

The use of sesame seeds in food production

L. A. Valevskaya, L. K. Ovsyannikova, S. S. Orlova, V. V. Yurkovskaya

Odessa National Academy of Food Technologies, Odessa, Ukraine
Corresponding author. E-mail: ludmila_valev@ukr.net

Paper received 25.08.17; Accepted for publication 29.08.17.

Abstract. The chemical and amino acid composition of sesame seeds is presented in the article, as well as the analysis of its consumer properties. The statistical data of the countries of exporters and importers of sesame seeds are given. According to the results of the conducted studies, it is established that sesame seeds have high nutritional and biological value. Therefore, its introduction into the composition of recipes in the manufacture of various food products will enrich the finished products with the necessary macro- and micronutrients.

Keywords: sesame seeds, consumer properties, chemical composition.

Sesame or sesame is an East Indian flower plant from the family Pedaliaceae and the genus Sesamum. The scientific name of sesame is *Sesamum indicum*. Sesame is a tropical, annual herbaceous plant with white and purple flowers. It is famous for its seeds, which are a source of very useful sesame oil, often it is used as a flavoring. It is a direct growing grass that has small, flat seeds of oval shape. Seeds of sesame can have several colors: red, white, black, yellow, etc., depending on the difference in varieties. As a seasoning, sesame seeds have been used since ancient times. Sesame was one of the very first flavors known to man.

Seeds of sesame are believed to have come to us from India, according to international studies. They inspired the catch phrase "open, open" from the "Thousand and One Nights", as the mature pod of this plant opens from a light touch, when it reaches maturity. Seeds of sesame come with or without film in various colors. They contain many nutrients and minerals, including copper, manganese, calcium and iron, and are used as powders for bread, pasta, vegetables, desserts. Also, from the crushed grains, oil and paste are obtained.

Seeds of sesame are highly valued for the high content of fats, from which sesame oil is extracted, it is very resistant to rancidity. Seeds of sesame are the main ingredients in oriental sweets, such as tahini pasta and halva.

Perhaps the most widely known sesame is the phrase "Sesame, open" - the magic words used by Ali Baba, in order to open a cave with treasures in oriental tales.

Table 1. – Chemical composition of sesame seeds

[3] Characteristic	Content in sesame seeds
Proteins, g/100 g	19,4
Fats, g/100 g	48,7
Carbohydrates, g/100 g:	
- mono- and disaccharides	2,0
- starch	10,2
Minerals, mg/100 g:	
Na	75
K	497
Ca	1474
P	720
Vitamins, mg/100 g:	
B ₁	1,27
B ₂	0,36
Energy value, kcal	605

Use of sesame seeds humanity began very long ago. It was used for therapeutic purposes in Ancient Greece, Rome and China. Sesame seed in ancient Babylon was considered to be the food of the gods. Mentions of sesame oil are reflected in the ancient cultural heritage of many countries, as well as in the Scriptures. The first one who described the maximum amount of beneficial properties of sesame and sesame oil was Avicenna, who created a huge work on treatment in the 11 th century [1].

Sesame was so well-known and common in the Arab countries that even it was suggested that this phrase would quickly be forgotten because it was so common.

Sesame seeds are added to many Asian dishes, they give the food a nutty taste and a thin, barely perceptible aroma. They are available throughout the year.

Sesame seeds contain a significant amount of protein, vitamins B (B₁, B₂), macro and microelements. The chemical composition of sesame seeds, its nutritional value is given in Table. 1.

The amino acid composition of sesame seeds is given in Table. 2

Table 2. – Amino acid composition of sesame seeds [4]

Characteristic	Content in sesame seeds, mg/100 g
Imminent amino acids	
Valine	886
Isoleucine	783
Leucine	1338
Lizin	554
Methionine	559
Throne	768
Tryptophan	297
Phenylalanine	885
Replaceable amino acids	
Alanin	781
Arginine	1900
Aspartic acid	1666
Histidine	478
Glycine	1386
Glutamic acid	3946
Proline	750
Serin	945
Tyrosine	716
Cystine	153
Total amount of amino acids	18253

