



Broccoli (*Brassica oleracea* Broccoli Group)

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Abstract. The article discusses the main properties of broccoli 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 broccoli in various types of medicine and the effectiveness of its use in various diseases are considered. The potentially adverse effects of broccoli on the human body under certain medical conditions and diseases are analyzed separately. The scientific foundations of diets with its application are considered.

Key words: broccoli, benefits, harm, beneficial properties, contraindications

Beneficial features

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

Main substances (g/100 g):	Fresh Broccoli [1]	Frozen broccoli [2]	Boiled broccoli [3]
Water	89.3	91 , 46	88.68
Carbohydrates	6.64	4.78	7.13
Squirrels	2.82	2.81	2.37
Alimentary fiber	2.6	3	3.3
Sugar	1.7	1.35	1.38
Fats	0.37	0.29	0.41
Calories (kcal)	34	26	35
Minerals (mg/100 g):			
Potassium	316	212	291
Phosphorus	66	fifty	67
Calcium	47	56	40
Sodium	33	24	288
Magnesium	21	eighteen	21
Iron	0.73	0.81	0.67
Zinc	0.41	0.48	0.45

Manganese	0.21	0.294	
Copper	0.049	0.038	0.061
Vitamins (mg/100 g):			
Vitamin C	89.2	56.4	64.5
Vitamin E	0.78	1.22	1.44
Vitamin PP	0.639	0.47	0.549
Vitamin B6	0.175	0.13	0.199
Vitamin B2	0.117	0.096	0.122
Vitamin B1	0.071	0.053	0.063

Of the minerals, macro- and microelements presented in the table, it should be noted potassium, which removes water and excess salts from tissues, phosphorus and calcium, which ensure the strength of bone and the functionality of brain tissue; iron and copper involved in the processes of hematopoiesis. There is iodine in broccoli that is not included in the table, which is necessary for the normal functioning of the thyroid gland.

Among the vitamins in broccoli, a special place is occupied by vitamin K (about 140-150 mcg / 100 g, which is 15-20% higher than the daily norm for an adult) and vitamin C, according to the content of which per 100 g asparagus cabbage, even boiled and frozen easily outperforms almost all citrus fruits. Moreover, in broccoli, vitamin C is presented in the form of ascorbigen, a precursor of ascorbic acid, which is almost not lost during storage. A lot in broccoli and the precursor of vitamin A - carotene. According to this indicator, asparagus cabbage "loses" only carrots, and favorably stands out against the background of cauliflower, where there is very little carotene. There is also a certain amount of Omega-3 (about 0.12 g / 100 g) and Omega-6 (0.05 g / 100 g) in this vegetable.

Broccoli contains more protein than potatoes, sweet potatoes, sweet corn and spinach.

In terms of the content of various essential amino acids (lysine, leucine, isoleucine, methionine, valine, etc.), presented in the protein of asparagus, it competes with beef, and in terms of the content of tryptophan, isoleucine and lysine, it competes with egg white.

It is also important that, unlike all other types of cabbage, the protein of which contains purine substances that are deposited in the form of uric acid in the kidneys and exacerbate gout, there are few purine substances in broccoli (compared to cauliflower, almost 4 times less), which significantly reduces the risk of stone formation.

The benefits of broccoli don't stop there. A number of compounds found in asparagus have pronounced medicinal properties. Let us consider their significance in therapeutic practice in more detail.

Medicinal properties

Broccoli sprouts (as well as cauliflower sprouts) contain a record amount of glucoraphanin, a precursor of an organic compound called sulforaphane, which prevents certain types of cancer [4] and has antibacterial properties [5]. In order for glucoraphanin to be transformed into protective sulforaphane, it is enough to simply chew the cabbage (and not swallow it in large pieces) or cut it, because with such a mechanical action, the plant catalyst, the myrosinase enzyme, is activated. Heat treatment at high temperatures destroys both myrosinase and glucosinolates, but if you do not boil, but only steam the asparagus, the benefits can be fully preserved.

