



Chia seeds (lat . *Salvia hispanica*)

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

Keywords: chia, chia seeds, benefits, harm, beneficial properties, contraindications

Beneficial features

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

Main substances (g / 100 g):	Chia seeds [1]
Water	6.96
Carbohydrates	28.88
Sugar	1.55
Alimentary fiber	27.3
Squirrels	18.29
Fats	42.16
Calories (kcal)	534
Minerals (mg/100 g):	
Potassium	813
Phosphorus	642
Magnesium	392
Calcium	255
Sodium	thirty
Iron	5.73

Zinc	4.34
Copper	1.22
Vitamins (mg/100 g):	
Vitamin PP	3.08
Vitamin B1	1.644
Vitamin C	0.6
Vitamin B6	0.473
Vitamin E	0.31
Vitamin B2	0.161

The chemical composition of chia seeds has been analyzed by many researchers, therefore, depending on the source of information, the values may vary slightly. After all, the chemical composition and nutritional value can be influenced by climatic conditions, geographical location, year of cultivation and other factors.

For example, the composition of fatty acids can change depending on climate change and the height of the plant - the higher the region and the colder it is, the greater the content of omega-3 unsaturated fatty acids in the product. But in April-May, due to an increase in temperature, the amount of polyunsaturated fatty acids present decreases.

But even with these variations, we can say that chia seeds contain a large amount of fat (30–33%), carbohydrates (26–41%), dietary fiber (18–30%), proteins (15–25%), vitamins (A, B, K, E, D), minerals, 32–33% fiber, have pronounced antioxidant properties.

- **Omega-3 and Omega-6.** The name "chia" comes from a Spanish word that means "oily". The main components of this oil are called polyunsaturated fatty acids: α -linolenic class omega-3/ ω -3 and linoleic class omega-6/ ω -6^[2]. Chia seeds contain 39% oil (by weight of dry seeds), in which up to 68% ω -3 and up to 19% ω -6 fatty acids^[3]. The ratio of ω -6 and ω -3 fatty acids is 0.3:0.35^[4]. 100 g of the product of polyunsaturated fatty acids contains about 390–395% of the daily requirement.
- **Squirrels.** The protein content of chia seeds is about 18%, which is higher than the protein content of all other cereals (for example, corn has a protein content of 9.4%, rice has 6.5%, and wheat has 12.6%). Amino acids such as arginine, leucine, phenylalanine, valine and leucine, glutamic and aspartic acids, alanine, serine and glycine are found in seed proteins. The absence of gluten protein makes chia seeds a valuable product for patients suffering from celiac disease.
- **Minerals.** Chia seeds contain minerals such as calcium, phosphorus, potassium, and magnesium. The calcium content here is greater than in rice, barley, corn and oats and twice as much as in milk. But the amount of magnesium, potassium and phosphorus in chia seeds also exceeds the amount of these minerals in other cereals.
- **Vitamins.** The seeds contain relatively many vitamins A, K, E, D, B vitamins - mainly B1, B2, niacin (B3 / PP). So, 100 g of the product contains more than 41% of the daily norm of thiamine (B1), almost 45% of the norm of vitamin PP. In addition, 100 grams of seeds provide 120% of the daily vitamin K requirement and about 55% of the vitamin C requirement.
- **Phenolic compounds.** Dry chia seeds contain 8.8–9% phenolic compounds. High levels of caffeic, chlorogenic acid, quercetin, rosmarinic, gallic, cinnamic, myricetic, kaempferolic acids are also reported. This is important because some of them exhibit anticarcinogenic, antihypertensive, and neuroprotective effects.

When we talk about chia seeds here, we mean black seeds. And although, in addition to black ones, there are also white ones, their phytochemical profiles practically do not differ and most researchers

describe black and white "seeds" as analogues. A slight difference is found only in morphology: white seeds are larger, thicker and wider than black ones.

Medicinal properties

Given this chemical composition, the use of chia seeds as a dietary supplement has the potential to support the digestive system, improve skin condition, strengthen bones and muscles, and reduce the risk of heart disease and diabetes.

Chia seeds and their oil are rich in natural antioxidants such as tocopherols, phytosterols, carotenoids, and polyphenolic compounds.

Polyphenolic compounds are the most important complexes that contribute to the antioxidant activity of chia seeds. They are known to have the ability to scavenge free radicals, chelate ions, and donate hydrogens [5].

Antioxidant compounds reduce the risk of developing oncology and heart disease, provide protection against diseases such as diabetes, Alzheimer's disease, Parkinson's disease [6]. Omega-3 fatty acids have the ability to block calcium and sodium channel dysfunctions that can cause hypertension, as well as improve heart rate variability and protect against ventricular arrhythmia [7].

