



## Corn (lat. *Zea mays*)

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**Abstract.** The article discusses the main properties of corn and its effect on the human body. A systematic review of modern specialized literature and relevant scientific data was carried out. The chemical composition and nutritional value of the product are indicated, the use of corn in various types of medicine and the effectiveness of its use in various diseases are considered. The potentially adverse effects of corn on the human body under certain medical conditions and diseases are analyzed separately. The scientific foundations of diets with its application are considered.

**Keywords:** corn, benefits, harm, beneficial properties, contraindications

## Beneficial features

Table 1. Chemical composition of corn (according to [Food+](#) ).

Main substances (g/100 g):	Fresh yellow corn [1]	Boiled yellow corn [2]	Frozen yellow corn [3]	Canned yellow corn [4]
Water	76.05	73 , 41	71.79	82.61
Carbohydrates	18.70	20.98	23.50	13.86
Sugar	6.26	4.54	3.78	4.15
Squirrels	3.27	3.41	3.28	1.95
Alimentary fiber	2	2.4	2.8	1.7
Fats	1.35	1.5	0.78	0.77
Calories ( kcal )	86	96	98	61
Minerals (mg/100 g):				
Potassium	270	218	294	136
Phosphorus	89	77	87	46
Magnesium	37	26	32	fifteen
Sodium	fifteen	one	5	195
Calcium	2	3	four	four
Iron	0.52	0.45	0.68	0.36

Zinc	0.46	0.62	0.70	0.39
<b>Vitamins (mg/100 g):</b>				
Vitamin C	6.8	5.5	7.2	2.6
Vitamin PP	1,770	1.683	1.681	0.884
Vitamin B1	0.155	0.093	0.103	0.015
Vitamin B6	0.093	0.139	0.179	0.037
Vitamin E	0.07	0.09	0.09	0.03
Vitamin A	0.056	0.079	0.073	0.010
Vitamin B2	0.055	0.057	0.088	0.015

The greatest losses of vitamins and some minerals occur during the preservation of the product. So, the presence of potassium, phosphorus and magnesium is almost 2 times reduced.

The sodium in corn is the mineral that varies the most with the type of preparation. If during cooking sodium almost disappears from the composition, then during canning its concentration increases by more than 10 times.

If fresh corn is not available, then the most complete replacement will be the frozen version, in which the proportion of vitamins and minerals not only does not decrease, but even increases in some positions.

### Medicinal properties

The main healing function is performed by corn stigmas and oil, which have a beneficial effect on several organs and life support systems of the body at once:

- In the circulatory system, substances isolated from the stigmas increase the number of platelets, contribute to the normalization of the blood coagulation process, and vitamin E in the oil reduces the concentration of cholesterol after damage to the inner wall of the vessel.
- Antioxidant properties and the ability to protect liver cells allows the use of stigmas in the treatment of toxic hepatitis and complications of diabetes.
- The choleretic effect of corn oil and stigmas, as well as an increase in bile secretion with a decrease in its viscosity and density, helps to fight a number of diseases of the gallbladder and liver.
- Maize hairs in water infusions of various concentrations are used to dissolve carbonate stones.

Some of the medicinal properties of raw corn are enhanced after processing, and some, on the contrary, are lost. So, for example, popcorn (if it is not “discredited” by the addition of a large amount of sugar and salt) increases the amount of plant antioxidants (polyphenols) that prevent cell oxidation and aging. And corn flakes, having passed the stages of processing and preparation, lose almost all phenolic acids that can fight cancerous tumors <sup>[5]</sup>.

### Use in medicine

For medicinal purposes, a raw material known as "corn hair" is used, obtained from corn columns with stigmas. Stigmas contain fat-soluble, hydrophobic vitamins (participating in the synthesis of proteins and ensuring a normal level of blood clotting), ascorbic acid (ensuring the functioning of connective and bone tissue), fatty oil, some steroidal alcohols, glycosides, traces of essential oil.

Since they have a choleretic and diuretic effect, their liquid extract is prescribed for insufficient bile secretion, as well as for infectious inflammation of the bile ducts (cholangitis), inflammation of the

gallbladder (cholecystitis), the formation of carbonate stones there, liver diseases (hepatitis). A little less often - with inflammation of the prostate gland, urinary tract, and also as a means to slow bleeding.

