU

Negative controls: no bacterial growth

Positive controls : increasing phenylalanine concentrations give bacterial halos

Negative blood test results: no bacterial growth = healthy babies

Phenylketonuria

TREATMENT

No cure.

A strictly controlled phenylalanine free diet

up to the age of about 14 years old.

Phenylalanine is itself an essential amino acid small doses must be supplied.

After 14 years, the growth and development of the brain is not affected by high levels of phenylalanine in the body.

TREATMENT

More frequent doctor visits.

Required dietary restrictions that may impact day to day activities.

Permanent monitoring of blood phenylalanine levels.

TREATMENT

Individuals with PKU must be alert for food sweetened with aspartame - artificial sweetener made from amino acids phenylalanine and aspartic acid.

If PKU goes untreated or undetected, severe brain problems occur such as seizures and mental retardation.

GROUPS OF FOOD IN Phenylketoneuria PKU

There are tree groups of natural products for **Phenylketoneuria** . The classification is based on the amount of phenylalanine in them:
RED LIST - products that must be completely excluded from the diet.
ORANGE LIST - are allowed in small quantities under strict control.
GREEN LIST - can be used without restrictions.

RED LIST	ORANGE LIST	GREEN LIST
All types of meat	Daires	Fruits
Sauseges	Rice and corn	Berries
All types of fish	Vegetables (potatoes, cabbage)	Greens
Seafood	Canned Vegetables	Vegetables
Eggs		Rice, corn flour
Cheese		Starch and sago
Cottage cheese		Sugar and jam
Nuts		Honey
Bread		Butter and vegetable oil, melted fat
Confectionery		
Cereals and flakes		
Soya food		
Поп-Pop-corn		
Aspartam		

PHENYLKETONURIA - ***a serious hereditary disease, most often associated with deficiency of the enzyme phenylalanine hydroxylase which converts phenylalanine to tyrosine.***

LACTASE DEFICIENCY (HYPOLAKTAZYA) ***occurs in approximately one out of ten. To the greatest extent, it is typical for people of Asian, Mediterranean and African descent, as well as American Indians.***

GALACTOSEMIA - ***an inherited disorder associated with disruption of the enzymes involved in the metabolism of galactose.***