A high amount of fiber reduces the risk of coronary heart disease, the risk of type 2 diabetes and certain types of cancer, and a large amount of dietary fiber in a daily meal reduces hunger.

After conducting test-tube experiments, some researchers suggest that the occurrence of celiac disease and constipation, as well as the risk of kidney disease, can be reduced by additional consumption of whole and ground chia along with seed oil.

If we structure the therapeutic manifestations identified in chia seeds in the course of various clinical studies, we can distinguish two key areas of their potential use in restoring or maintaining human health.

- **Blood pressure and cardioprotective effect.** The effect of chia seed powder on reducing blood pressure and related cardiometabolic factors in hypertensive patients was demonstrated in a randomized, double-blind, placebo-controlled trial [8]. Chia consumption has not caused any gastrointestinal, liver or kidney problems. At the same time, the use of the ground product consistently lowered blood pressure, even in people with hypertension who had previously taken medication. Moreover, this decrease was expressed to the same extent as in patients who had not previously taken drugs for hypertension. In addition, consumption of chia seeds (50 g per day for a month) resulted in a decrease in plasma omega-6 levels, which in turn decreased the ω -6: ω -3 ratio, thus creating a cardioprotective effect.
- **Type 2 diabetes.** The inclusion of dietary fiber and α -linolenic fatty acids in chia seeds in the diet improves the condition of patients with the main and indirect risk factors that occur in type 2 diabetes. Seeds dramatically reduce postprandial glycemia at just 37 grams per day of food and prolong satiety. A comparison of the effects of flax seeds and chia seeds on postprandial glycemia and satiety measures showed that, despite the similarity in nutrient composition, chia appears to have the ability to convert glucose into a slow-release carbohydrate and influence satiety more than flax. , (perhaps due to the higher viscosity of the fiber) [9].

Also, the seeds were considered as a promising product for inclusion in the composition of laxatives, anticarcinogenic, anti-inflammatory, painkillers. A number of scientists are studying its antidepressant

and sedative properties. Several studies have demonstrated the potential ability of bioactive chia seed peptides to repair damaged tissues.

In medicine

Despite numerous promising studies, official medicine does not yet consider chia seeds to be a medicine. But in pharmaceuticals, this product is considered as an element of the ω -3 fatty acid delivery system.

In stores selling dietary supplements, you can now freely buy packaged chia seeds. Manufacturers recommend them as a means to reduce pressure and levels of "bad cholesterol", as well as a food supplement to restore energy and strength.

In folk medicine

In traditional folk medicine, the inhabitants of Central America (in the homeland of chia) used the seeds of the plant to treat colds, sore throats, and digestive disorders. Seeds eliminated unpleasant body odor, and powder was sprinkled on wounds for quick healing. In addition, it was believed that it was chia seeds that gave the warriors of the Aztec army stamina and strength.

However, the details of the medical use of chia seeds by pre-Columbian civilizations have practically not been preserved, and those that remain are based on an anonymous document from the middle of the 16th century (the "Code of Mendoza"), the "Florentine Code" of the Spanish monk Bernardino de Sahagun of the same time, and scattered Jesuit chronicles.

In particular, Bernardino de Sahagun, in his work on the history of the Aztecs, writes that from chia seeds mixed with white willow root, a healing drink (porridge) atole is prepared, useful for hemoptysis and coughing. With this drink, you can cure a multi-day and deep chronic cough, as well as purulent diarrhea, if you drink the remedy 2-3 times a day. The juice squeezed from the seed will also help "cleanse the chest", if you use it on an empty stomach.

The lack of information about the traditional uses of seeds in Indian therapeutic practices is partly due to the unfortunate fate of the plant. It is believed that the European conquerors, conquering new territories, in every possible way eradicated chia plantations, which were so important for the indigenous people, thereby declining the tradition of using seeds in medicine. For centuries, almost no one heard anything about this culture. And only in the second half of the 20th century, interest in chia began to revive again.

Therefore, modern traditional healers in their recommendations rely mainly not on ancient practices, but on the popular opinion today about chia seeds, as a product that can have a beneficial effect on the health of patients:

- with type 2 diabetes,
- with high blood pressure and cardiovascular pathologies,
- with anemia
- with gastrointestinal disorders
- with disorders of the nervous system.

In addition, recommendations for pregnant women to take chia seeds have become popular in folk therapy recently. It is claimed that such a supplement can improve the condition of the future mother and child, as well as ensure a sufficient amount of breast milk after childbirth. But such

recommendations are often objected even among a number of representatives of traditional medicine, as not entirely safe.

With their supposed regenerative abilities, chia seeds have become a favorite among athletes, bodybuilders, and fitness enthusiasts. It is believed that seed-based drinks quickly relieve fatigue and muscle pain, increase stamina and strength.