Unrefined fatty oil, which contains up to 57% in the germs of some varieties of maize, is prescribed as an auxiliary and prophylactic agent for obesity, lipid and protein metabolism disorders in atherosclerotic formations, as well as for impaired glucose uptake and the risk of developing diabetes mellitus.

### In folk medicine

Despite some differences in the approach to treatment, traditional healers often used corn remedies for the same indications as modern doctors representing scientific medicine.

- The South Slavic tradition prescribed the use of a decoction of corn stigmas for urolithiasis and inflammation of the urinary tract. But in addition, they were prescribed to combat tapeworms.
- Eastern Slavic healers "prescribed" corn decoctions for diseases of the gallbladder and ducts, and also as a diuretic.
- In Central Asia, corn was used to treat tuberculosis. Boiled corn cakes with vinegar were applied to eczema, they healed skin cracks on the arms and legs. Chewed corn grain was considered a remedy that could improve eyesight if the resulting slurry was applied to the eyes. As a medicinal drug, such a gruel was also used for insect bites. Eaten corn belonged to fasteners in gastrointestinal disorders. And an enema of boiled flour, according to traditional healers, could cure intestinal ulcers.

Not everywhere, but quite widely in folk medicine, the ability of corn stigmas to relieve nervous tension and act soothingly is still used. In addition, in lotions and by internal use, stigmas are recommended for glaucoma and hemorrhages in the vitreous body and conjunctiva of the eye.

### Decoctions and infusions

There are several recipes for decoctions and infusions of corn stigmas, which are prepared depending on what health problems need to be addressed.

- **With diseases of the biliary tract.** Raw materials in the amount of 2 tbsp. spoons are crushed and poured with 250 ml of boiling water. After 30 minutes of infusion, the liquid is filtered and then taken warm, 60-70 ml before meals three times a day.
- **To restore blood clotting.** A similar method of preparation is used, but 100 g of raw materials are taken, and the decoction is taken in 1 tbsp. spoon every hour.
- **As a diuretic** for edema and kidney disease. Raw materials in the amount of 1 teaspoon are crushed, poured into an enameled pan, 200 ml of boiling water is poured, closed with a lid and aged for half an hour until cool. After filtering, the liquid is taken in 2-3 tbsp. spoons before meals three times a day.
- **For the dissolution of stones in the kidneys and ureters .** Raw materials in the amount of 1 teaspoon are crushed, 200-250 ml of water is poured and boiled for an hour over very low heat. In case of boiling off , you can add a little water until the volume is restored. The broth is infused until cool and taken 1-2 tbsp. spoons before meals four times a day.
- **With eye hemorrhages.** Raw materials in a volume of 15 g are poured with 200 ml of boiling water and infused for 40 minutes. After filtering, the liquid is taken in 2 tbsp. spoons three times a day.

- **With uterine bleeding.** The infusion is prepared in a similar way, but 1 teaspoon of raw materials is used and the infusion time is reduced to 20 minutes. It is taken in 2-3 tbsp. spoons before meals (20 minutes) three times a day.
- **In infusions for weight loss,** raw materials (3-4 tablespoons) are usually infused for about 3 hours in a thermos, and the liquid itself is taken in 1 tbsp. spoon before meals (30 minutes) three times a day.

### **in oriental medicine**

In traditional Chinese medicine, foods are classified according to the extent to which they represent the two fundamental principles of Yin and Yang (on a scale of -3 to +3, respectively). Corn in this division, along with other cereals, is the basis of human nutrition, with a value of "-1" (the minimum degree of Yin), considered a very balanced product.

It has a tonic effect on the vital energy of the pancreas and spleen, soothes and “extinguishes” the heat of the liver, regulates the fullness of the urinary and gall bladders, and also moves the blood of the “triple warmer / heater”, through which the Qi energy performs its functions.

Tibetan medicine expands the list of diseases and pathological conditions in which corn is useful, adding to it constipation, poisoning, leucorrhoea, urinary retention. It is believed that corn can slightly aggravate Cold diseases with Kapha (Plucus) at the base. There are many more of them than Heat diseases and, if started, they are more difficult to treat.

