

MEAT – FROM FUNCTIONAL FOOD TO DISEASES OF MODERN CIVILIZATION**

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Meat is an important component of the human diet and provides many nutrients, in particular high-value protein that contains all amino acids, vitamins (including vitamin B₁₂ not found in plant foods), mineral compounds that contain bioelements, saturated and unsaturated acids and enzymes, among other things. This is the most important information on the nutritive value of meat. In arguing against theories that meat is harmful to humans, because our organisms are adjusted to digestion of plant products, it is worth recalling that some 2.5 million years ago mutations emerged in our DNA thanks to which human bodies began to tolerate a meat diet, and we can digest large amounts of animal protein.

A look at the daily consumption of protein in different parts of the world shows that plant foods cannot eliminate hunger. What is more, only animal protein is high-value protein.

	Total protein, g/day	Including animal protein, g/day
Europe	100	58
North America	97	56
South America	67	31
Asia	64	16
Africa	56	12

Objectively speaking, meat can be both functional food and a cause of civilization diseases depending on the quality, quantity, form and time of meat consumption by humans.

The idea of functional food is connected with Eastern philosophical tradition, which does not clearly distinguish between food and medicine. This philosophy is based on the words of Hippocrates of Kos, who is considered one of the most outstanding figures in the history of medicine

and is credited as the father of modern medicine: Live in Harmony with Nature. The Hippocratic method is based on the following pillars:

- Food, drink, sleep, love – all in moderation.
- The doctor treats, nature heals.
- The physician's only duty is to cure the sick, using whatever means.
- A wise man should consider that health is the greatest of human blessings, and learn how by his own thought to derive benefit from his illnesses.
- First, do no harm (*Primum non nocere*).
- The health of the patient is the highest law (*Salus aegroti suprema lex*).
- Let food be your medicine and medicine be your food (<http://pl.wikipedia.org/wiki/Hipokrates>).

The latter tenet is the fundamental principle of functional food. It must be remembered, however, that the borderline between functional food and diseases of modern civilization is very thin and comes down to observing the first principle of Hippocrates: “Food, drink, sleep, love – all in moderation”. Meanwhile, we must not forget the basic rule of our lives: WE EAT TO LIVE, WE DON'T LIVE TO EAT. Failure to observe these principles leads to civilization diseases, such as diseases related to the negative consequences of living in highly civilized societies (stress situations, nervous tension, low muscular activity, effects of environmental pollution and noise, imbalanced nutrition). These include arterial hypertension, obesity, coronary heart disease, peptic ulcers, allergies, and psychiatric disorders. According to the European definition, a functional food is a food that contains ingredients having a particularly favourable effect on the body's physiological function, the effect being different than that resulting from the nutritional value of the ingredients. Therefore, functional food, in addition to the basic aim of nutrition, has a psychological and/or physiological effect on the human organism. For example, functional food can lower cholesterol, boost the immune system, restore microbiological balance in the digestive tract, aid the treatment of irritable bowel syndrome, and reduce inflammation (http://pl.wikipedia.org/wiki/Żywność_funkcjonalna). Functional food is defined as food that is (or can be) a component of the daily diet and is suitable for general consumption. Therefore, pills, dietary supplements and other pharmaceuticals are not considered functional food, which must be a product obtained from natural components and having a clinically proven health-promoting effect (*Buttriss et al.* 2001). Now that we have established

the definition of functional food, let us give some thought to the functional traits of meat. When hearing about the harmful effect that orthodox vegetarians claim meat has on the human body, it should be admitted that mindless consumption of meat can do more harm than good. What initially comes to mind is the first principle of Hippocrates: “Food, drink, sleep, love – all in moderation”. The opponents of meat-eating quote the sayings of famous people who ate no meat. The recommendations of the American Dietetic Association that consumption of beef, pork and mutton should be limited to as little as one meal per week, or the appeals of the World Health Organization to reduce red meat in our diets, are perhaps acceptable in highly developed countries, in which no people are going hungry.

Meat gives you wings

Meat is a rich source of specific amino acids, which cross the blood/cerebrospinal fluid barrier. Tryptophan, phenylalanine and glutamic acid are precursors of neurotransmitters that regulate the function of the central nervous system, with their secretion levels affecting the emotional state and mood. In the brain, phenylalanine is converted into L-tyrosine, which is converted into dopamine, noradrenaline and adrenalin. By stimulating the central nervous system, dopamine, noradrenalin and adrenalin improve physical and mental efficiency, memory and the ability to concentrate, shorten the reaction time (improved reflexes) and reduce depressive states, which may significantly improve a person’s general physical and mental state. Phenylalanine is found in foods rich in protein such as meat, eggs, fish, milk and cheese. Less phenylalanine is found in cereal products, vegetables and fruit. L-tyrosine is found in protein-rich foods such as meat, poultry, seafood, beans and lentils.