For therapeutic use, chia seeds are usually either ground into powder or poured with hot water (milk) to be added to the main dish in a quarter of an hour in a swollen form or simply eaten separately.

In scientific research

Recently, many new discoveries have been made regarding the nutritional properties, phytochemicals and extraction methods of chia seeds. But of particular interest are clinical studies involving humans. The results of such studies give more reliable ideas about the therapeutic potential of the product. Therefore, we have detailed them in the description of the medicinal properties of chia seeds.

However, it must be admitted that not all the alleged therapeutic effects are experimentally confirmed. For example, researchers studying the effects of chia seed supplementation on risk factors for disease in overweight postmenopausal women found no significant difference in scores in women in the seed group compared with those in the control group ^[10].

Part of 62 overweight women aged 49-75 received 25 g of crushed seeds per day for 10 weeks. The scientists measured body weight, blood pressure, serum lipid profile, inflammatory markers from fasting blood samples, plasma fatty acids, and metabolic profile. According to the results of the experiment, only an increase in plasma eicosapentaenoic and α -linolenic acid by 39% and 58%, respectively, was recorded.

Other scientists conducted a study on the effect of chia seed oil on performance, which also did not find any benefit from supplements ^[11].

The experiment involved runners divided into two groups, one of which received 0.5 liters of flavored water (placebo), and the other - 0.5 liters of water with 7 kcal / kg of chia seed oil. Blood sampling was carried out before and after training "to exhaustion".

The results showed that, despite an increase in plasma levels of alpha-linolenic acid, the chia seed oil group (337% compared to the 35% water group) showed no significant difference in either running time to exhaustion or tests for respiratory rate, oxygen consumption, ventilation, perceived exercise, and plasma glucose levels. The seed oil did not interfere with the increase in cortisol levels and the increase in the inflammatory process. As a result, scientists stated the absence of a positive effect of taking chia seed oil on a person's running ability.

Weight regulation

The results of the work of scientists studying the issues of weight loss and reducing obesity with the help of chia seeds can also be called contradictory.

For example, that chia seeds do not contribute to weight loss or change risk factors for disease in overweight adults, a group of scientists said after an experiment involving 90 healthy overweight and obese men and women aged 20 to 70 years. ^[12]. The subjects took 50 g of chia seeds per day for 12 weeks, and indicators of body weight and composition, markers of inflammation from fasting blood samples, markers of oxidative stress, and lipid profile indicators were taken as accounting.

Another group of scientists in their study of 77 patients with type 2 diabetes ^[13], on the contrary, came to the conclusion that the transition for 6 months to a diet with the inclusion of chia seeds suppressed appetite and led in the group of subjects to weight loss, reduction waist circumference, visceral and general obesity (compared with the control group).

Thus, there is no unambiguous data on the effectiveness of the use of chia seeds in the fight against extra pounds. But despite this, based on their own ideas about effectiveness, people quite widely use chia seeds for weight loss. The calculation, in this case, is often made on the absorbent capacity of seeds. It is known that the seeds of a plant are able to absorb water, 12 times their own weight, while increasing in size and filling the stomach. The same phenomenon is partially associated with the opinion about seeds as a product that can quickly and permanently create a feeling of satiety.

In general, chia seeds are a fairly high-calorie product containing 480-490 kcal per 100 grams. Dietary guidelines published in the US in 2000 even stated that chia seeds can be used as a staple food, but in limited quantities with a recommended daily allowance of no more than 48 grams of seeds.

In cooking

In the food industry, chia seeds, which have a slight nutty flavor, can be used in various forms: whole, ground, flour (up to 5% of the total mass), oil and gel. They can be mixed with cookies, pasta, cereal, snacks, yogurts and cakes. They pair perfectly with oatmeal. Sprouted seeds are put in salads.

In Colombia, chia seeds are eaten as an energy drink or, after roasting, they are made into hearty, jelly-like drinks. But since not everyone likes a jelly-like drink made from swollen seeds, smoothies in which seeds are mixed with berries, juice or milk are no less popular. Such drinks are refreshing, and the "mucousness" is almost not felt in them.

As an example of a refreshing drink, let's take the Chia Fresco recipe. To prepare it in 300 ml of boiled water, you need to dissolve 3 tbsp. l. lemon juice, 2.5 tsp. sugar and 1 tsp. chia seeds. Next, you need to wait 10 minutes and, after the formation of a characteristic gel around the seeds, mix everything well. In this form, "Chia fresco" is ready for use.

Due to their hydrophilic properties, chia seeds are sometimes used as a substitute for eggs and fat. Chia gel can also be used as an alternative to butter or eggs in baking. It has been shown that chia oil can replace about 25% of eggs in cakes ^[14].

