

LUPIN AND CHICKPEA

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Summary

Lupin is an annual legume, native to the Mediterranean basin. The protein and the oil content of the seeds vary between 38 and 62%, and 1 to 17% respectively, depending on genotype and the extent of de-hulling. The seeds contain a low amount of starch (0 to 5%).

The application of reduced alkaloid-content lupin-genotypes is wide. It is used for human consumption as well as for animal feed. The processed products of lupin (flour and isolate) are mainly used in bakery and pastry products.

Chickpea is a long-established cultivated legume of Europe and Asia, with consumption being mainly traditional in southern Europe and in the United Kingdom.

The protein content of chickpea is about 20%, and the oil content, which consists mainly of polyunsaturated fatty acids, about 6%. Chickpea is characterized by high iron, zinc and calcium content, and a good source of essential nutrients for vegetarians and lactose-intolerant people.

The world's chickpea production is about 8 million tonnes. The main chickpea producer is India. In Europe the major producer is Spain, followed by Portugal, Italy and Greece.

1. Lupin (*Lupinus albus*, *L. luteus*, *L. angustifolius*)

1.1. Introduction

The members of the genus *Lupinus* are very handsome plants. They are represented in Europe, Asia and North and South America. A number of species are cultivated purely as ornamental plants, but the best-known species are grown for human consumption or animal fodder.

1.2. History, Taxonomy and Distribution

History

Lupins have been used for traditional human food and animal feed since ancient times. White lupin (*L. albus* L.) has been cultivated in Egypt for at least 4000 years.

The early lupins were considered “bitter”, because the alkaloid (lupanine, sparteine, spatulatine and hydroxylupanine) content could exceed 2%. The alkaloids can affect the central nervous system causing depression, laboured breathing, convulsions and death from respiratory failure (Matthews, 1989).

Early in the twentieth century breeders developed “sweet” lupin in Germany, making this crop potentially much more desirable. The sweet lupins also contain alkaloids, but by boiling and steeping the seeds in water the alkaloids could be successfully removed.

Taxonomy

Three main lupin species have been used for human food and animal feeds. The white lupin (*L. albus*), the yellow lupine (*L. luteus* L.) and the blue lupine (*L. angustifolius* L.) have significant nutritional value. Also the Andean lupin (*L. mutabilis*) is a valuable protein and oil source for human consumption. It was domesticated in pre-Columbian civilization and seems to be a valuable progenitor for interspecific crosses to improve the seed quality of the cultivated species.

Distribution

Lupin is herbaceous to woody annual legume, native to the Mediterranean basin and Andean highlands. The main lupin-producing areas of the world are Australia, Europe, South-Africa, Chile, New Zealand, USA and the former USSR.

1.3. Chemical composition

The chemical composition of dehulled lupin seed flour prepared from different lupin varieties is summarized in Table 1.

Species	Protein, %	Lipids, %	Ash, %	Fibre, %	Carbohydrates, %
L. albus	45.7	17.0	2.4	3.5	30.4
	43.6	11.3	3.4	12.0	29.7
	45.1	0.9	4.4	3.0	46.6
L. angustifolius	34.8	7.2	3.7	3.5	50.8
	38.5	7.8	4.4	3.3	46.0

L. luteus	62.5	7.8	2.7	4.2	22.8
	46.1	6.1	4.4	4.4	39.0

Table 1. Chemical composition of dehulled lupin seed flour

Protein content

Lupins have attracted special interest owing to the relatively high protein content, which creates possibilities for soybean substitution in Europe.

The protein content of lupin may vary from 38 to 62% depending on cultivars and the extent of de-hulling. Lupins are rich source of sulphur-containing amino acids and arginine, and have a good balance of essential amino acids with a high degree of digestibility.

Oil content

The oil content of lupins may range from 1 to 17 %, with a high variation in fatty acid composition. The dominating fatty acids are oleic and linoleic acid. According to the composition of lupins, the metabolizable energy of it is estimated to have an average value of 2427 kcal/kg.

White lupins have been found to accumulate high levels of manganese, which can cause toxicity problems, especially in pigs.

Carbohydrate content

The seeds contain low amounts of starch (0 to 5%), and structural polysaccharides such as hemicellulose. The primary cell walls of cotyledons are composed of arabinogalactans, arabinans, rhamnogalacturosan, galactoxyloglucans and galactans. Mature seeds of yellow lupin accumulate stachyose, verbascose and raffinose, amounting 11% of dry mass, and sucrose (1.5%) (Piotrowicz et al.1998).

Lupin seeds contain about 1.5 to 3.5% of sucrose, a relatively high amount of stachyose (6.0 to 7.5%). The raffinose and verbascose content are about 0.5 to 0.9%, and 0.3 to 0.8% respectively (Bagger et al., 1998).

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Biographical Sketch

Dr. Ildikó Schuster-Gajzágó was born in 1942 in Budapest, Hungary. He is married with one child. From 1961 to 1966 he attended the Eötvös Lóránd University of Sciences in Budapest, attaining an MSc in Biology. In 1985 he was awarded a University Doctoral Degree and in 1997 a PhD in Biology. From 1967 to 1986 he was a Research Worker at Department of Enzymology at the Central Food Research Institute. From 1986 he was a Research Worker in the Department of Technology at Central Food Research Institute, and from 1997 a Senior Research Worker.

His research activities have focused on the following:

1967-1972. Basic and applied research of enzymes (glucose oxidase, milkclotting enzyme of microbial origin, cellulase).

1972-1986. Study of enzymic browning of fruits (apple, pear, apricot) and establishment of the relationship between PPO activity and endogen substratum content. Study of the inhibition of enzymic browning of fruits. Study of the effect of location and year on polyphenoloxidase-polyphenol content of apple.

1986-1998. Enzymic modification of plant protein. Study of the effect of animal and microbial origin protease enzyme on the colloid properties of modified plant protein. (This program was supported by the EU Copernicus project). Study of antinutritional compounds of legume seed (protease inhibitors and oligosaccharides).

1998-present. Study of health protecting compounds such as glucosinolates and polyphenols of legume seeds and mustard. Determination of polyphenol content and composition as well as antioxidant properties of mustard varieties.