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Nutritional and Biological Properties of Chickpea

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ABSTRACT

This paper reviews the nutritive and biological value of chickpea. The chemical, vitamin and mineral compositions of chickpea are described in this paper. Chickpeas contain more than 80 beneficial substances for the human body. It contains about 20 percent protein, 50-60 percent carbohydrates, about 5 percent fat, most of which is polyunsaturated, the amino acid lysine, vitamins A, C, B1, B6 as well as mineral elements (zinc, magnesium, potassium, phosphorus, iron). It gives an overview of the use of chickpea flour in the production processes of confectionery, bakery, macaroni and meat products. Its effect on the quality characteristics of received food products is assessed.

Keywords: Chickpea, Chickpea Flour, Biological Value, Functional Properties.

Chickpea: biological features and chemical composition

Chickpea belongs to the family of legumes (Fabaceae Lindl.) and the Cicer L. genus. There are 39 species of the genus Cicer, distributed in Central and West Asia. There is only one species of Cicer arietinum L. which is not found in the wildlife [1]. The chickpea has a long history. It has been grown in India, the Middle East and parts of Africa for many years. In modern Turkey, it became known about 7,400 years ago [2].

The chickpea has high biological value and functional properties because it contains more than 100 nutrients. The protein content of chickpea seeds varies from 20.1% to 32.4%. Soybeans, peas and other beans have a higher protein content in their seeds (Table 1). However, it is known that the nutritional value of a crop is determined not only by the quantity of protein but also by its quality, which depends on the balance of its amino acid composition, the content of essential amino acids, digestibility of protein and the nature of the influence of some unfavorable factors on protein utilization [3].

Depending on the variety, the fat content of the seeds ranges from 4.1 to 7.2%, and by this indicator chickpea is superior to other beans besides soybeans. On average, peas, beans, mash and lentils contain up to 2.0 g/100g of fat.

Chickpea flour has a low glycemic index and low calorie content, is gluten-free and rich in fibre compared to wheat flour. The chickpea flour also contains a significant quantity of soluble dietary fibres, which are essential for the human body's health and well-being. It is proved that the addition of chickpea flour to the diet improves digestive processes and enhances immunity. In 100 g of chickpea is found up

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to 10 g of dietary fiber. According to numerous studies, the beneficial effect of chickpea is its ability to reduce the probable risk of strokes, heart attacks and other cardiovascular diseases [4, 5].
In terms of digestibility, chickpea proteins are superior to other grain legumes. Chickpea proteins are rich in such essential amino acids as tryptophan, leucine, isoleucine, lysine, methionine, as well as essential amino acids - histidine, arginine, tyrosine, cystine.

The chickpea is a good source of lecithin, riboflavin (vitamin B2), thiamine (vitamin B1), nicotinic and pantothenic acids, choline. The content of vitamin C in chickpea seeds is an average of 4.0 mg/100g, while in germinating seeds it rapidly increases on the 12th day after germination and its amount is 147.6 mg per 100 g of dry matter. The chickpea flour enriches our body with pyridoxine, which is essential for the functioning of the immune system [3, 6].



Figure 1. Chickpea (pictures obtained from https://blog-travushka.ru)

In terms of mineral composition, chickpea seeds contain a lot of phosphorus, calcium, potassium and magnesium. The magnesium normalizes the pressure and is essential for muscle function. Calcium helps maintain healthy bones, teeth and heart muscles. The chickpea ranks first among legume crops in terms of selenium content, which is involved in regulating the permeability and stability of cell membranes, by incorporating it into cellular structures. Tocopherols, carotenoids and sulfur-containing amino acids contained in grains of chickpea increase the anticarcinogenic activity of selenium [7, 8].
Chickpea flour is a processing product made from chickpea beans. It is an excellent source of calcium, zinc, and protein. It also contains a considerable amount of soluble dietary fibres, so-called complex carbohydrates. The chickpea flour is rich in vitamins, trace elements and amino acids as well. The biological value of the product increases with the addition of chickpeas flour to the formulation [9].
It is known that chickpea flour is used as a preventive agent against malignant tumors, liver diseases, and is also very useful for diseases of the bones and joints [10]. Due to its high nutritional and biological value, chickpea is widely used in various food processing technologies.