### **In scientific research**

Recent scientific studies have made it possible to talk about corn-based preparations as a way to effectively combat obesity, type 2 diabetes, and various types of inflammatory processes.

In the spring of 2019, a team of researchers from the University of Illinois tested how purple (purple) corn phenols in water extracts extracted from the pericarp of Apache hybrids Red will affect laboratory mice. The concentration of the obtained anthocyanins and phenolic compounds differed significantly depending on the specific hybrid, but the therapeutic effect was recorded to some extent in all cases.

Scientists noted a change in the development of adipose tissue cells ( adipocytes ) under the influence of maize extract and a decrease in fat content by 8-56% (depending on the phenol studied). In addition, they found that a key marker of insulin resistance decreased by 29-64% and cellular glucose uptake decreased by 30-139% (depending on the anthocyanin chemistry).

It is assumed that in the near future the choice of the ideal concentration of phenolic compounds and chemical composition will reduce the effect of oxidative processes in insulin-resistant fat cells and, in general, improve the insulin profile in people suffering from obesity <sup>[6]</sup>.

A few years earlier, in 2012, a Korean research team from the Department of Biochemistry at Hallym University also experimented with purple maize from Chile and Peru to determine how anthocyanins derived from this maize would affect the development of diabetic kidney disease (nephropathy). The experiment was carried out in 2 stages: first "in a test tube" ( in vitro ) and then in mice.

Within 6 hours, the cells were exposed to corn anthocyanins at different concentrations from 1 to 20 µg/ml. Mice (both diabetic and control) were injected with the drugs for 8 weeks. As a result, an interruption of the cellular signal was recorded, which stimulates the mechanism for the development of nephropathy, and can also inhibit macrophage infiltration, which is closely associated with kidney

inflammation. Thus, the researchers concluded that the use of maize anthocyanins can be considered as an element of an overall strategy for the prevention of renal vascular disease in type 2 diabetes <sup>[7]</sup>.

A whole range of studies has been devoted to the effect on the body of high fructose corn syrup (with a glucose and fructose ratio of 45:55, respectively), which is added on an industrial scale to sweet water, bread, ketchup, mayonnaise, yogurt and is used in cooking.

- Research conducted at the Baylor College of Medicine in March 2019 showed that daily consumption of corn syrup in drinks, even in small quantities (for a person, this is about 0.35 liters per day), leads to a progressive growth of intestinal tumors, regardless of the degree of obesity. It is assumed that the syrup "feeds" the cancerous tumor, so that it grows faster. The study was conducted on mice in which a mouse model of colon cancer was created by deleting a certain gene. The control group of rodents drank pure water throughout the experiment, and they did not observe such intensive cancer growth <sup>[8]</sup>.
- In 2008-10 Scientists from the Duke University Medical Center, after examining the dietary questionnaires of 427 adult patients with non-alcoholic fatty liver disease, suggested that it was the increased consumption of corn syrup that led to scarring and the development of fibrosis <sup>[9]</sup>.
- According to a research group at Princeton University, corn syrup is more likely to cause obesity than other sweeteners of the same calorie content. In one experiment, experimental male rats received water with syrup, while control groups received water sweetened with table sugar and sucrose. Males drinking syrup-containing water gained weight much faster. Moreover, they did not just get fat, but showed signs of morbid obesity. The second experiment, which was carried out for six months, led to similar conclusions <sup>[10]</sup>.

It must be said that the Corn Processors Association responds to almost all critical studies of scientists, pointing to certain errors (or incorrect interpretation) in the experiments. But scientists continue to work. And more often it is not aimed at debunking corn products, but at finding their beneficial properties.

For example, researchers from Purdue University recently concluded that the addition of soluble corn fiber can help accumulate and retain calcium in the bones if fiber is consumed at critical moments in the process of calcium formation in a woman's life - during adolescence and postmenopause <sup>[11]</sup>.