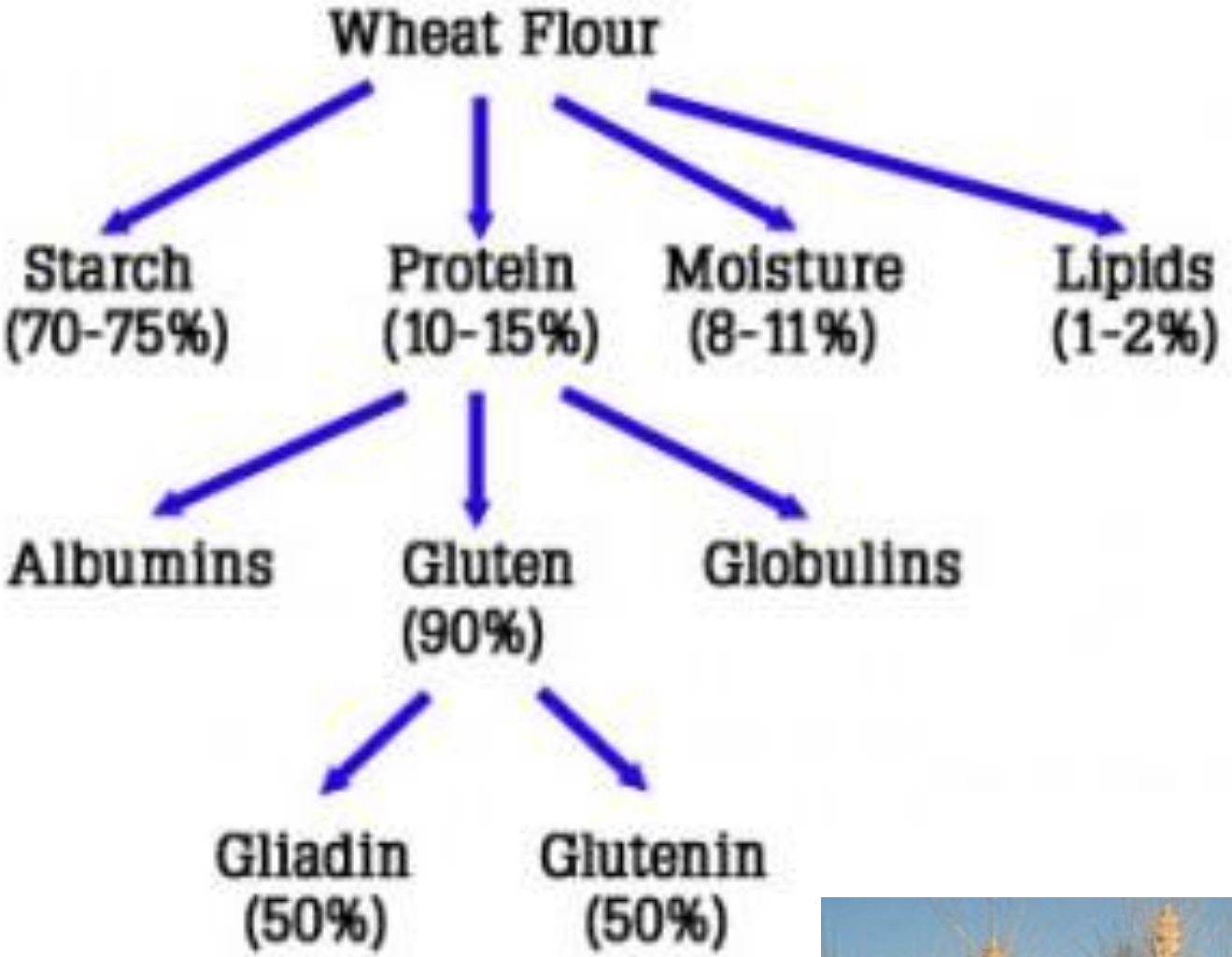
SPREAD: In 1 child 70,000 newborns.

CELIAC DISEASE - ***GLUTEN*** ***intolerance food proteins (gluten). Gluten is a natural component of wheat, rye, barley and products based on them.***

In addition, it should be mentioned that there is a **FOOD INTOLERANCE OF ALCOHOL-RELATED** disadvantage ACETYIDEHYDROGENASE enzyme that converts the decay product of ethanol - acetaldehyde to acetate.

Celiac Intolerance

Mrs. M. was excited. Finally, somebody found out what was wrong with her. A mother of 3 children she had been feeling more and more tired in 18 months. She found herself taking naps in the afternoon. It was all she could do to keep up with her family. She had been seen by her family physician several times over the past year was told she was anemic. She was given a prescription for iron pills and told to get lots of rest. She saw no improvement. She was very frustrated and began to think it was all in her head. Finally she was sent to a gastrointerologist who finally diagnosed with **Celiac Sprue or Gluten Intolerance**.



Gluten, a substance in wheat and other grains, may be found in a variety of foods including breads, cakes, cereals, pasta, commercial dairy products and alcoholic beverages