Table 1. Chemical composition of legumes, g/100g

Legume	Water	Protein	Oil	Mono- and dysaccharides	Starch	Fibres	Ash
Chickpea	14.0	20.1	4.3	3.2	43.2	3.7	3.0
Peas	14.0	20.5	2.0	4.6	44.0	5.7	2.8
Beans	14.0	21.0	2.0	3.2	43.4	3.9	3.6
Mash	14.0	23.5	2.0	3.8	42.3	3.8	3.5
Lentils	14.0	24.0	1.5	2.9	39.8	3.7	2.7
Soybean	12.0	34.9	17.3	5.7	3.5	4.3	5.0

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Table 2. Vitamin composition of legumes, mg/100g

Legume	Vitamin A	Vitamin B1, thiamine.	Vitamin B2, riboflavine	Vitamin B4, choline	Vitamin B5, pantothenic	Vitamin B6, pyridoxine	Vitamin C, ascorbic	Vitamin E, alpha tocopherol
Chickpea	0.0015	0.08	0.212	95.2	1.588	0.535	4	0.82
Peas	0.002	0.81	0.15	200	2.2	0.27		0.7
Beans		0.747	0.213		0.748	0.309		
Lentils	0.005	0.5	0.21	96.4	1.2	0.54	4.4	0.5
Soybean	0.012	0.94	0.22	270	1.75	0.85		1.9

Table 3. Mineral composition of legumes, mg/100g

Mineral	Chickpea	Peas	Beans	Lentils	Soybean
Potassium	968	873	1100	677	1607
Calcium	193	115	150	35	348
Magnesium	126	107	103	47	226
Sodium	72	33	40	6	6
Sulfur	198	190	159	246.3	244
Phosphorus	444	329	480	281	603
Iron	2.6	6.8	5.9	6.51	9.7
Manganese	2.14	1.75	1.34	1.393	2.8
Copper	0.66	0.75	0.58	0.754	0.5
Selen	0.0285	0.0131	0.0249	0.0001	
Zinc	2.86	3.18	3.21	3.27	2.01

Chickpea in production of bread and confectionery products

Work [11] shows the method of bread preparation, which includes preparation of starter dough, mixing dough with subsequent proofing, molding, and baking. Fermented solution is used in the preparation of the starter dough, which includes chickpea protein isolate in the form of dry powder in the amount of 5-28% of the total wheat flour and yeast preparation "Fervital" in the amount of 0.19% of the total protein isolate of chickpea. This method allows to obtain a product balanced in protein-carbohydrate composition, enriched with essential amino acids and a shortened period of technological process, which makes it possible to increase the production of product output.

The composition for preparation of raw gingerbread is known (RU 2240004, MPK A21D 13/08, published: 20.11). 2004), containing wheat flour of I grade, granulated sugar, carbon ammonium salt, chickpea flour, in the following ratio, (kg) per 100 kg of flour used: wheat flour of I grade - 10-70, chickpea flour - 30-90, water to dough humidity 23.5-25%, granulated sugar - 62, carbon ammonium salt - 0.9.

Spice cakes with the addition of chickpeas flour as a result of better porosity have good organoleptic characteristics. Due to the increased protein and fat content in the product, they have better taste and higher energy value.

The addition of chickpea into the composition improves the taste and organoleptic characteristics of the product by enhancing the porosity of the crumb. The content of chickpea flour in the formulation in this ratio provides original taste characteristics, expands the range of gingerbread products, giving a natural yellow coloring of finished products without using colorants [12].

The authors [13] patented a method for making cookies of high nutritional and biological value. The composition contains a flour mixture of wheat and chickpea flour in a ratio of 1:3-3:1, powdered sugar, pumpkin puree, invert syrup, plasticized margarine, melange, salt, leavening, flavoring, pods, water. The offered composition for cookies preparation allows to increase the quality of cookies; to increase food and biological value; to lower caloric value; to reduce the expense of wheat flour; to lower the cost price of production; to expand assortment of flour confectionery products of better composition for children.

Abuova et al. [14] used chickpea in a flour composite mixture for cookies. According to the research results,

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it was found that the best organoleptic and physicochemical quality parameters had cookies based on flour mixtures containing 40 % wheat; 15 % sorghum; 15 % chickpea, 15 % triticale flour and 15 % rapeseed flour..