With the help of asparagus cabbage extracts, scientists expect to suppress the development of the herpes virus. The first subtype of the hsv-1 virus (which infects more than half of humanity) manifests

itself mainly as a rash on the lips, neck, around the eyes, affects the central nervous system, but there is also evidence that it may be associated with the development of Alzheimer's disease and genital cancer. Another subtype (hsv-2) is reliably capable of dangerously affecting the genitals, and it lives in about every 8-10 adults on the planet. Since the rate and extent of the spread of the virus depend on the work of genes regulated by the NRF2 protein, stimulation of the activity of the protein can slow down the spread of the viral infection [6]. In this regard, broccoli extracts are considered as potential protein activators and, accordingly, as an effective tool in the fight against herpes simplex virus of both subtypes.

The therapeutic effect of sulforaphane has been investigated in the treatment of prostate cancer. During the experiments, the substance selectively suppressed the growth of cancer cells (by restoring the reduced activity of the PTEN gene), without affecting healthy cells. Work is underway to study the ability of sulforaphane to treat cancer of the colon, stomach, pancreas, and lungs.

Sulforaphane is also known as a substance used in rehabilitation programs for stroke patients. More recently, highly concentrated sulforaphane-rich broccoli extracts have been seen as an effective treatment for type 2 diabetes (or at least diabetic kidney and vision problems). In antidiabetic therapy, such extracts can complement metformin treatment, and sulforaphane (unlike metformin) is safe for the kidneys.

In matters of diabetes therapy, we are talking about concentrated extracts, the daily dose of sulforaphane in which is equivalent to a dose of 5 kg of mature asparagus. However, the preventive and curative effect of broccoli can be significantly enhanced if sprouted seeds of this cabbage (3-day-old sprouts) are eaten, since they contain 10–100 times more glucoraphanin than already ripened vegetables [7]. As a result, seedlings are better protected against carcinogenesis, mutagenesis, and other forms of electrophile and reactive oxygen species toxicity. At the same time, valuable glucoraphanin is also preserved in mature cabbage, and in the relatively recently bred Beneforte variety, it is three times more than in other varieties.

In addition to glucoraphanin, broccoli glucosinolates contain goitrin and its inactive form, progoitrin. In the event of a lack of iodine in the body, goitrin can slow down the development of goiter by increasing the secretory activity of the thyroid gland. But there is much more progoitrin in broccoli than goitrin, and in order for it to go into an active form, enzymes are needed, and they are destroyed during heat treatment. Therefore, to preserve the benefits, it is preferable to cook asparagus cabbage at a temperature not exceeding 50-60 C.

From cruciferous plants in general and from asparagus in particular, the compound 3,3'-Diindolylmethane, known as DIM, has been obtained, which, due to its antitumor potential, is regarded as a tool for combating various types of cancer, but not only. DIM can mitigate the effects of radiation therapy (for example, in the treatment of cancer) and protect healthy cells from intense gamma radiation.

DIM is also being studied as a treatment for a rare relapsing disease caused by the human papillomavirus - papillomatosis, characterized by inflammation of the upper respiratory tract [8].

Another compound called Indole-3-Carbinol in asparagus activates the body's detoxification system, which, among other things, can slow down the aging process.

Phenolic compounds that accumulate in broccoli can have a choleric, diuretic, and laxative effect. They can lower blood pressure, fight bacteria, and suppress inflammation. Due to this, regular consumption of broccoli can potentially reduce the risk of coronary heart disease, asthma, and type 2 diabetes. By crossing different varieties of broccoli, geneticists strive to obtain the most useful

asparagus with an increased amount of phenolic compounds, but now known varieties are also characterized by a high content of useful flavonoids [9].