Gluten

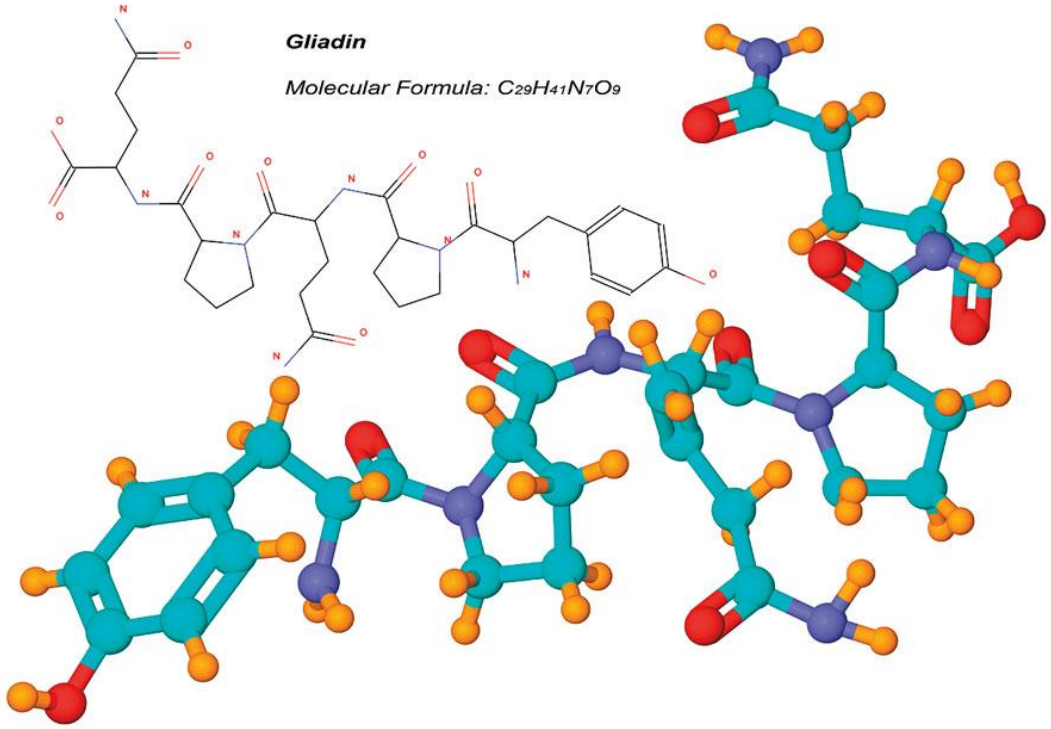
Proteins found in

Wheat	Gliadin & Glutenins
Barley	Hordein & Glutelin
Rye	Secalin & Glutelin
Oats	Avelin & Glutelin