Sesame is an ancient oilseed culture, the first mention of it has been known since the time of Babylon and Assyria, more than 4000 years ago. From there til spread to the Ancient Near East. Now sesame is grown in many parts of the world for more than 5 million acres. The largest areas occupied for the cultivation of sesame are in India, but the crop is also harvested in China, Korea, Russia, Turkey, Mexico, South America and a number of African countries (Ethiopia, etc.). In the US, industrial sesame production began around the 1950s. The area under sesame in the US is busy, primarily in the state of Texas and the southwestern states, their size varies from 10,000 to 20,000 acres in recent years. However, the USA acts as a major importer of sesame. Sesame will take no less than 100 thousand hectares of sesame in the US only to meet domestic demand, so there is no question of producing sesame for export. As early as the 19th century, Thomas Jefferson recognized the potential of sesame when he raised

it on trial plots (he called it beni or benne), but 200 years later in the US did little to develop this culture.

In sesame seeds, unusually high oil content (about 50% of the weight of seeds) compared with 20% of the oil in soybeans. Sesame yields a fairly high yield, it has a high nutritional value. Seeds of sesame are used both in baking and cooking oil. Sesame loves warmth and is mainly adapted to areas with a long growing season and well-drained soils. It is believed that sesame is resistant to drought, but needs good soil moisture. In the US, sesame features were studied in detail in the state of Missouri, where it adapted well to local growing conditions.

Seeds of sesame are rich in proteins, fats, carbohydrates, fibers and other minerals and vitamins. In many cuisines of the world, especially in the Middle East, it plays a very significant role, as many of the dishes are completely based on its crisp taste. Sesame seed oil is used for various purposes: cooking, cooking salads and other industrial uses; Oil can be used in the production of margarine, soap, pharmaceuticals, paints and lubricants. The residues after crushing the seeds for oil production are called oil cake, it is used as a feed for livestock.

The global production of sesame seeds is about 5 to 6 million tons per year, India along with China acts as the largest producer of sesame seeds. Sesame production is mainly concentrated in the countries of Asia and Africa, the first five countries from these regions occupy the largest share in total sesame production. The production and consumption of sesame is in an upward trend, especially in the last decade, and both figures are steadily growing.

The production of sesame seeds is concentrated in several countries, this has also led to concentrated exports. Several major producer countries dominate the production of sesame seeds. The main world exporters are India, China, Mexico.

A large number of countries import sesame seeds to meet their domestic demand. Japan leads the list of world importers of sesame, annually purchasing about 165,000 tons of sesame seeds, followed by Egypt – about 86,000 tons [2]. Also, the main importing countries of sesame are South Korea, the United States, the Netherlands, Syria, Saudi Arabia, Greece, Israel, Mexico, Germany.

Sesame seeds are the most economical and valuable agricultural commodity because of its unique chemical composition. The approximate composition and quantitative content of protein and oil were determined in the seeds of sesame collected in 1998 and 1999. Seeds contained about 19.0-23.5% and 46.4-52.0% of oil, protein – in the range of 34.9-39.6% and 19.8-24.2%, respectively.

Seeds of sesame are rich in manganese, copper, and calcium (90 mg per tablespoon of seeds for unrefined seeds, and only 10 mg for cleaned seeds), and also contain vitamin B1 (thiamine) and vitamin E (tocopherol). Sesame contains powerful antioxidants, the so-called lignans, which help in the fight against carcinogens. Sesame contains one lignan, only inherent only to him, it is called sesamine. Also, sesame seeds contain phytosterols, which block cholesterol. Nutrients in sesame are better absorbed if it is ground or grind before consumption.

Analysis of the composition and physico-chemical properties of sesame (*Sesamum indicum* L.) showed that sesame seeds contain 5.7% moisture, 20% total proteins, 3.7% ash, 3.2% coarse fiber, 54% fat and 13, 4% of carbohydrates. Seeds proved to be good sources of minerals.

They contain a lot of potassium (851.35 ± 3.44 mg / 100 g), as well as phosphorus (647.25 ± 3.52 mg / 100 g), mag-

nesium (579.53 ± 0.42 mg / 100 g), Calcium (415.38 ± 3.14 mg / 100 g) and sodium (122.50 ± 4.21 mg / 100 g).

Seeds of sesame are of different colors and shades depending on the variety of plants. Including, they can have shades of brown, red, black, yellow, and more often, pale gray or even ivory.

But basically there are three main types of sesame: brown, black and white.

Depending on the color, sesame seeds are divided into types [2]:

And the type is white or with a creamy shade;

Type II – yellow-brown or brown of various shades;

The third type is black.