Use in medicine

Since the end of the 20th century, preparations have been produced in a number of countries that include biologically active substances isolated from asparagus cabbage. A partial list of dietary supplements and drugs with raw materials obtained from broccoli is presented below:

- *Grapine by Nature's Sunshine Products, Inc.* American drug is used 1 tablet per day to strengthen the walls of blood vessels and improve blood circulation. Grapine is listed as an antioxidant.
- *Mastofit from Evlar.* The Russian drug is recommended for long-term (from 2 months) administration in diffuse and/or fibrocystic mastopathy, reproductive disorders in women, uterine fibroids, and premenstrual syndrome.
- *Ikvalin from Enrich International Inc.* . Another drug from the USA with broccoli concentrate that reduces the risk of inflammation and ulcerative processes in the gastrointestinal tract.
- *Rose ox by D&F Industries.* dietary supplement with claimed antioxidant effect.
- *Broccoli Seed Extract by Solaray.* Dietary supplement in capsules with an extract activated by myrosinase. Designed for detoxification and prevention of cancer, aging, osteoporosis.
- *30% glucoraphanin (Wisepowder)* . Wisepowder releases purified 30% glucoraphanin powder, presenting it as a weight loss agent and reducing the negative symptoms of obesity, an antioxidant, as a drug for the prevention of cancer, cardiovascular diseases, and as a substance alleviating the symptoms of autism and diabetes 2- type.

In folk medicine

The range of uses of broccoli in traditional medicine is very wide. With the help of asparagus cabbage they treat:

- peptic ulcers of the duodenum and stomach (pain, vomiting, nausea are relieved),
- flatulence , dysbacteriosis and digestive disorders (dispersion),
- liver disease, inflammation of the bile ducts,
- type 2 diabetes (with obesity),
- diseases of the heart and blood vessels by eliminating cholesterol deposits,
- sunburn, cuts and skin diseases,
- insomnia
- eye diseases (clouding of the lens, senile macular degeneration).

The traditional use in folk medicine of freshly squeezed broccoli juice to fight infectious diseases has recently received experimental confirmation: it was found that such juice is able to suppress the bacteria *Staphylococcus aureus* and tuberculosis. The folk experience of using broccoli shows high efficiency in suppressing *Helicobacter pylori* infection, including those forms of bacteria that are resistant to antibiotics.

Decoctions, infusions and drinks

In folk medicine, a recipe for a very simple broccoli broth is known, where cabbage and water are taken in an approximate ratio of 100 g of vegetable / 300 ml of water, and the cooking time is 5

minutes. Sometimes such a decoction is prescribed for the treatment of prostatitis in the mode "1.5 months of continuous intake - a month of break - a month of admission." But the expediency of using decoctions of asparagus cabbage is a moot point even among fans of folk methods of treatment due to the formation of amino derivatives of purine (guanine and adenine) during cooking broccoli.

More common in folk medicine are infusions with broccoli juice in the composition, intended for the prevention of cardiovascular diseases, as well as an infusion of broccoli seeds to combat helminths.

On the seeds of asparagus cabbage, the infusion is prepared as follows: 1 tbsp. l. seeds are poured with 250 ml of boiling water and infused for 30 minutes until cool. The liquid is then filtered and either divided into two portions for taking in the morning and evening, or drunk at a time.

For the treatment of cardiovascular diseases, you can prepare the following drinks based on broccoli juice with additional ingredients:

Chokeberry (50 g of fruits) is infused in boiling water (250 ml) for 20 minutes, then the infusion is filtered, cooled and mixed with asparagus juice (120 ml). This portion should be drunk during the day, and the entire course lasts one and a half to two weeks.

, which include coltsfoot leaves (10 g), birch leaves (5 g), dried licorice root (5 g), flax seeds (10 g) , are crushed in a mortar, poured with boiling water (200 ml) and, after cooling , mixed with broccoli juice (200 ml). The resulting drink should be drunk throughout the day. The duration of the course is 1-1.5 weeks.