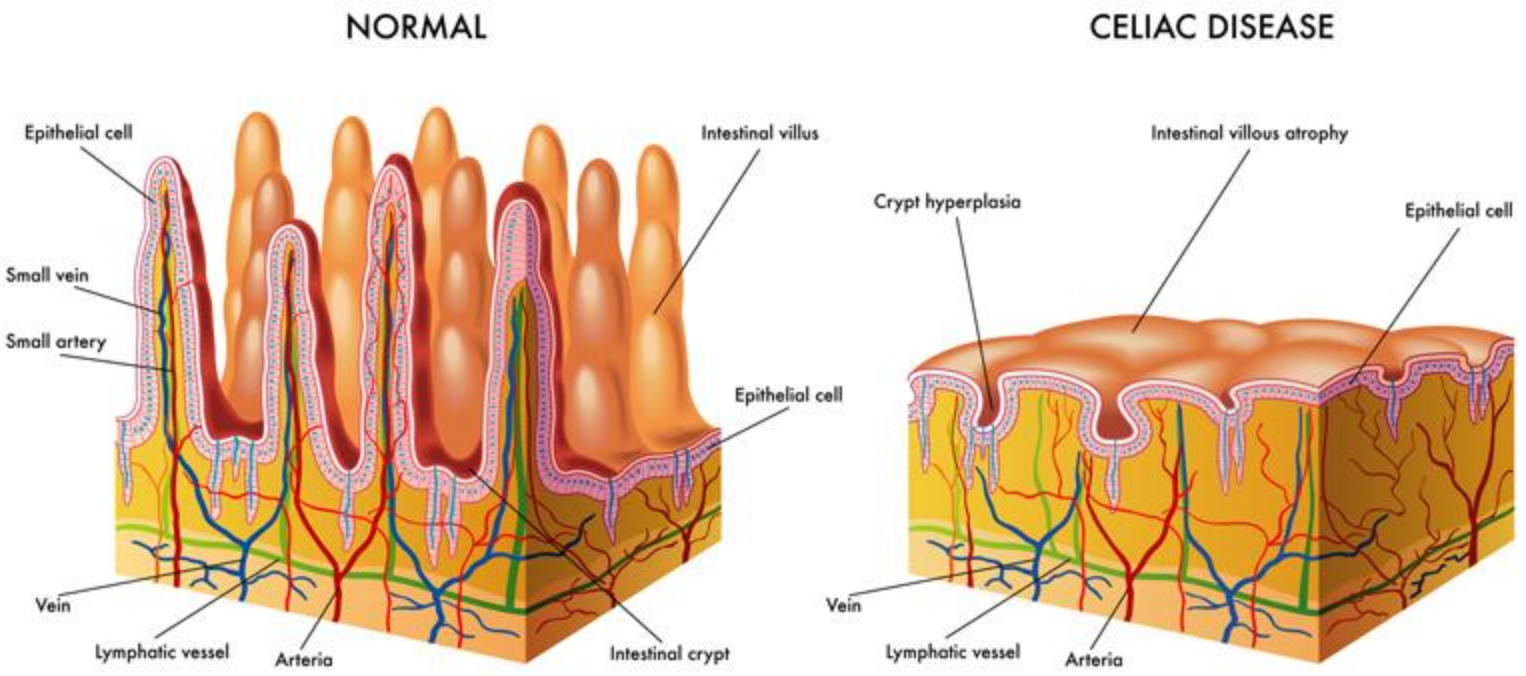
Gluten Intolerance- Celiac Disease

- Celiac disease is caused by a reaction to gliadin, the alcohol-soluble component of gluten.

- Results in damage to the villi of the intestinal mucosa and malabsorption of virtually all nutrients.



Gluten Intolerance



- The disease primarily affects the mucosa of the jejunum or ileum.

Gluten Intolerance- Celiac Disease

- The mechanism by which gliadin damages the bowel is unknown, but it appears to have genetic and immune components.
- Diagnostic procedures consists of IgA and IgG blood tests and mucosal biopsy.

Gluten Intolerance- Celiac Disease

- Symptoms in children:
  - diarrhea, growth failure in children, projectile vomiting.
  - Stool frequency can be in excess of 10/day.