The nutritional value of butter can be increased by mixing it with chia butter at a ratio of 6.5% to 25%, when the concentration of ω -3 fatty acid in the chia-enriched butter is increased from 4.17% to 16.74% ^[15].

In cosmetology

Despite the fact that chia seeds have relatively recently become available to the general consumer, they are already considered an integral part of phytocosmetology and, together with oil, are widely used in home cosmetology for:

- moisturizing and softening the skin,
- elimination of edema, redness, burning and itching,
- hair growth activation
- massage treatments.

Below are examples of recipes for face and hair masks:

- **Mask for the face.** Chia seeds (2 tablespoons) should be poured with 70-80 ml of hot water and left to cool. Water-saturated "gel" seeds are ground in a blender with the addition of honey and olive oil (2 tsp of each ingredient). For a sustainable moisturizing and softening effect, the resulting mixture should be applied to the skin for 15-20 minutes twice a week for a month.
- **Hair Mask.** To add shine to hair, you need 4 tbsp. l. ground chia seeds and half a liter of warm water. The seed powder must be mixed in water and then again after swelling, after 10-15 minutes. Lemon juice 50 ml can be added to the chilled gruel. This mask is applied to the hair for a quarter of an hour, and then washed off with cool water.

Dangerous properties of chia seeds and contraindications

Chia seeds have quite a few contraindications. They should be avoided in people with low blood pressure (because chia can aggravate the condition of patients), as well as people who take aspirin, due to the anticoagulant properties of the seeds - it is also believed that here you can get an uncontrolled increase in the effect of the drug that reduces blood clotting. Due to the increased risk of bleeding, it is recommended that pregnant women include chia seeds in their diet only with the permission of a doctor.

In addition, chia seeds can provoke excessive gas formation in the gastrointestinal tract, although, if limited to the recommended 50 g per day, then such a "side" effect is observed only in case of individual intolerance to the product.

Selection and storage

Chia seeds come to our country already packaged in sealed packages, so the main task when buying is choosing a reliable brand and country of origin. Today, chia seeds have learned to grow even in the cold UK, but they are commercially produced mainly in Mexico, Peru, Argentina, Bolivia, Ecuador, Chile, Guatemala, Australia and the USA. All plants from South and Central America, thanks to a favorable climate, have time to produce mature seeds with the maximum set of nutrients.

Reliable brands are *Navitas Organics*, *Earth Circle Organics*, *California Gold Nutrition*, *Mamma Chia*, which supply organic products. But domestic companies with high-quality goods are also widely represented on the market. Product compliance with standards is confirmed by quality certificates from the country of origin, as well as national protocols. Therefore, when choosing the best chia seeds, you should pay attention to the presence of these documents.

Seeds of saturated black or white colors with a smooth shiny surface are considered to be of high quality. White seeds may have a serpentine pattern that does not affect product characteristics. It is worse if seeds of a reddish or brownish hue come across. This may indicate unfavorable weather conditions during the growing process, the immaturity of seeds, or violations of storage rules. Such seeds have a bitter taste and it is better to refrain from buying them. But there are practically no fundamental qualitative differences between white and black seeds. It is believed that the former may contain a little more protein, and the latter may contain antioxidants. But this difference is very small.

Another factor to consider when choosing chia seeds is the purity of the package contents. The inclusion of third-party elements (stems, pebbles, grains or other seeds) indicates insufficient control in production. However, it is quite difficult to achieve 100% purity of the collection, and minor accidental inclusions of a "blade of grass" or "leaflet" are generally allowed.

If before buying it is possible to study chia seeds more carefully and compare several options, then to determine the quality, you can conduct a simple experiment - mix the "seeds" with liquid. All chia

seeds, when in contact with water, are covered with a jelly-like mass, but the more it is, the better the product.

Finally, good, ripe, properly stored seeds should have a neutral smell. An unpleasant aroma may appear due to the expiration date, and due to violation of the rules of transportation and storage.

At home, it is better to store chia seeds in an airtight glass dish out of light. If the factory packaging has a zip fastener, then the seeds can not be poured. You can also not put them in the refrigerator. It is enough to provide a storage temperature in the range from +10 to +25°C and adhere to the storage periods indicated on the package. At the same time, it is important not to allow high humidity - unclosed seeds easily become damp and moldy.

Given that data on the therapeutic efficacy of chia seeds is still ambiguous, it is probably too early to unambiguously call this product a super healthy food. This requires additional research. But the presence of polyunsaturated fatty acids in the composition, as well as the abundance of proteins, microelements and phenolic compounds in seeds, make them one of the most promising candidates for study in this direction.

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Chia seeds - useful properties, composition and contraindications

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