## **Weight regulation**

The use of corn in diets for weight loss causes conflicting reactions from experts. More often, it is recommended to exclude it from the diet or reduce consumption to a minimum during the course. However, there are people who practice mono-nutrition in express diets, talking about the feeling of satiety and quickly leaving kilograms. The 4-day program of the Canadian nutritionist Ishmael Kitner is also based on the use of this particular cereal.

- The first two days are eaten: grains of 2 cobs of boiled corn (if it is not possible to use fresh or frozen grains, then canned ones will do); vegetables and fruits 1 each - carrots, cucumbers, tomatoes, sweet peppers, onions, kiwi.
- The last two days, the same thing is used, only with the addition of boiled champignons in the amount of 150 g.
- During all this time, it is advisable to drink at least a liter of water per day, and also add a drink from brewed cob fibers to the diet.

Regardless of dietary preferences, when choosing corn, you need to consider its variety and method of preparation. The least calories in the raw version - about 85 Kcal / 100 g, boiled and canned corn in

sweetened syrup contain approximately the same amount - 120-125 Kcal / 100 g, in popcorn with flavorings - about 325-350 Kcal / 100 g, and in a fried product, usually more than 400 kcal.

### **In cooking**

There are many uses for corn products in cooking.

Grains in the stage of milky ripeness can be eaten raw or boiled. Some maize varieties make great popcorn, others make great corn flakes. Canned maize is included in numerous salad recipes. Corn glucose-fructose syrup is also known in cooking, which, however, causes a critical attitude and even concerns among nutritionists and scientists.

Porridge is made from coarse flour. And when fine flour is added to cakes and puddings, they become more crumbly. Cornmeal is also used to make pancakes and dumplings. This is especially true for people with gluten intolerance who cannot eat traditional wheat, barley or rye bread. However, cornmeal can be a real challenge for a novice cook. It is heavy and the dough does not want to rise with it. Therefore, if you use it, it is better to deal with the finest flour.

In the cuisines of peoples around the world, you can find traditional maize dishes that have already become traditional: from Argentinean locro soup and Italian polenta porridge, to Chinese donuts and Egyptian pineapple cake. In Mexico, the beer drink chicha ( chicha ) is brewed from sprouted maize grains .

### **In cosmetology**

A number of different cosmetic components are obtained from maize, but starch is considered the most demanded in the beauty industry for its absorbent capabilities and the ability to give the skin a silky smoothness. "Universal sensory modifier" is called by the manufacturers themselves. When applying cosmetics based on it, a powdery matting effect appears, due to which the skin feels dry and smooth, excess shine and stickiness disappear. Starch, instead of talc in the composition, absorbs excess sebaceous secretions and at the same time delicately polishes the surface of the skin.

In addition, starch in cosmetics acts as an emulsifier, preservative, thickener. Depending on the specific task, its concentration can reach different levels:

- in powders - up to 99%,
- in creams - up to 30%,
- in lotions - about 0.5-3%.

Corn derivatives play other roles in cosmetics as well. Corn protein - nourishes and conditions the skin and hair. Corn alcohol esters (glycerides) - moisturize, and in combination with corn germ oil, these components protect the skin from damage and irritation.

At home, you can easily make a face mask using one tablespoon of boiled cornmeal. The slurry swollen from water is applied to previously cleaned skin areas and left for 15 minutes. After this time, the gruel is washed off with warm water without soap.

### **Dangerous properties of corn and contraindications**

Since corn stigmas create a choleretic effect, they can provoke the movement of stones in the gallbladder and ducts. Boiled corn grains are relatively difficult to digest, so people with

gastrointestinal problems (indigestion, ulcers, increased gas formation) should use the product with caution.

Potential health risks associated with eating corn include its ability to increase blood clotting and increase blood viscosity. In addition, slowing blood flow is one of the causes of thrombophlebitis, so people with such circulatory system problems should consult a medical specialist before including corn in their diet. Perhaps a balanced diet rich in amino acids (particularly taurine) will reduce the risk.

The absence of iodine in corn grits adversely affects the state of the thyroid gland. More precisely, corn itself as a product does not increase the risk of goiter, but the forced transition to long-term corn diets in history has already led to a regional increase in thyroid diseases. In particular, in the years of famine in northern Italy, local corn porridge - polenta ( polenta ) - helped the locals survive due to its nutritional value, but the lack of a sufficient amount of iodine in the daily diet eventually led to a surge in diseases provoked by this factor.