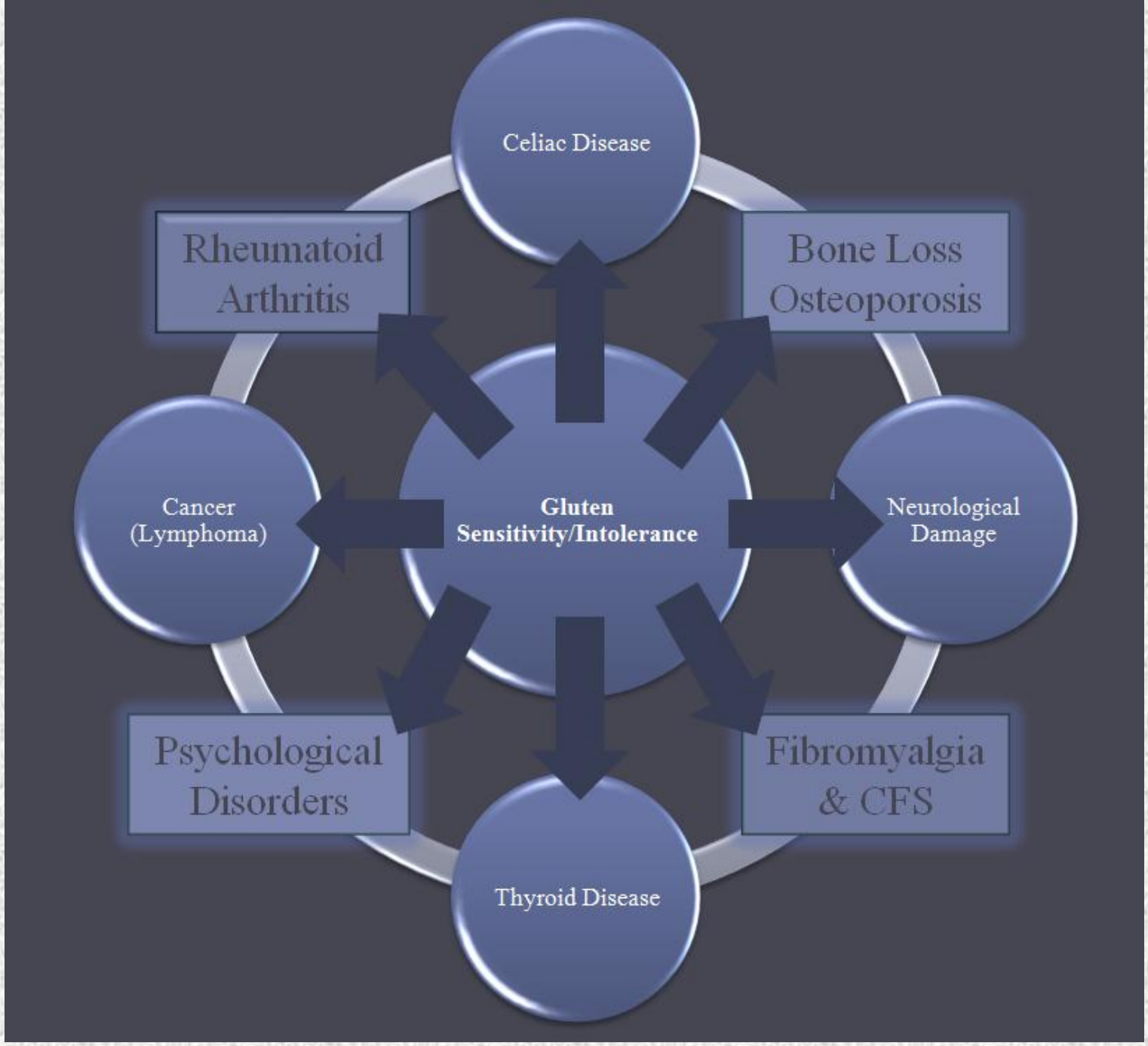
- **Adults may have:**
  - increased appetite, weight loss, weakness, fatigue and anemia.
  - Diarrhea may or may not be present. Bowel movements usually are large, putty colored, and foul-smelling.

Nutritional Care

- Nutritional care includes **complete** withdrawal of gliadin from the diet.
- Gluten is found in wheat, barley and rye.
- Oats Hold the Oats for Celiac Disease?
- Corn, rice, soy, arrowroot, tapioca and potato flours may be substituted for wheat flour.

How Gluten Causes Disease

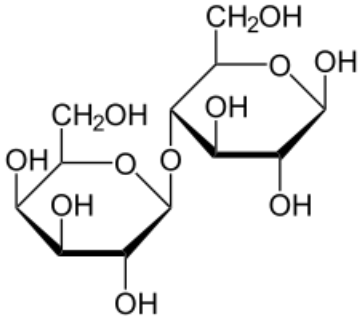
When one's digestive system is healthy, undigested or partially digested proteins will be eliminated as fecal matter. However, if one's digestive system becomes weakened due to poor food choices, food intolerances, alcohol consumption, eating processed foods and sugars as well as from the normal day to day stresses of life the ability of the body to digest gluten proteins can become difficult. As a result any of the symptoms listed above will be seen because of the undigested proteins floating through the bloodstream thus causing an autoimmune reaction. In addition the protective mucus lining of the intestinal track gets attacked as well. Like the skin on your body, this protective mucus lining is a first line of defense in protecting the body from illness and disease. When this lining breaks down it leads to leaky gut syndrome; therefore, making one's immune system vulnerable and weak.