Tryptophan is converted into serotonin, which inhibits the central nervous system, reduces nervous tension and susceptibility to stress, and has a soothing and relaxing effect by slowing down reaction time, inducing a feeling of satiety after meals and sleep. The sources of tryptophan are soybean, semolina, poultry meat, hard cheese, bananas, sunflower seeds and milk (*Wurtmann and Wurtmann, 1988*).

Glutamic acid converts into gamma-aminobutyric acid (GABA), which is an inhibitory neurotransmitter and has a similar effect to serotonin. Sources of glutamic acid include rabbit meat and beef. This means that you should eat poultry and rabbit meat dishes to get some relaxation (*Suffes and Wurtman, 1997*).

Encourage your brain to work

If in the morning L-tyrosine reaches the brain before L-tryptophan, it will make the brain function optimally throughout the day. However, if L-tryptophan reaches the brain first, it will stimulate serotonin production, reducing our mental efficiency and making us tired in the middle of the day. Therefore, we should eat a substantial breakfast that is rich in animal protein (Somers, 1998). An old proverb says: “Eat your breakfast alone, share your lunch with your friend, and give your dinner to your enemy”.

Meat helps you overcome the consequences of stress

Activation of the body is highly desirable when we are under threat or doing intense mental work that requires quick reactions, for example. When activation is too frequent, protection should be provided against the resulting unfavourable changes in the body. These include mainly peroxidative changes in body lipids and proteins (particularly DNA), resulting from oxidative stress (Nemeroff, 1998). Oxidative stress develops as a result of more intense body catabolism, leading to increased production of highly reactive free radicals responsible for degenerative changes in the body. To counteract depression and inhibit peroxidative changes, you should eat foods rich in:

- vitamin E (meat, vegetables, milk and eggs),
- vitamin C (raw fruit, vegetables and liver),
- coenzyme Q-10 (mackerel, salmon, sardines, bovine heart and bovine liver).

Over and above social factors, factors important in depression control include an adequate supply of vitamins, particularly group B vitamins:

- B₃ (niacin) – brewer’s yeast, sunflower seeds, peanuts, whole cereal grains, dried beans and peas, liver and turkey meat,
- B₅ (panthotenic acid) – brewer’s yeast, liver, turkey and broiler meat, eggs, bran, whole cereal grains, oatmeal,
- B₆ (pyridoxine) – yeast, bananas, lean meat, poultry, legumes,
- B₁₂ (cobalamin) – bovine and calf liver, seafood,
- folic acid – lettuce, cruciferous vegetables, parsley leaves, beets, cucumbers, peas, beans, soybeans, lentils, oranges, wholemeal bread, liver,
- choline – egg yolk, liver and other offal, lean meat, yeast, wheat sprouts, soybean, green peas.

Symptoms of anxiety are alleviated by omega-3 polyunsaturated fatty acids, which also have antidepressant effects and indirectly increase the sense of satisfaction. Sources of omega-3 polyunsaturated fatty acids are salmon, tuna, sardines and marine crustaceans. Fish are a source of iodine, and saltwater fish are particularly rich in iodine. A daily ration of 0.18-0.2 mg iodine for adults prevents goiter. Because fish are such an excellent source of iodine, we should eat fish meat once or twice a week, giving preference to saltwater fish.

Omega-3 fatty acids neutralize the harmful effect of omega-6 acids, saturated acids and LDL cholesterol, and play an important role as they protect the cells of the body. In addition, polyunsaturated fatty acids are a component of cell membranes, improve the serum lipid profile, reduce platelet reactivity, and stimulate the synthesis of eicosanoids (prostacyclin, thromboxanes, leukotrienes).

The meat of slaughter animals is a rich source of both n-3 and n-6 polyunsaturated fatty acids:

Species		PUFA	C18:2	C18:3
Ostrich	-	32.5	18.0	6.0
Chickens	-	19.6	13.5	0.7
Cow	-	4.8	2.0	1.3
Camel	-	18.5	12.1	0.5
Kangaroo	-	37.7	19.5	3.6
Buffalo	-	13.8	8.5	0.2

In discussing the properties of the lipids found in meat, mention should be made of L-carnitine, which plays a major role in fat degradation and burning in the cells. L-carnitine is produced in the liver and vitamins C, PP and B₆ and iron are required for its synthesis. The primary source of L-carnitine is meat.

