

Chia Seeds (*Salvia hispanica*): Health Promoting Properties and Therapeutic Applications – A Review

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ABSTRACT

Chia seed was a staple in the lives of ancient Aztecs and Mayans thousands of years ago. Chia's chemical composition and technological properties: The Chia plant has a high nutritional potential. Chia seeds have been used as whole, flour, mucilage, and seed oil. The consumption of Chia seed products has increased recently, including this functional food in a daily human diet could improve consumers' health. Chia is currently under investigation due to its high content of Omega 3, richer in essential fatty acids and capacity to retain water because of the mucilage. Many scientific centres are currently researching the nutritional and therapeutic aspects of Chia. This paper's main aim has been to provide an overview of Chia seed in relation to its perceived medicinal properties.

Keywords: Chia seed; Nutritional potential; Essential fatty acids; Therapeutic aspects

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INTRODUCTION

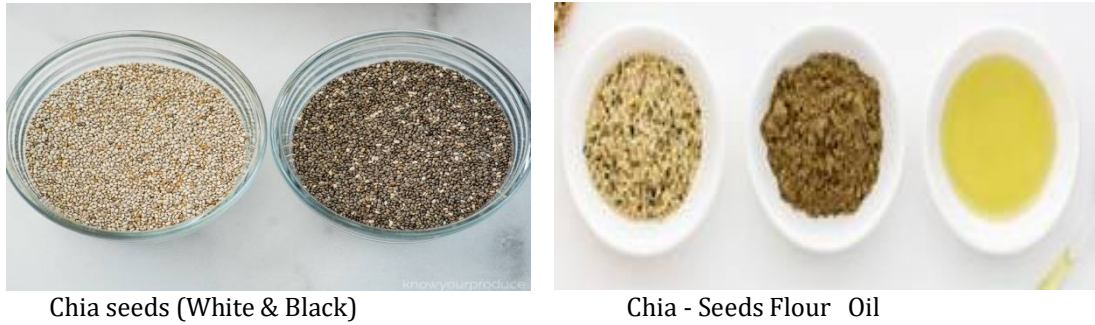
Chia seeds are native to Central America. They were consumed by indigenous people over 6000 years ago. Archaeological site findings show that Chia Chiagrown in the Valley of Mexico Teotihuacan. Chia is tChiaically derived from the Mayan language and means "strength." Chia (*Salvia hispanica*), also called Mexican chia or SChia chia, is Chiaowering plant in the mint family (Lamiaceae) grown for its edible seeds. Chia seeds are touted for their health benefits, being high in fibre and omega-3 fatty acids. They are grown commercially in several countries, including Argentina, Australia, Bolivia, Peru, and the United States. Chia seeds are oval-shaped. They are tiny, approximately 1.5 mm wide x 2mm long [2]. Its colour is variable depending on the variety. They may be plain white, brown or black, or mottled with different colours ranging from dark brown, cream, grey, black and white. Chia seeds can be used as whole, mucilage, flour and oil seeds. The popularity of Chia seeds increased rapidly in the last few years. They have been revalued due to their nutritious properties: high fibre, polyphenols and lipids content. Chia requires less water than cereals or other oil seeds to grow [1].



Chia seed plant with leaves and flower

SCIENTIFIC CLASSIFICATION

Kingdom	Plantae
Subdivision	Spermatophyta
Order	Lamiales
Family	Lamiaceae
Genus	<i>Salvia</i>
Species	<i>S. hispanica</i>



Chia seeds (White & Black)