Celiac Disease
Rheumatoid Arthritis
Bone Loss Osteoporosis
Cancer (Lymphoma)
Gluten Sensitivity/Intolerance
Neurological Damage
Psychological Disorders
Fibromyalgia & CFS
Thyroid Disease

Types of Food Intolerance

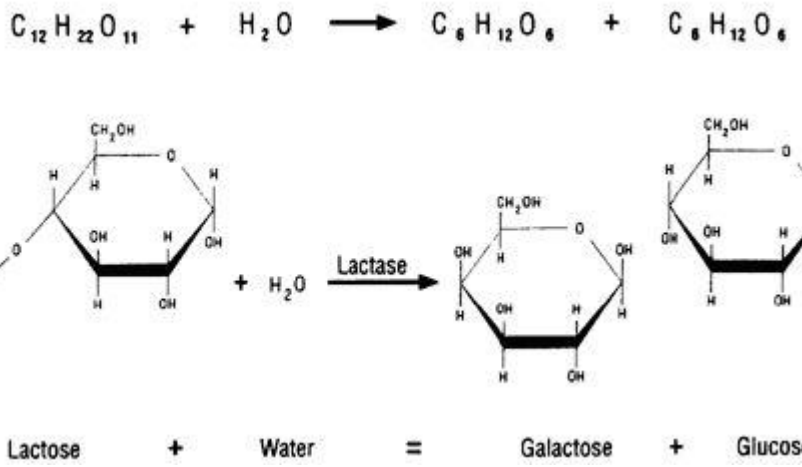
- **Lactose intolerance**
  - It caused by **lactase deficiency**.
  - Lactase is an enzyme that is in the lining of the gut.
  - Lactase breaks down lactose, a sugar found in milk and most milk products.
  - Lactose is used by bacteria to form gas which causes bloating, abdominal pain and diarrhea.
  - At least **one out of ten** people suffer lactose intolerance.

Lactase Deficiency



- Lactose that is not hydrolyzed into galactose and glucose remains in the gut and acts to osmotically draw water into the intestines.

- Bacteria ferment the undigested lactose, creating lactic acid, other organic acids, CO_2 and hydrogen gas.



Lactase Deficiency

- The result is bloating, flatulence, cramps and diarrhea.
- Lactase activity declines at weaning..

- Asians and Native Americans tend to be most lactose intolerant.
  - ~75% of African-Americans, 50% of Hispanics and 20% of Caucasian have varying degrees of lactose intolerance.
- Lactose intolerance can also develop secondary to an infection of the small intestine or destruction of mucosal cells by other causes.

Lactose Intolerance

- Diagnosis is based on a oral dose of lactose equivalent to 1 quart of milk.
- In lactose intolerance blood glucose increases less than 25 mg/dl and GI symptoms develop.

Nutritional Care

- Most adults with lactose-intolerance can consume some lactose without symptoms.
- Lactose is better tolerated as part of a meal than when **taken separately.**
- Some milk products such as **aged cheese** are usually tolera because the lactose content is low.

- Milk and milk products treated with lactase enzyme (Lactaid™) are well tolerated.