Meat is a rich source of some mineral compounds. Unlike plants, it supplies iron in a form easily available to the body. The human organism needs approximately 10-15 milligrams of iron per day, mainly for haemoglobin and myoglobin synthesis. Meat, and red meat in particular, is very considerably rich in iron, which may increase the amount of free oxygen radicals generated in a Fenton reaction, possibly leading to many metabolic disorders. Large amounts of iron are found in beef, horsemeat and liver, which also contains vitamin A. However, frequent liver consumption is not recommended due to the high levels of cholesterol (230 mg per 100 g)

and harmful compounds it gathers during the animal's life (heavy metals and toxins). Meat contains relatively small amounts of minerals such as potassium, sodium, phosphorus, calcium, magnesium, iron and copper.

Meat and cholesterol

The opponents of meat-eating object to the excessive level of cholesterol in meat, which can be harmful and lead to atherosclerotic changes. However, cholesterol is needed for the normal functioning of tissues and organs, and is used for the production of hormones, bile acids, and provitamin D₃. A cholesterol level of 200 mg/dl or lower is considered normal, while levels of 200-239 mg/dl are considered borderline high-risk. The body can obtain cholesterol from two sources. The greatest source of cholesterol is liver, which produces approximately 1 g of cholesterol per day. Between 20 and 40% of cholesterol in the body comes from food. However, dieticians believe that the supply of dietary cholesterol should not exceed 300 mg per day - excessive consumption may increase the concentration of blood cholesterol, and this, in turn, may increase the incidence of ischaemic heart disease. In blood plasma, cholesterol occurs in combination with proteins in the form of lipoproteins. There are high-density (HDL) and low-density (LDL) lipoproteins. Low-density lipoproteins transport cholesterol to body cells, including the epithelium of arterial vessels, where, under some circumstances, it can be deposited on arterial walls in the form of atherosclerotic plaques. For this reason, LDL cholesterol is known as “bad” cholesterol. Cholesterol found in the HDL fraction transports cholesterol from arterial vessels to the liver. It has a protective and antiatherosclerotic action and is known as “good” cholesterol. In the case of food, there is no differentiation between “good” and “bad” cholesterol: cholesterol is the same compound in all products (*Gawęcki and Hryniewiecki, 2003*).

Most dietary cholesterol in animal products is found in brains, egg yolk, liver, cured meats, mutton, veal, beef and pork. It must be recalled that cholesterol is not destroyed by heat or during storage.

Bearing in mind the sex hormone synthesis pathways and the ***cholesterol – steroids – sex hormones – love – new life*** chain, it is time to dispel some long-held but false beliefs.

One of the main reasons why it is recommended to limit consumption of meat and meat products is the high concentration of hidden fat, which is rich in saturated fatty acids that disturb the lipid balance. The composition of the pool of fatty acids in meat and depot fat varies according to species, but

environmental factors, mainly nutrition, also have a significant effect. Nutrition can be used to modify the fatty acid profile of animal fat, but the consequences of these changes must be taken into consideration. An increased proportion of unsaturated fatty acids lowers the oxidative stability of fat and requires the use of antioxidants, and meat modified in this way must be subjected to thermal treatment and used for a specific purpose. Thermal treatment of meat, especially at high temperature, is conducive to the formation of carcinogenic compounds such as heterocyclic amines and polycyclic aromatic hydrocarbons. The highest concentrations of carcinogenic compounds have been detected in meat products that were burned during frying or roasting. Thermal treatment and long-term storage of inadequately protected meat products are conducive to the oxidation of unsaturated fatty acids (and cholesterol), which determines their use-by date. Over the last 150 years, in the daily ration consumed by humans in industrialized countries there has been a considerable increase in the proportion of fats and a decrease in the consumption of n-3 polyunsaturated fatty acids, as well as a decrease in the consumption of vitamin C and E, dietary fibre and other bioactive substances (e.g. polyphenolic compounds) connected with plant cell walls. Excessive consumption of high-energy food disturbs the body's energy balance and leads to many metabolic disorders and diseases such as obesity and lipid imbalances (hyperlipidaemia or insulin-independent diabetes). Excessive consumption of animal fat and cholesterol as well as limited amounts of daily physical exercise due to the development of mechanization and motorization are the main environmental factors affecting the development of atherosclerosis. As a systemic metabolic disease, atherosclerosis is related to obesity and diabetes, the presence of which increases the development of atheromas in blood vessels. Because of the strong links between these three diseases, they are known as metabolic diseases of civilization. In addition, environmental stress has a negative impact on the body as it increases the blood levels of some hormones, which in turn increases arterial blood pressure. Obesity is defined as pathological accumulation of fat in the body, exceeding the body's physiological needs and adaptive capacity. From the medical point of view, obesity occurs if adipose tissue accounts for over 20% of total body weight in men and 25% in women. According to this standard, 29% of Polish men and 22% of Polish women are obese, which makes Poles an obese nation along with Romanians and Kuwaitis. The inhabitants of Switzerland and Italy represent a model to be followed, as only 6% and 7% of men and 5% and 6% of women in these countries, respectively, are obese. However, it is