Chia - Seeds Flour Oil

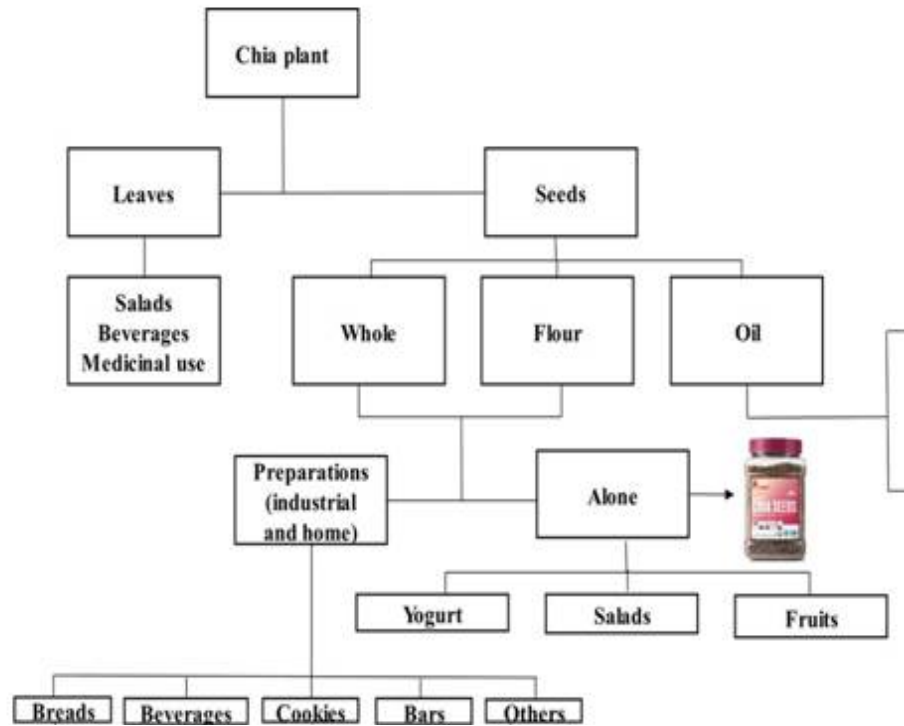


Fig 1 : Uses of Chia seeds

NUTRITIONAL VALUE

In 2009, Chia was Chiaoved as a novel food by the European Parliament and the European Council [3]. Chia seeds are a concentrated food containing healthy omega-3 fatty acids, carbohydrates, protein, fibre, antioxidants, and calcium. Chia seed is approximately 15- 24% protein, 26-41% carbohydrates, and 25-40% fat. Chia seeds supply many minerals, with phosphorus (860–919 mg/100 g), calcium (456–631 mg/100 g), potassium (407–726 mg/100g) and magnesium (335–449 mg/100 g) found in most outstanding amounts [3]. It has been studied principally due to its oil quality content, possesses almost 55-60% linolenic acid (ω -3), 18-20% linoleic acid (ω -6), 6% monounsaturated ω -9, and 10% saturated fat [4]. On the other hand, the seed has highly soluble and insoluble dietary fiber, over 35% of the total weight, and it is a rich source of the B vitamins and minerals. It also contains 6 times more calcium, 11 times more phosphorus, and 4 times more potassium than 100 g of milk, besides possessing magnesium, iron, zinc, and copper [5]. In addition, it has a high amount of natural antioxidants, such as phenolic compounds, which protect against some adverse conditions. Another important characteristic of this seed is that it does not contain gluten and can be consumed by persons with celiac disease [6-9]. It balances essential and non-essential amino acids [10].

The defatted chia seed flour had 40% dietary fibre (TDF). Also, the literature contends that chia seeds are excellent sources of antioxidants and polyphenols, which include quercetin, myricetin, rosmarinic acid, and caffeic acid. Chia seed oil is a versatile ingredient that is used in the skincare industry as a potent anti-ageing ingredient, as well as an edible and delicious alternative to olive oil in kitchens worldwide. It contains significant amounts of Omega-3 essential fatty acids for the brain, heart, immune system and joints. Chia seed oil also contains many antioxidants like polyphenols and carotenoids, which protect the skin and cells [28-32].

COMPOSITION OF CHIA SEEDS [38-40]:

Nutrient (per100 gm)	Content
Carbohydrates	47.87
Protein	16.62
Fats	26.25
Fiber	38
Folic acid	114
Vitamin A	36
Vitamin C	15.7
Vitamin E	0.5
Copper	1.66
Calcium	631mg
Potassium	407mg
Magnesium	335mg

FIBER

Dietary fibre is an essential component in the daily diet due to its beneficial effect on health. Some of these effects are the reduction of cholesterol, modification of the glycemic and insulin responses, changes in intestinal function, decrease of the risk for coronary heart disease, diabetes mellitus type II, and several types of cancer, and also antioxidant activity. The consumption of dietary fibre has been associated with an increase in post-meal satiety, decreasing subsequent hunger. Chia mucilage has approximately 48% total sugar content, 4% protein, 8% ash, and 1% fat. The fibre is a polysaccharide with a high molecular weight, and its basic structure is a tetrasaccharide with 4-O-methyl- α -D-glucuronopyranosyl residues that branch b-D-xylopyranosyl on the main chain structure. The monosaccharide composition is 16% D-xylose, 1 D-mannose, 2% D-arabinose, 6% D-glucose, 3% galacturonic acid, and 12% glucuronic acid [35-36, 11].