White sesame seeds are exquisite food, they look like white rice. Brown sesame seed has a softer taste, it has less antioxidants than in black seeds. In black sesame seeds there are more antioxidants, and they have a more intense flavor. Black sesame has a reputation in Ayurveda and in Chinese traditional medicine as food helping to avoid aging. Black sesame seeds are considered to be the best for consumption, the brown ones follow them. If you want to buy sesame seeds inexpensively, find a large food store or cooperative that sells black or brown sesame seeds wholesale. Buying from wholesalers will save money.

For example, in India, one of the main exporters of sesame, produce all three types (white, black and brown). Natural white sesame is the most popular for export, it is used for crushing and direct consumption in food, used in confectionery production, etc. White sesame is used in bakery, confectionery, in the production of sesame products such as tahini paste, halva and many other products Power supply. Indian producers mainly use white sesame to produce unrefined and filtered sesame oil, while in East and South-East Asia they consume fried butter. In the Middle East, mostly tilm is used in the production of tahini paste and halva. Brown sesame seeds are also used for the production of butter, while black sesame seeds are used for medicinal purposes, as they are known to bring a lot of health benefits. After grinding the sesame seeds for oil production, the by-product of the extraction (cake) is also used. Sesame seed cake has a high protein content (45-47%), so it is used as a valuable ingredient in poultry feed. Purified sesame seeds, which are widely used in bakery and confectionery industry, are obtained by removing the outer shell of seeds with the help of peeling. Prepared for sale tiles are of two types, depending on the drying method - Autodried (dried mechanically) and Sundried (dried in the sun). More developed countries prefer Autodried sesame, while developing countries buy Sundried type.

Black sesame seeds have a strong flavor. It is believed that black sesame seeds have medicinal properties, since they have a high level of antioxidants. They are used for flavoring baking, they also produce a fragrant powder. Powder is often used in rice dishes. The highest quality of oil is produced from this type of sesame seed. Black sesame seeds are sometimes used as a substitute for nuts.

White sesame is often added to buns and bread, and other baked goods, adding a crunchy texture. In powder form, white sesame seeds are used in curry, chutney and rice sauces, they have a more moderate flavor than black varieties. Fried white seeds are usually added to sushi rolls. In China, white is called chi mah, and in Japan it is called muki-goma.

The therapeutic properties of sesame are as follows:

- due to the high content of magnesium, prevents and reduces blood pressure;

- eliminates gingivitis (plaque), bleeding gums, dryness in the throat;

- useful for infants' health.
- helps with multiple sclerosis.
- protects against kidney damage with antibiotics.
- prevents atherosclerosis due to anti-inflammatory properties.
- reduces depression (thanks to sesame oil contained in the oil).
- protects DNA from radiation damage;
- blocks the development of cancer cells;
- useful for skin health (seeds contain zinc).
- useful in the treatment of anemia and weakness due to high iron content.
- to improve bone health (contains calcium);
- promotes better digestion (contains fiber);
- promotes hair growth.
- reduces stress.

- protects the liver from harmful effects (due to the presence of acetaminophen in oil, which reduces the level of glutathione in the liver) [5].

Whole sesame seeds are consumed in raw, boiled and roasted, and also used for the preparation of "oriental sweets", sweets, taffeta oil and halva, other confectionery. Roasted seeds are sprinkled with bakery products (buns, bagels).

At the Odessa National Academy of Food Technologies, the Department of Technology for Storage of Grains conducts research on determining the properties of sesame seeds.

For a more detailed evaluation of organoleptic parameters, a general profilogram of color, smell and taste of sesame seeds was constructed (Fig. 1).

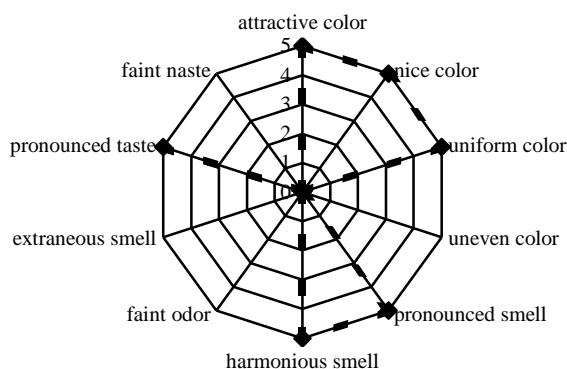


Figure 1. – The overall profilogram of the sample sesame sample by color, smell and taste

Based on the results of the general profilogram, it was established that a sample of sesame seeds has an attractive, uniform color, a harmonious smell and pronounced taste.