Valerian roots (7 g) are crushed and poured with boiling water (250 ml) for half an hour, after which the liquid is filtered and mixed with cabbage juice (200 ml). Within a week, the drug is taken 30 ml twice a day.

in oriental medicine

Dr. Yanbum Gyal, describing the traditions of using herbal products in Tibetan medicine, said about broccoli (also known as tyope-cel, pulgebi, bekor-pecel, label-nyotsel, etc.) that it is a sweet and salty, slightly cool product. :

- treats inflammation
- gets rid of parasites
- provides prevention of diabetes and oncological diseases,
- thins the blood
- increases the seven components of the body,
- enhances digestion heat, while contraindicated in cold and phlegm diseases.

Some modern sources state that raw broccoli should be avoided in Mucus disorders, but when cooked, it can be included in the diet in certain cases. Some of these authors, based on ancient traditions, recommend using broccoli (and other foods in the diet containing vitamins A and C) to prevent demodicosis, a skin disease caused by a parasitic mite.

Following the principles of clinical nutrition , current Chinese medicine practitioners

broccoli is introduced into the number of "unloading" spring products to improve liver function. Cabbage is advised to eat boiled with the addition of a small amount of lime (lemon).

In scientific research

Scientists in their projects are exploring the possibility of creating drugs from broccoli for diabetes, cancer, cardiovascular disease, and even schizophrenia.

Asparagus extract has been shown to be safe in the treatment of type 2 diabetes.

The highly concentrated drug was tested for three months in an experiment involving 97 diabetic patients. In addition, all participants in the experiment had problems with being overweight. Supplementation of broccoli extracts in the experimental group taking high concentrations of cabbage-derived sulforaphane resulted in a 10% reduction in glucose levels compared to the control group. Despite the seemingly insignificant difference in results, according to project leader Anders Rosengren, this may be enough to save patients from associated kidney and vision problems [10].

Regular consumption of broccoli reduces the risk of prostate cancer even in the presence of genetic preconditions for it.

Since the pathological changes leading to prostate cancer are associated with the loss and loss of activity of the PTEN gene, scientists have studied the possibility of correcting the gene defect using sulforaphane isolated from broccoli. The substance was tested first on a cell culture of human prostate cancer, then on laboratory rodents and, in the final stage of the project, on humans.

In the second phase of the experiment, some PTEN-deleted mice were given regular food, while others were given sulforaphane-enriched food. In the first group, a complex genetic disorder occurred due to the inoperability of PTEN, and in the second group, sulforaphane corrected the defect so that there was no statistically significant difference with healthy mice from the third control group.

Testing in humans occurred by including in the diet of patients in the precancerous stage of the investigated products. Representatives of one group during the year were supposed to eat 400 grams of green peas weekly, while others - 400 grams of broccoli. Both diets affected dozens of genes, but the "cabbage" diet had an effect more similar to that of sulforaphane in mice in the second stage of the experiment [11].

Sulforaphane-rich broccoli extract and zinc activate metallothionein and Nrf 2, respectively, protecting the body from cardiomyopathy (dysfunction of the heart muscle) .

In the 8-week experiment, mice were divided into 4 groups and all were subjected to intermittent hypoxia. The first group was not treated with anything, the second was given zinc, the third was given broccoli extract, and the fourth was given broccoli extract and zinc at the same time. The heart was then examined for pathological changes, fibrosis, inflammation, and oxidative damage. In those animals that were not treated with anything, cardiac dysfunction was clearly observed. With monotherapy, the changes were not so significant, and with combination therapy (extract and zinc), the best results were recorded [12].

Broccoli extract is likely to be used in the treatment of schizophrenia in the future.

Such expectations among scientists appeared after conducting three interconnected studies.

At the first stage, scientists found that compared with healthy people, patients with symptoms of schizophrenia have a different metabolism in the brain. They have been found to have 4% lower levels of glutamate (one of the most important neurotransmitters) and are also deficient (3% and 8% in different parts of the brain) of glutathione (of which glutamate is a part) [13].

In the second phase, the researchers tried using the drug to change the balance of glutamate in the brains of laboratory rats. They blocked an enzyme that is needed to convert glutamate to a constituent of glutathione. The release of glutamate increased the number of signals the brain cells sent out, but

this was similar to what is typical in schizophrenia. Then they used sulforaphane, extracted from broccoli, to increase the amount of glutamate converted to glutathione. Brain cells began to send fewer signals, and it was more like healthy brain activity [14].