But both the monotonous diet and the overeating of corn products with added sugar (cereals, “sticks”, popcorn, chips) are not so much about the harmfulness of maize itself, but about abuses and extremes in matters of nutrition in general.

Glucose-fructose syrup, created from corn, also threatens, first of all, with an excess of purified fructose in the composition, which harms the brain and creates prerequisites for the formation of tumors. In addition, it “feeds” already existing tumors, which is why they grow faster. There are studies showing that such a syrup increases the risk of developing cirrhosis and fibrosis in people with fatty liver . Therefore, sugar should not be replaced with corn syrup (as is sometimes recommended).

Separate serious disputes are caused by the dependence of the risk of developing cancer on the use of genetically modified corn. The discussion was aggravated by a two-year study by French scientists who, after an experiment on rats, stated that GMOs lead to the appearance and rapid increase in cancerous tumors. According to the data presented, breast cancer was especially common in female rodents.

Throughout the study, animals were fed only genetically modified corn of the famous Monsanto brand , after which a number of countries, just in case (until the results were confirmed or denied), banned the import and cultivation of GM corn.

However, the research of the French group almost immediately after the publication was questioned and debunked. Skepticism was caused by the lack of details about the course of the experiment, insufficient information about the diet of the control groups, and the small number of rodents studied. Several other laboratories requested all information about the work carried out in order to cross-check the results.

In parallel, the collection of statistical information on the possible harm of GM products was also carried out. For this, scientific articles on the subject over the past 30 years, expert assessments, information on the ratio of the number of various diseases and the share of GM crops in the national economy (on a national scale) were raised. This study did not reveal any negative effects of GMOs on human health. On the contrary, the assertion was made that by reducing the pesticide load and increasing the vitamins in hybrids, the health of the nation has improved.

## **Selection and storage**

When choosing corn for cooking, they are guided by several characteristics:

1. **Color.** Since young corn is tastier and softer, it is better to take cobs with light yellow or white kernels. The rich yellow color of the varieties common in our country indicates a high degree of maturity.
2. **Density.** The grains should be moderately elastic, but still quite soft to the touch. It is better if they are the same size. In good corn, they fit snugly together.
3. **Flaws.** "Dimples" on the grains can indicate either improper pre-sale storage of corn, or its overripeness. In any case, it is better not to take such a product.
4. **Leaves.** It is safer to buy corn with leaves, which ideally should still be "alive" and green, close enough to the cob.

While the corn is not cooked, its "life" can be extended to 3-4 weeks if the cobs are dipped in cold water with ice, citric acid and salt (a teaspoon per liter) for about half an hour. After that, you need to remove the grains, dry them, then send them for storage in hermetically sealed bags in the refrigerator. In the freezer, they can lie all winter.

Boiled corn is usually not stored, but if it is necessary, for example, to keep the temperature of the cob before the guests arrive, it is wrapped in foil. In the case when the boiled head still remains uneaten, it can be wrapped in cling film and put in the refrigerator. For a longer period, the separated corn grains are sent to the freezer, previously, still on the cob, by arranging a contrast dipping in hot and cold water. Before freezing, the corn is dried and laid out in bags.

When choosing canned corn, attention to the release date should be paid at least in order to understand whether fresh or frozen grains will be in the bank. As a rule, freshly harvested crops fall into canned food dated in summer and early autumn, while winter and spring packages contain previously frozen grains, which were thawed with 70-75-degree hot steam before sealing.

According to the rules, canned corn can be stored for 3 years. But after opening it should not be kept in the same metal can. If you didn't eat it right away, it's better to pour it into a glass dish, adding the remaining "brine" there, close the lid tightly and send it to the refrigerator, where it can stand for another three days without loss of quality. However, people store even sour grains, using them for fishing as bait. But even more so, they need to be closed as tightly as possible, otherwise the sour smell will permeate the rest of the products.

## Varieties and cultivation

Any corn in cultivation loves the sun and warmth. Seeds germinate at least at 8-10 C, at -3 C, seedlings die. Maize is a drought-resistant crop, but for a good harvest it still needs 450-600 mm of rainfall.