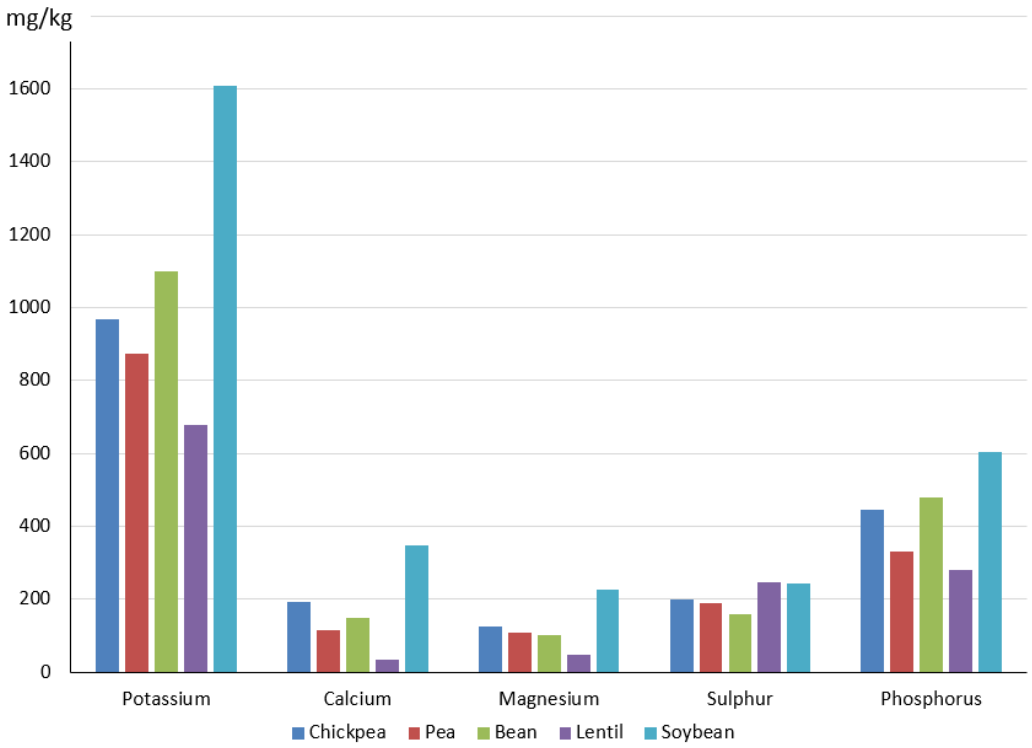


Figure 2. Comparative diagram of mineral composition of legumes, mg/100g

Chickpea in production of pasta and sauce products

In work [15] proposed composition for the production of pasta, which contains wheat flour, soft wheat flour and chickpea flour with the following ratio of components, weight.%: durum wheat flour 5%, bakery soft wheat flour 85%, chickpea flour 10%. The invention makes it possible to obtain a product with increased biological value, improved organoleptic and rheological quality indicators. The introduction of chickpea flour in the formulation of pasta is explained by the need to enrich with balanced essential amino acids and minerals, which are more in chickpea flour than in pea and bean flour. The use of protein-containing additive in the form of chickpeas flour in the amount of 10 % leads to improvement of organoleptic and rheological characteristics and biological value of pasta products.

Also, chickpea flour is used in sauces like mayonnaise. The authors of the patent [16] have developed a method for preparing mayonnaise, which contains vegetable refined deodorized oil, egg powder, sugar, salt, drinking soda, acetic acid 80%, chickpea flour and water. This invention allows to reduce the production cost of mayonnaise by adding chickpea flour at the same time increasing the stability and quality of the finished product. The use of chickpea flour not only simplifies the technological process of mayonnaise production, but also allows to achieve a high degree of tissue dispersion (cell walls) and obtain a colloidal system consisting of finely dispersed particles of cell walls, uniformly distributed in a solution of chickpea polysaccharides. The intensive mixing ensures a more complete interaction of polysaccharides with other components, which contributes to the stability of the emulsion, as the finely dispersed cell walls of chickpea flour create a strong three-dimensional structure that enhances the emulsifying and stabilizing effect.

Chickpea in production of meat products

Another group of food products where chickpea is used are meat products. The method of producing

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molded meat products described in [17] includes the preparation of minced meat, the application of a structure-forming additive, spices, water, forming and heat treatment. As structure-forming additive, an additive containing extruded chickpeas flour, mustard powder and ground spinach is used. The method and ratio of components of structure-forming additive allow to obtain a molded product of preventive action having a good structure, as well as to increase the yield of finished molded products.

Thus, the stated structure-forming additive is a biologically valuable supplement to the minced systems, and its application for the production of meat molded products promotes good emulsification of minced systems, the desired structure and high yield of finished molded products.

Conclusion

The rich chemical composition of chickpea flour, high taste advantages, beneficial effect on the human body predetermine the prospects of using this raw material in the food industry.

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