Thus, according to the results of the research, it has been established that sesame seeds have a high nutritional and

biological value. Therefore, its introduction in the formulation, in the manufacture of various products will allow the finished products an attractive color, harmonious taste and will enable the products to be enriched with the necessary macro and micronutrients.

ЛИТЕРАТУРА

1. Кунжут для переработки. Технические условия [Текст]: ГОСТ 12095-76. – Введ. 1977-07-01. – : Изд-во стандартов, 1977. – 5 с.
2. Овсянникова, Л.К. Використання кунжутного шроту в харчуванні [Текст] / Л.К. Овсянникова, Л.О. Валевська, Д.В. Андрасович, Ю.В. Шарапаниук // Міжнар. наук.-практ. конф. «Розвиток харч. виробництв, ресторан. та готельн. господарств і торгівлі: проблеми, перспективи, ефективність», 14 травня 2015 р. – Харків: ХДУХТ, 2015. – С. 82-83.
3. Химический состав пищевых продуктов: книга 1 [Текст]: Справочные таблицы содержания основных пищевых веществ и энергетической ценности пищевых продуктов / Под ред. И.М. Скурихина. – 2-е изд., перераб. и доп. – М.: ВО «Агропромиздат», 1987. – 224 с.
4. Химический состав пищевых продуктов: Книга 2 [Текст]: Справочные таблицы содержания основных пищевых веществ и энергетической ценности пищевых продуктов / Под ред. И.М. Скурихина. – 2-е изд., перераб. и доп. – М.: ВО «Агропромиздат», 1987. – 359 с.
5. Каперикова, Н.В. Кунжут как источник кальция в рационе лиц пожилого возраста [Текст] / Н.В. Каперикова, Ю.С. Липатова // Пищевая промышленность. – 2009. – № 2. – С. 48-49.

REFERENCES

1. Kunzhut dlya pererabotki. Tehnicheskie usloviya: GOST 12095-76. – Vved. 1977-07-01. – M.: Izd-vo standartov, 1977. – 5 s.
2. Ovsyannikova, L.K. Viktoristannya kunzhutnogo shrotu v harchuvanni / L.K. Ovsyannikova, L.O. Valevska, D.V. Andrasovich, Yu.V. Sharapanyuk // Mizhnar. nauk.-prakt. konf. «Rozvitok harch. virobnitstv, restoran. ta goteln. gospodarstv i torgivli: problemi, perspektivi, efektivnist», 14 travnya 2015 r. – Harkiv: HDUHT, 2015. – S. 82-83.
3. Himicheskij sostav pischevyih produktov: kniga 1: Spravochnye tablitsi sodержaniya osnovnyih pischevyih veschestv i energeticheskoj tsennosti pischevyih produktov / Pod red. I.M. Skurihina. – 2-e izd., pererab. i dop.– M.: VO «Agropromizdat», 1987.–224 s.
4. Himicheskij sostav pischevyih produktov: Kniga 2: Spravochnye tablitsi sodержaniya osnovnyih pischevyih veschestv i energeticheskoj tsennosti pischevyih produktov / Pod red. I.M. Skurihina. – 2-e izd., pererab. i dop. –M.: VO «Agropromizdat», 1987.–359 s.
5. Kaperikova, N.V. Kunzhut kak istochnik kaltsiya v ratsione lits pozhilogo vozrasta / N.V. Kaperikova, Yu.S. Lipatova // Pischevaya promyshlennost. – 2009. – № 2. – S. 48-49.

Возможности использования семян кунжута при производстве пищевых продуктов

Л. А. Валевская, Л. К. Овсянникова, С. С. Орлова, В. В. Юрковская

Аннотация. В статье представлен химический и аминокислотный состав семян кунжута, а также анализ его потребительских свойств. Приведены статистические данные стран экспортеров и импортеров семян кунжута. По результатам проведенных исследований установлено, что семена кунжута имеют высокую пищевую и биологическую ценность. Поэтому введение его в состав рецептур при производстве разных пищевых продуктов позволит обогатить готовые изделия необходимыми макро- и микронутриентами.

Ключевые слова: семена кунжута, потребительские свойства, химический состав.