Nutritional Care

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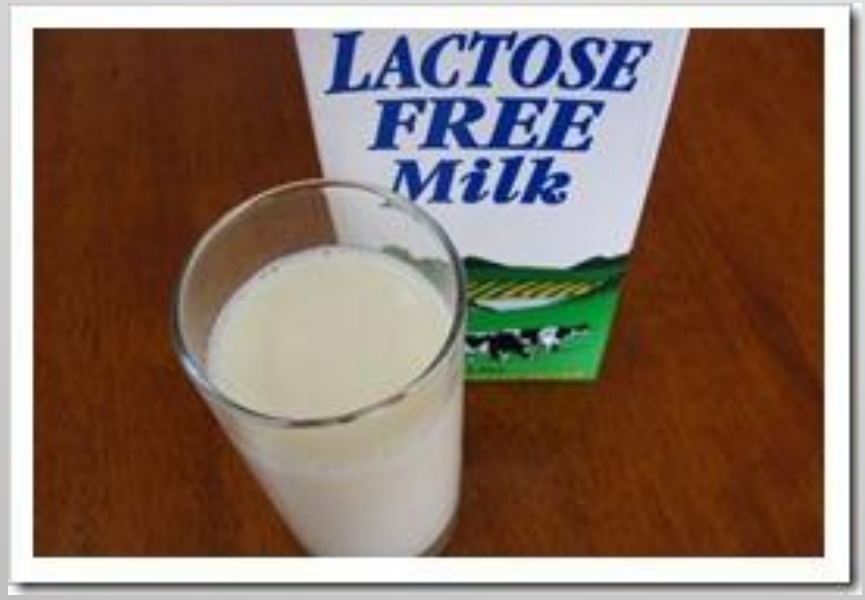


Lactose Content of Foods

- Milk - 1 cup 10-12 gm
- goats Milk - 1 cup 9 gm
- Sour Cream 1/2 C 4 gm
- Cottage Cheese 1/2 C 2-3 gm
- Yogurt - 1 cup 5 gm
- Cheese - 1 oz 1 -2 gm
- Ice cream - 1/2 C 6-9 gm

Alcohol Intolerance Symptoms

One of the most common symptoms of an intolerance to alcohol is red facial flushing, commonly referred to as alcohol flush reaction.

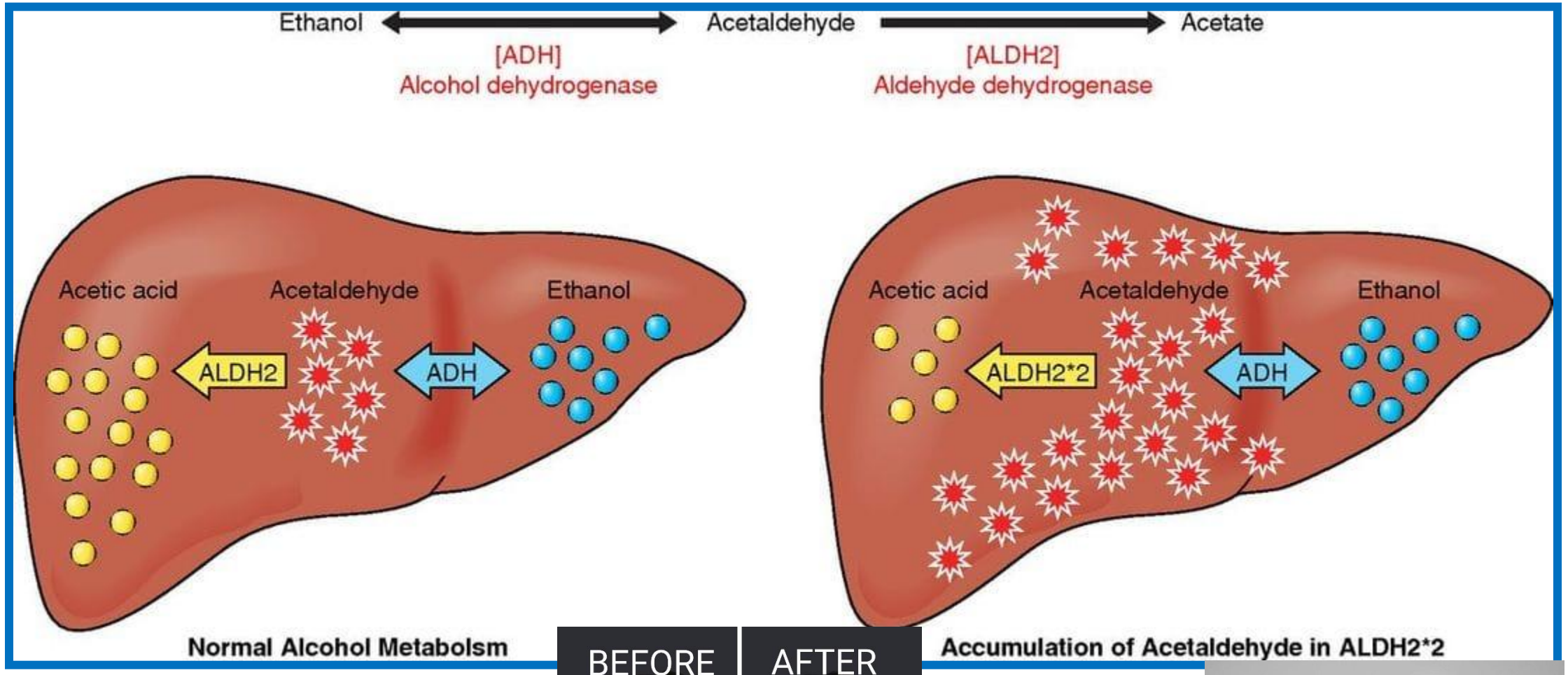
The red facial flushing shown in the woman is not the only symptom plaguing people with an intolerance to alcohol.
Other symptoms of alcohol intolerance include:

- swelling around the eyes
- rapid heartbeat
- wheezy or restricted breathing
- pulsing headache

The onset of alcohol intolerance symptoms begins with a respiratory reaction. Most sufferers will first report minor breathing difficulties, usually accompanied by a **noticeable increase in heart rate.**
Approximately 20 to 30 minutes after alcohol consumption, sufferers will feel **a hot or tingling sensation around the eyes, cheeks, forehead, and ears**. This is soon followed by a red flushing skin reaction that lasts anywhere between 30 minutes to a few hours depending on the amount of alcohol consumed and a person's individual tolerance to alcohol.

More severe cases of intolerance can also **involve migraine-like headaches** that occur approximately 1 to 2 hours after alcohol consumption and last up to several hours.

Alcohol methabolism, Alcohol intolerance



Alcohol intolerance

Symptoms of such a reaction as alcohol intolerance, in most cases manifest the same.Change can only their intensity and recovery period. The first sign that a person has an individual alcohol intolerance is **a rapid redness of the face after using the minimum doses of alcohol**. Ethylene in this case catalyzes blood circulation processes in connection with the production of toxic acetaldehyde.

Other signs of **intolerance** include:

- manifestation of redness on the skin;
- noticeable redness of the proteins of the eyeballs;
- sudden itching;
- paroxysmal cough;
- tear;
- a sharp throbbing headache;
- manifestation of dizziness;
- fever, increased sweating;
- vomiting;
- bleeding (most often from the nose);
- prolonged syncope.

Metabolism of alcohol

ADH activity is just responsible for the rate of decrease in the concentration of alcohol in the blood (AS). People may differ in the activity of ADH.

- A number of nationalities of the Mediterranean basin have a version of the ADH, which slowly destroys alcohol.
- Europeans have quite active ADH.
- Asians - less active ADH.
- Heavy drinkers induce ADH (this is called enzyme induction) and therefore alcohol is destroyed faster by them. The phenomenon of "tolerance" arises.

After the development of cirrhosis, the amount of ADH that can utilize alcohol decreases, and in such people the need for alcohol to achieve a state of intoxication also decreases.

A number of spirits, such as aged **whiskey, contain substances that block ADH**, so their intoxicating effect may last longer.

Acetaldehyde under the influence of ADH is toxic and its accumulation causes extremely unpleasant sensations.

In the case of food allergy and food intolerance avoid food with food additives:

Treatment

- The best current treatment for food intolerance is to **either:**
- **avoid certain foods or**
- **eat them less often and in smaller amounts,** as well as
- **taking supplements that may help digestion.**

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