The third stage is human testing. 9 healthy volunteers took 2 capsules of 100 μ mol sulforaphane in the form of broccoli extract daily for a week. Such an extract on an empty stomach may cause upset or gas, but is generally well tolerated. As a result, it was noted that the level of glutathione increased by 30% in the subjects [15]. And although the study is not completed (it is necessary to determine the optimal doses and find out how long you need to take the extract for the desired effect to appear), the results were rated as encouraging.

Weight regulation

Contained in 100 grams of broccoli 30-35 kcal by themselves make asparagus a dietary product. But besides this, two more characteristics help broccoli to become a very effective product for weight loss:

Abundance of fiber. In broccoli, it is about 2.6 g / 100 g, which corresponds to approximately 9-10% of the daily requirement. Although asparagus cabbage is not a champion in this indicator, but, for example, Beijing cabbage, cauliflower, red and white cabbage, it is ahead. Dietary fiber is not processed by digestive enzymes, but fills the gastrointestinal tract, serves as an object for processing microflora, and improves the motor function of the intestine. In general, this creates an effect that is called "negative calorie" - a ratio in which the body takes more energy to digest and utilize the product than it receives from this product during meals.

The presence of tartronic acid. Contained in asparagus cabbage, tartronic acid inhibits the transformation of carbohydrates into fat and cholesterol deposits, inhibiting further weight gain and obesity in overweight people.

Today, two diets with broccoli are most widely used: a hard 3-day diet and a "soft" 10-day diet. The three-day one combines two types of cabbage: asparagus and cauliflower. In total, you need to eat 1.5 kg of vegetables daily with the possible addition of mild spices and lemon juice. Unsweetened tea and still water are also acceptable.

The 10-day diet is much more varied and easier to tolerate:

1-2 day. For breakfast and dinner - 200 g of broccoli with tea. For lunch - chicken broth, chicken cutlets (150 g) and cabbage (100 g).

3-4 day. For breakfast and dinner - stewed broccoli with butter (200 g), bell pepper (1 pc.) And mineral water. For lunch - broccoli stew (150 g), tomatoes (2 pcs.), Onions and fruit juice.

5-6 day. Breakfast - cabbage (100 g) in sour cream, beef stew (100 g), yogurt. Lunch - steamed asparagus cabbage (200 g) with tea. Dinner - boiled beef (150 g) with mineral water.

7-8 day. Breakfast - steamed broccoli (200 g) with boiled hard-boiled eggs (2 pcs.) And fruit juice. Lunch - chicken broth (200 ml) and blanched broccoli (100 g). Dinner - asparagus cabbage (100 g), rye bread (70 g), tomato juice.

9-10 day. For breakfast and dinner - blanched broccoli (100 g), baked potatoes (100 g), tomato juice. For lunch - boiled cabbage (100 g), low-fat fish (100 g), tea.

In cooking

The use of double boilers and multicookers in the process of cooking broccoli is due to the desire to preserve the maximum amount of nutrients. Chinese scientists even conducted a special study, studying the effect of five different methods of cooking broccoli on the safety of beneficial compounds. Among the methods tested are: microwave cooking, boiling (boiling), frying, frying with boiling, steaming. As a result of any cooking method, except for steam treatment, significant losses of vitamin C, soluble proteins and sugars, chlorophyll were recorded, in addition, glucosinolates underwent significant changes [16].

However, it is difficult to single out a single cooking algorithm as a priority. So, for example, glucosinolates are better preserved with a one-minute steaming and begin to be lost already with a two-minute one. The overall antioxidant capacity remains high even after 5-10 minutes of steaming. In some cases, it is more appropriate to use a microwave oven. And although frying the product is the worst way to cook it if you want to preserve the maximum benefit, the further choice depends on the specific tasks of nutritionists.