LIPIDS

The most essential characteristic of chia ChiaChiaigh is the content of PUFAs. The seed has around 25-40%, comprising 55-60% linolenic acid (ω -3) and 18-20% linoleic acid (ω -6). The human body requires these essential fatty acids for good health [12, 13, 34]. Chia contains the highest percentage of any plant source of α -linolenic acid. This fatty acid is the precursor for the long-chain PUFAs, considered essential fatty acids because the human body cannot produce them. Chia seeds contain high concentrations of PUFAs that provide potent lipid antioxidants [4, 31].

PHENOLIC COMPOUNDS

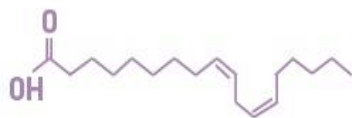
Chia seeds are rich in phenolic compounds and have a high antioxidant capacity. Polyphenols responsible for antioxidant activity are most commonly flavonoids and cinnamic acid derivatives—the amounts of phenolic compounds in Chia are around 0.881.6 mg GAE/g. The seed contains significant gallic, caffeic, chlorogenic, ferulic, and rosmarinic acid concentrations. In addition, they also contain myricetin, quercetin, and kaempferol. The most critical phenolic compounds present in Chia pherolsare a concentration of 238427 mg/kg, similar to peanut oil [41].

Also, seeds contain isoflavones such as daidzin, glycerin, genistin, glycitein, and genistein [4, 15]. Chia seed oil is an excellent source of fatty acids and fibres. Its high content of fats provides numerous health benefits such as healthy skin, healthy hair, and reduces the risk of heart diseases [42-49].

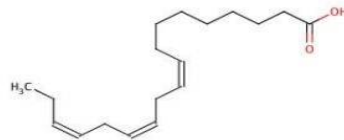
Chia seeds also contain antioxidant compounds, most of them derivatives of caffeic acid, 67 such as rosmarinic acid, dashes, and its glycosides [16], but also 68 some flavonoids such as quercetin and kaempferol have been reported. After oil is extracted from chia seeds, a fiber-rich, protein-rich, and polyphenol-rich fraction remains a by-product. The partially-deoiled chia flour (PDCF) fraction could naturally improve the nutritional profile and the antioxidant capacity of traditional cereal-based products such as pasta [50].



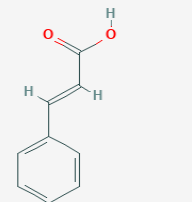
Fig 2: BENEFITS OF CONSUMPTION OF CHIA SEEDS [39, 40, 45]