There are 9 botanical groups of cultivated corn ( *Zea mays* ), 4 species, 3 wild subspecies and thousands of varieties and hybrids that differ in shape, color, size, yield, ripening time, content of various elements and other parameters.

- Sugar maize. The most common high sugar group. The cobs of this maize are yellow in color, ranging from pale to rich, almost orange. They need to be harvested before full ripening and cooked as quickly as possible so that the grains do not become "rubber" and starchy.
- Waxy maize. Varieties come with yellow, red and almost white grains. Due to the recessive "waxy gene", varieties of this group cannot be planted next to varieties from other groups. Waxy corn is quite vulnerable to adverse factors - it often dies and does not have consistently high yields. But it is valuable for its 100% amylopectin starch.



- Tooth maize. When the grain of this group ripens, a depression appears in it, making it look like a tooth, which determines the name. Most of the cultivars are medium late or late, providing high survival and yield.
- Silicon maize. The species is hardy, fruitful, with a high starch content. Grains (from lilac-chocolate to yellow) are mainly used for cereals and cereals. An alternative name - "Indian" - this corn probably got because of the "mistake of Columbus", who, having landed on the shores of America, thought that he had found his way to India.
- Starchy maize. Large yellow or white grains contain up to 80% soft starch and little protein, which is why it is used mainly for the production of flour, molasses, and alcohol.
- Bursting maize. This is high-protein corn, which, when heated, breaks the peel and bursts, turning out into a white mealy lump, which determined the technology of popcorn production.
- Filmy maize. It owes its name to the scales ( films ) that cover the grain. This quality makes corn of this group unsuitable for the food industry and, as a result, unpopular with farmers.

There are also semi-dentate and starchy-sugar groups.

The varietal- hybrid variety of corn is extremely large, therefore, for familiarization, let's pay attention to the amazing maize, which in appearance is noticeably different from the corn we are used to.

- "Mother of Pearl Miracle" (Japanese). The plant itself, and the flowers, and the cobs look spectacular. Thanks to thick juicy stems with striped yellow-green-red-orange-pink stripes, they are often planted along walls and fences as a decorative one and a half meter hedge, and with small elongated cobs with dark red grains, designers decorate interiors after harvest.
- Glass \_ Gem ", or "Kaleidoscope". When looking at the cob of this hybrid, it seems that the grains are made of glass of different colors and transparency. Moreover, the set of colors is not repeated, and therefore we can say that every time a completely unique edible and at the same time decorative product appears on the dining table. Glass \_ Gem is not boiled, but excellent popcorn is made from its grains.
- "Strawberry". This variety surprises in color, size and shape. The cobs are small in length - do not exceed 10 cm, have a wide base and a narrow top, which resembles the shape of a berry. The reddish-purple color is also associated with strawberries. The grains of this hybrid are small, but in the milky stage of maturity, sweet and healthy. The flour made from this corn retains a natural dye that is used in cooking.
- Peruvian black. Black corn is spoken of not only as the most ancient domesticated crop, but also as the most useful among corns. Gardeners are often impressed by the black "black" grain, and the powerful stem of the plant with purple aboveground roots and dark striped leaves. The second, "Ukrainian", name of Peruvian corn - "Mama Sara" - came from the name of Saramama ("mother of maize") - a female deity from the mythology of the Quechua people.
- White. The grain color of these hybrids is really snow-white, which is reflected in the names of many of them: "White Cloud" - used to make popcorn, "Snow Queen" - has a high sugar content, "Snow Avalanche" - a high-yielding hybrid with sweet and juicy grains. Thompson \_ Prolific " is a starchy, hearty white corn variety known in Virginia (USA) since 1910 and very popular with American farmers.

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Corn is an indispensable crop in the world economy. Starch, flour, alcohol, oil, biogas - all this is produced in sufficient quantities thanks to corn. Without it, humanity simply would not have been able to feed itself or provide food for domestic animals. But new research into the healing potential of corn may further fuel interest in this unique crop.

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### **Corn - useful properties, composition and contraindications**

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