hard to conclude that high consumption of meat or fat is the main cause of obesity; rather, it is a lack of exercise, improper meal times and improper proportions of particular foods that cause us problems. Polish slaughter animals and the meat consumed by Poles are similar to those in Switzerland or Italy. If we are to believe WHO forecasts, the percentage of obese people (BMI >30 kg/m²) is on the rise (*WHO Obesity Taskforce* 2003).

Year	USA	Great Britain	Brazil
2000	12	8	7
2010	20	17	9
2020	28	26	12
2030	41	30	19

Civilization diseases also include allergies – diseases resulting from excessive activity of the immune system. In contact with an allergen (a substance that causes an allergic reaction), the body of a predisposed person overreacts and produces antibodies, which induce irritations. The course of allergic reactions may vary considerably and take on different forms.

Does meat cause allergic reactions?

The answer is yes, and pork is the greatest allergy-inducer. Rabbit, turkey and lamb meat cause the smallest allergic reactions. Fish can cause very strong allergic reactions, but the commercial treatment of fish reduces its allergy-causing properties. The heating of meat produces chemical compounds known as heterocyclic amines (HCA), which have strong mutagenic properties. They are formed in muscle cells under the influence of high temperature, especially during frying and grilling, and less so when meat is stewed or cooked. Most HCA compounds are found in fried bacon, and a dozen times less in fried fish (Mała Encyklopedia Medycyny, 1972). The addition of 10% soy protein to meat considerably limits the formation of HCA compounds during frying, decreasing the HCA content of hamburgers by 90%. The smallest amount of HCA compounds is formed when meat dishes are prepared in microwave ovens.

Viagra or meat for lunch?

Humans do not need chemical encouragement in love: specific amino acids help to solve sexual fitness problems. Dopamine and serotonin are neurotransmitter substances, factors extremely important for sex drive and physical realization of sexuality. They control our urges and emotions, transmitting nerve impulses from the brain, stimulating the brain, improving our moods and evoking a sense of pleasure and euphoria. Serotonin is also found in sleep control centres and pain inhibition centres (*Somer, 1998; Suffes and Wurtman, 1997*).

The sexually arousing properties of some dishes were known thousands of years ago. Greek and Roman gods delighted in passionate love, taking strength from ambrosia, the food apparently made from millet and honey. Aphrodite, the Greek goddess of love, used dishes from the sea depths and honey to make her romances more exciting. Mortals envied Aphrodite and began to look for effective stimulants of sexual desire, naming them “aphrodisiacs” after her.

Meat gives energy to those exhausted from amorous exploits, while poultry and hare dishes are known to whet the appetite for repeated sex. Other known aphrodisiacs include offal (liver, kidney, stomach, tripe, bone marrow and brain) and exotic delicacies such as bulls’ testicles (in Spain), lambs’ eyes (in the Balkans) or roosters’ combs (in Hungary).

Hard-to-digest meat puts a damper on love-making. Lovers should therefore avoid pork chops, beef cutlets, and underdone beefsteaks. Seafood has a strong stimulatory effect, and Casanova is said to have eaten 50 oysters for breakfast. Other aphrodisiacs include shrimps, lobsters, octopuses, and fish (salmon, pikeperch, trout, eel and sole). Caviar is also popular as an aphrodisiac.

During a romantic dinner, light wine or a glass of champagne are often on the menu, but alcohol should not be drunk in excess. A small dose acts as a stimulant, overcomes shyness and encourages a good mood, but excess alcohol has a soporific effect, eliminating our appetite for sex and discouraging our partner. If we want to know our partner’s intentions, we should take a close look at his or her menu during a romantic dinner.

Meat is treated as a prestigious food attesting to the wealth of the society. F. M. Lappe called this universal worship of meat in the USA the “Great American Steak Religion” (*Lappe, 1982*).

Meat and religion

Religions differ in their attitudes to different meats.