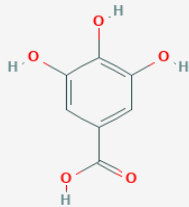
Linoleic acid



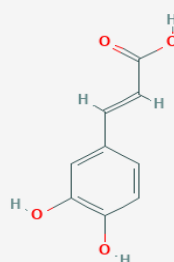
α -linolenic acid



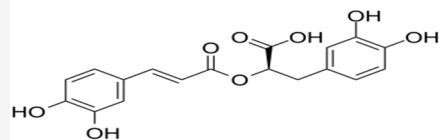
Cinnamic acid



Gallic acid



Caffeic acid



Rosmarinic acids

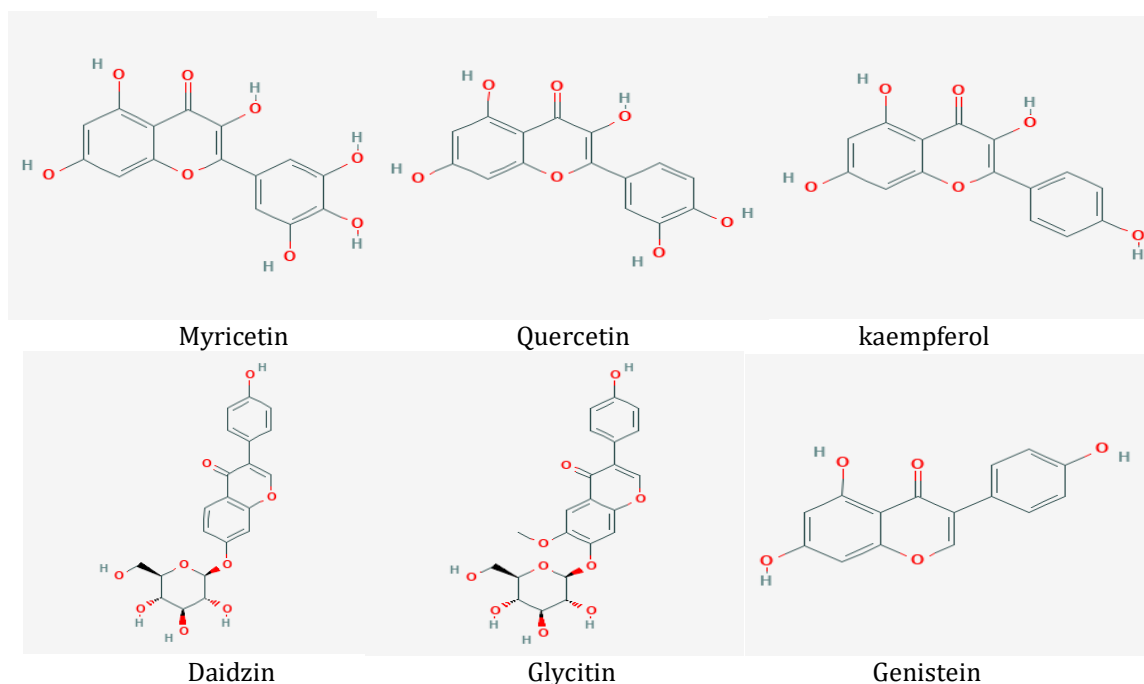


Fig 3: CHEMICAL STRUCTURE OF THE MAIN POLYPHENOLIC COMPOUNDS IN CHIA SEED [35-40]

CHIA SEED THERAPEUTIC VALUE

ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES

Antioxidants protect cells against oxidative damage caused by excess reactive oxygen species. Adding chia seeds to food prevents food deterioration caused by lipid oxidation. Oil extracted from Chia seeds contain several phenolic compounds such as tocopherols, phytosterols and carotenoids with their related antioxidant activity that play a vital role in the deterioration of the oil due to lipid oxidation [18, 19]. The antioxidant activity of chia seeds was also confirmed by Coelho and Salas-Mellado 2014. The antioxidant properties of chia seed may be used to protect the lipids and biologically active substances in the oil during storage and use of thermal processes [21-34].

CARDIO-PROTECTIVE EFFECTS

Due to the presence of α -linolenic acid, Chia seeds are crucial for certain biochemical compounds linked to the human body's vital physiological functions like thromboxanes and leukotrienes. High concentrations of blood serum HDL-cholesterol (HDL-c) are directly associated with the development of cardiovascular disease (CVD) in humans [20]. Chia seed consumption has shown promise for reducing serum cholesterol levels since it has high concentrations of dietary fibre and unsaturated omega-3 fatty acids [21]. Plant sterols are effective in inhibiting cholesterol incorporation into mixed micelles, which is an essential step at the intestinal epithelium for cholesterol absorption.

CONTROL DIABETES

From the investigation by Vuksan et al. [51], it was established that upon having 37 g/day supplementation of Salba-chia to isocaloric diets, there tends to be an improvement in emerging and significant risk factors for type-2 diabetes.

ANTI-INFLAMMATORY

Chia seeds have numerous antioxidant compounds, such as vitamins, polyphenols, and peptides. These compounds can inhibit the activation of the NF- κ B transcription factor *in vitro*, thus reducing the inflammatory and carcinogenic processes [52].

CHIA OIL AS SKIN CURATIVE

Chia seed oil is a popular ingredient in skin care products due to its high fatty acid content. The oil is wealthy in omega-3 alpha-linolenic acid (ALA), omega-6, and smaller amounts of other healthy fats, such as oleic and stearic acid [53].

ANTI-CORROSION EFFECT

It has been reported that macerated chia seeds in methanol show an anti-corrosion effect on steel mainly attributed to the unsaturated fatty acids [48].

CONCLUSION

In summary, this paper has provided an overview of Chia seeds' medicinal properties, chemical composition and nutritional potential; if they are added to food, they may improve their nutritional value. It was used as a beverage and medicine in ancient times and has a vast religious value. Chia seed is a high packet of nutrients like protein, fibres, lipids, vitamins and minerals, and antioxidants. Also, it is very beneficial in treating many diseases because of its oil content (omega-3 ALA). Shortly, demand for chia ChiaChiarease will gain immense popularity among people and researchers, and many other studies can be done on it. The most important compounds of the seeds include soluble and insoluble fibre, oil with high amounts of ω -3 and -6 fatty acids, proteins with a high level of essential amino acids, minerals, vitamins, and phytochemicals with high antioxidant activities, including phenolics and isoflavones. Consumption of chia IncrChiad due to its beneficial effects related to obesity, cardiovascular disease, diabetes and some types of cancer. Over the last decade, researchers have focused on the presence of these active compounds in seeds to identify and improve their properties, especially their antihypertensive and antioxidant potentials. Thus, Chia ChiaChiamé was the golden seed of this century.

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