While broccoli can also be eaten raw, the most popular method of eating it is cooking is still boiled and roasted (or a combination of these types of processing). An example of such a culinary approach is a salad with asparagus in oyster sauce.

Broccoli (1 small head) is divided into inflorescences and each additionally cut in half. Carrots (1 pc.) are chopped into strips. Sliced vegetables are added to the oil heated in a frying pan and fried with stirring for one to two minutes. Then sugar (1 tsp), oyster sauce (5 tbsp) and water (50 ml) are added. Stew this mixture for about 3 minutes, after which it is served with cashew nuts.

You can also quickly cook broccoli with shrimp, tomatoes, cheese, mushrooms and eggs. Soups, casseroles, frittata are made from this cabbage - a traditional Mediterranean omelet stuffed with vegetables, cheese, sausages, etc. Broccoli goes well with meat dishes, potatoes, pasta.

In cosmetology

Separately, dry broccoli extract (at a concentration of 0.5% to 10%) can now be purchased to create cosmetics at home with various functions:

- rejuvenation - due to the action of antioxidants and regenerating substances that can restore epidermal cells,
- even tone and light whitening,
- moisture,
- relieve inflammation,
- cellular UV protection, activated by the action of sulforaphane.

Asparagus seed oil, obtained by cold pressing, is used in acne treatments, in skin care products for oily skin (because it reduces sebum secretion), in lip products, and nourishing balms. Also, seed oil is recommended in the care of brittle and dry hair, which, due to the action of erucic acid from the Omega-9 family, allows the hair to shine without making it heavy and "dirty". After such oil, there is no feeling of greasiness. Therefore, it is not surprising that broccoli seed oil is often added to shampoos, rinses, and hair styling products.

Dangerous properties and contraindications

Broccoli has few contraindications, and the side effects that can occur when the product is abused are usually temporary. These include gas formation and irritation of the walls of the large intestine with vegetable fiber.

However, people with high stomach acid, patients with pancreatic disease, and those taking anti-clotting drugs should limit their consumption of broccoli. The latter is explained by the fact that vitamin K contained in the vegetable can affect the effectiveness of drugs.

In addition, the use of broccoli is recommended to be limited to people with hypothyroidism - an endocrine disease associated with insufficient production of triiodothyronine and thyroxine by the thyroid gland, which leads to disruption and slowing down of metabolic processes.

Selection and storage

When choosing broccoli, you should focus on the color and density of the plant. Ripe buds of classic asparagus will be a rich green color (with some varietal variations in green from purple to sage). The pale color of the cabbage indicates that it has not yet ripened. Yellowed buds indicate that the cabbage is overripe and should be discarded. Also, a sign of overripe broccoli can be small yellow buds on the head of the vegetable.

Dark green cultivars with a purple hue are thought to have more beta-carotene than lighter colored vegetables, and smaller buds (10-15 cm in diameter) are said to have more sweetness. A dense, but not stiff, stalk without mucous formations and a rounded head with a close fit of inflorescences up to 15-20 cm in size are a sign of a quality product.

The most delicious is autumn and winter broccoli. Cabbage harvested in spring, summer and early autumn has a less pronounced taste and juiciness. For the sake of preserving sunlight-sensitive vitamins, it is better to choose vegetables from the back of the box.

Before use, purchased cabbage should not just be washed under running water (which can be done, for example, with your garden broccoli), but it is recommended to leave it in the water with the cutting up for half an hour in order to more likely get rid of nitrate traces.

Before storing in the refrigerator (in the compartment with a temperature of 1-3 C) for several days (up to a week), it is not recommended to wash broccoli, because water can provoke the onset of rotting processes. But to preserve for a long period, such a method of freezing is practiced, in which the cabbage is cut into inflorescences and stems, blanched in boiling water for 3-5 minutes (the vegetable is immediately placed in boiling water), after which it is abruptly transferred to ice water. When broccoli cools, it is dried, laid out in containers and frozen (in this form, cabbage is easily stored for six months or a year).