- Pork is impure for followers of Judaism and Islam.
- Beef is the meat of sacred animals for followers of Hinduism.

According to the French naturalist Buffon, pork stopped the expansion of Islam among the Chinese, who preferred its taste to the dogmas of faith. Today, pork meat, and pork lard in particular, are used as a deterrent against Islamic suicide bombers.

The Maring of New Guinea hold pig feasts known as *kaiko*. Several years of famine are followed by the slaughter of many pigs and feasting over several days, and again by years of famine. Elsewhere in Polynesia, a first-born son slaughters his late father's beloved sow and eats the meat on his grave to win him the favour of the spirits. The memory of the dead is also commemorated at wakes in Eastern Europe, where fatty meat or lard is a traditional snack with very strong alcoholic beverages.

In Eastern Europe, meat can be considered a symbol of falling political systems. Meat shortages or drastic increases in meat prices would end in the “diseases of first party secretaries”, changes of government, and turns in history. Slaughter animals or their meat were and continue to be the main currency in some regions of the world (Polynesia). It is interesting to mention the conversion rate – 1 pig is a war tribute for a killed warrior and 4 pigs (in addition to many other gifts for the father of a family) are payment for one's sweetheart.

In ancient Rome and Greece, meat was an extravagant luxury. The tables of the rich bore flamingos, nightingale tongue pâtés and sows' vulvas and teats in addition to *koiridion* (a roast piglet fattened on grape must and stuffed with herbs). Calf and bull testicles are still known as *frivolités* in France.

It is also worth noting the positive and negative feelings connected with meat and the extremely different reactions aroused by:

- snails and frogs' legs in the French, and Poles,
- horsemeat in Italians, the French, and Poles,
- pork in Poles and followers of Judaism and Islam,
- beef in Americans and Hindus,
- meat in vegetarians and meat-eaters.

Meat products are national dishes and a cause for pride. *Kindziuk*, *kumpiak*, Krakowska sausage or Lisiecka sausage are to Poles what Parma ham is to Italians, salami to Hungarians, *ćevapčić* and *pljeskavica* to Serbs,

prsut to Croatians, and *hangikjöt* to Icelanders.

Exotic meat

Original customs are found in different parts of the world. The meat of exotic animals and their organs are treated as a potency drug that guarantees longevity. Chinese people believe that meat protects against all kinds of spells.

Bear's claws sold by Tibetan vendors on the streets of Beijing are used to cure arthritis, impotence and bone diseases. The meat of a pangolin, an insectivorous cousin of anteaters, is considered an effective cure for asthma, and the organs and even the urine of this animal are used to treat haemophilia and prostate cancer. A tiger's penis is highly prized as an aphrodisiac, and tiger's bones soaked in alcohol are used to strengthen bones. Tigers' internal organs have thousands of applications; as a result of these miraculous properties, only 20 tigers have survived in the jungle of northern China. Dog meat is a traditional dish in China and Korea. Chinese restaurants offer monkey's brains, camel's hump, and crocodile and civet meat, although it is illegal to serve the meat of most of these animals. The consumption of meat from these animals decreased following the SARS epidemic that occurred in China in December 2002. SARS probably came from the civet, and people were infected because they ate civet meat, especially in southern China, where it is quite often used in the kitchen (*La Vanguardia*).

MESO – OD FUNKCIONALNE HRANE DO BOLESTI MODERNE CIVILIZACIJE

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Rezime

Meso je važna komponenta obroka ljudi koja obezbeđuje mnogobrojne hranljive materije, naročito visokovredne proteine koji sadrže sve aminokiseline, vitamine (uključujući vitamin B₁₂ koga nema u hrani biljnog porekla), minerale koji sadrže bioelemente, zasićene i nezasićene kiseline i enzime između ostalog. Ovo je najvažnija informacija u pogledu nutritivnih

karakteristika mesa. Razmatrajući teoriju prema kojoj je meso štetno za ljude, zato jer naši organizmi su prilagođeni na varenje proizvoda biljnog porekla, vredno je ponoviti da su pre 2.5 miliona godina pojavile mutacije u našim DNA zahvaljujući kojima je ljudsko telo postalo tolerantno na mesu u obroku, i mi možemo variti velike količine proteina animalnog porekla.

Objektivno govoreći meso može biti i funkcionalna hrana i uzrok bolestima civilizacije u zavisnosti od kvaliteta, kvantiteta, forme i vremena konzumiranja mesa kod ljudi.

Ideja funkcionalnosti hrane je povezana sa tradicijom istočnjačke filozofije, koja jasno ne raspoznaje odnos hrane i medicine.

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