It is believed that keeping broccoli in boiling water for about 3-5 minutes still makes it possible to retain a sufficient amount of flavonoids, carotenoids lutein and beta-carotene, although, for example, temperature-sensitive vitamin B1 will begin to quickly break down. Chlorophyll in such a procedure will help save the addition of salt to boiling water.

Vitamins C, B2, B6, E are easily lost when the vegetable is stored in the light. Also, the content of vitamins decreases rapidly in chopped vegetables. Therefore, for a long time, cabbage is most often frozen in closed containers with large inflorescences. However, it must be taken into account that freezing broccoli reduces the activity of the myrosinase enzyme by 10 times, due to which glucoraphanin is transformed into valuable sulforaphane. Therefore, methods for enriching frozen asparagus with myrosinase are being developed today.

Varieties and cultivation

There are about 200 varieties of broccoli in the world, but only a small part of the varieties and hybrids are cultivated in our country, although the climate for growing asparagus is favorable in a large area of the country. Broccoli grows well in moist areas on deep clay soils and at a temperature of 18-23 °C. Under good conditions, the crop can be harvested several times a year - including in winter (which is considered one of the features that distinguish broccoli from related Calabrese and Romanesco).

The classic type of broccoli is a plant with a height of 50 cm to 0.9-1 meter, a powerful stem which ends in a densely folded inflorescence-"head", usually green. Depending on the variety (hybrid), there may be color variations of shades: light green (Caesar, Koros F 1), blue-green (Naxos F 1, Karato F 1), gray-green (Curly head, Agassi F 1), etc. But there is also asparagus of non-classical species, broccoli with white and purple (violet) flowers.

New hybrid plants are being created on the basis of broccoli. In particular, since 1985, the Japanese company Sakata Seed Company has been developing a hybrid of Chinese cabbage Gailan and broccoli for 8 years, which was registered under the trademark "Broccolini". With its thin, edible stem, the plant resembles asparagus, and its head resembles broccoli. Broccolini is similar in taste to both parent cultures at the same time, but differs in a sweetish aftertaste.

Often, another cultivated cabbage variety, Romanesco, is called a hybrid of broccoli and cauliflower - a plant with a mathematically beautiful inflorescence that forms a logarithmic spiral. In terms of the content of some vitamins, this cabbage even surpasses broccoli, but in general, the classic asparagus cabbage is so healthy that it is difficult for it to compete.

Since regular consumption of broccoli can help treat a variety of diseases (from diabetes and gastrointestinal problems to cardiovascular and oncological diseases), the fact that this product is available almost all year round can be considered a great success, so do not neglect the opportunity to make broccoli a part of daily diet.

Literature

1. US National Nutrient Database, <https://fdc.nal.usda.gov/fdc-app.html#/food-details/170379/nutrients>
2. US National Nutrient Database, <https://fdc.nal.usda.gov/fdc-app.html#/food-details/169968/nutrients>
3. US National Nutrient Database, <https://fdc.nal.usda.gov/fdc-app.html#/food-details/342302/nutrients>
4. Kensler, TW, Egner, PA, Agyeman, AS, Visvanathan, K., Groopman, JD, Chen, & Talalay, P. (2012). Keap1–nrf2 signaling: a target for cancer prevention by sulforaphane. In *Natural Products in Cancer Prevention and Therapy* (pp. 163-177). Springer, Berlin, Heidelberg.
5. Moon JK, Kim JR, Ahn YJ, Shibamoto T (2010). Analysis and anti-Helicobacter activity of sulforaphane and related compounds present in broccoli (*Brassica oleracea* L.) sprouts. *J. Agric. food chem.* 58(11): 6672–7. DOI:10.1021/jf1003573
6. Wyler, E., Franke, V., Menegatti, J. et al. Single-cell RNA-sequencing of herpes simplex virus 1-infected cells connects NRF2 activation to an antiviral program. *Nat Commun* 10, 4878 (2019) doi:10.1038/s41467-019-12894-z
7. Fahey JW, Zhang Y, Talalay P. Broccoli sprouts: an exceptionally rich source of inducers of enzymes that protect against chemical carcinogens. *Proc Natl Acad Sci US A.* 1997 Sep 16; 94(19): 10367–10372. doi:10.1073/pnas.94.19.10367

8. Wiatrak, BJ (2003). "Overview of recurrent respiratory papillomatosis". *Current Opinion in Otolaryngology & Head and Neck Surgery*. 11(6): 433–441. doi:10.1097/00020840-200312000-00005
9. Wiatrak, BJ (2003). "Overview of recurrent respiratory papillomatosis". *Current Opinion in Otolaryngology & Head and Neck Surgery*. 11(6): 433–441. doi:10.1097/00020840-200312000-00005
10. Annika S. Axelsson, Emily Tubbs, Brig Mecham, Shaji Chacko, Hannah A. Nenonen, Yunzhao Tang, Jed W. Fahey. Sulforaphane reduces hepatic glucose production and improves glucose control in patients with type 2 diabetes. *Science Translational Medicine* 14 Jun 2017: Vol. 9, Issue 394, eaah4477 DOI: 10.1126/scitranslmed.aah4477
11. Traka, MH, Spinks, CA, Doleman, JF et al. The dietary isothiocyanate sulforaphane modulates gene expression and alternative gene splicing in a PTEN null preclinical murine model of prostate cancer. *Mol Cancer* 9, 189 (2010) doi:10.1186/1476-4598-9-189
12. Wang J., Zhang J., Chen L., Cai J., Li Z., Zhang Z., Zheng Q., Wang Y., Zhou S., Liu Q., Cai L. Combination of Broccoli Sprout Extract and Zinc Provides Better Protection against Intermittent Hypoxia-Induced Cardiomyopathy Than Monotherapy in Mice. *Oxid Med Cell Longev*. 2019 Dec 14;2019:2985901 . doi: 10.1155/2019/2985901.
13. Anna M. Wang, Subechhya Pradhan, Jennifer M. Coughlin, Aditi Trivedi, Samantha L. DuBois, Jeffrey L. Crawford, Thomas W. Sedlak, Fredrick C. Nucifora, Gerald Nestadt, Leslie G. Nucifora, David J. Schretlen, Akira Sawa, Peter B. Barker. Assessing Brain Metabolism With 7-T Proton Magnetic Resonance Spectroscopy in Patients With First-Episode Psychosis. *JAMA Psychiatry*, 2019; 76 (3): 314. DOI: 10.1001/jamapsychiatry.2018.3637
14. Thomas W. Sedlak, Bindu D. Paul, Gregory M. Parker, Lynda D. Hester, Adele M. Snowman, Yu Taniguchi, Atsushi Kamiya, Solomon H. Snyder, Akira Sawa. The glutathione cycle shapes synaptic glutamate activity. *Proceedings of the National Academy of Sciences*, 2019; 116 (7): 2701 DOI: 10.1073/pnas.1817885116
15. Thomas W. Sedlak, Leslie G. Nucifora, Minoru Koga, Lindsay S. Shaffer, Cecilia Higgs, Teppei Tanaka, Anna M. Wang, Jennifer M. Coughlin, Peter B. Barker, Jed W. Fahey, Akira Sawa. Sulforaphane Augments Glutathione and Influences Brain Metabolites in Human Subjects: A Clinical Pilot Study. *Molecular Neuropsychiatry*, 2017; 3 (4): 214 DOI: 10.1159/000487639.
16. Yuan GF 1, Sun B , Yuan J , Wang QM . Effects of different cooking methods on health-promoting compounds of broccoli. *J Zhejiang Univ Sci B*. 2009 Aug;10(8):580-8. doi: 10.1631/jzus.B 0920051.

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Broccoli - useful properties, composition and contraindications

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Abstract. The article discusses the main properties of broccoli 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 broccoli in various types of medicine and the effectiveness of its use in various diseases are considered. The potentially

adverse effects of broccoli on the human body under certain medical conditions and diseases are analyzed separately. Considered scientific basics diets With her application.