

Nutritional Significance of *Salvia Hispanica* (Chia Seeds)

Ritika Parashar, Abhimanyu Kumar Jha, Niraj Kumar Jha and Saurabh Kumar Jha*
Department of Biotechnology, School of Engineering & Technology, Sharda University,
Greater Noida, Uttar Pradesh, India

*Corresponding Author: saurabh.jha@sharda.ac.in

Abstract: *Salvia hispanica* (Chia seeds), one of the superfoods, rich in omega-3 fatty acids has lately acquired popularity because of its rich nutritional content. The purpose of this article is to understand the chemical composition, biological significance, dietary impact, and remedial properties of Chia. It contains high levels of polyunsaturated fatty acids, vital amino acids, polyphenols, diabetes resistant, vitamins, and various bio elements. Recent studies have established anti-atherosclerotic, hypotensive, and cardioprotective properties of Chia. The bioactive compounds derived from *Salvia hispanica* exhibited radical scavenging, liver-protective and anti-inflammatory properties during in-Vitro studies. Increasing demand and popularity of *Salvia hispanica* in food, cosmetic and pharmaceutical industries calls for a deeper understanding and exploration of its other benefits.

Keywords: Amino acids, Chia seeds, Fatty acids, *Salvia hispanica*.

I. INTRODUCTION

Chia, scientifically referred as *Salvia hispanica*, is a widely consumed edible herb, indigenous to Latin America region that belongs to mint family (Labiatae), majorly cultivated for its seeds. It is believed that Aztecs were familiar with Chia seeds and its benefits. They consumed chia seeds in diet and made herbal mixtures using it. The lipids derived from the seeds were also utilised in making cosmetics, creative artworks and worship purposes. The word "Chia" is sourced from a Latin term "Chain", meaning "oily" [1].

Salvia hispanica (Chia) seeds are a rich source of Omega 3 fatty acids. It contains upto 40% oil that consists of ω -3 alpha linolenic acid (~60%) and ω -6 linoleic acid (~20%), both of which are vital for good health, naturally occurring and cannot be processed synthetically. *Salvia hispanica* seed contains 15-25% amino acids, 30-33% fatty acids, 26-41% carbohydrates, 18-30% high dietary fibre, 4-5% ash, minerals, vitamins and 90-93% dry matter with large amount of antioxidants. The seed is gluten free [2], mycotoxin free and show safe levels on heavy metal analysis, not surpassing the threshold for metal levels

as per food safety norms [3]. Till date, very few scientifically proven data is available on *Salvia hispanica*, hence these traditionally consumed seeds have a lot of scope to research on. The cardioprotective outcome of ALA and n-3 long chain PUFA on women was also studied [4], leading a backbone for further human clinical studies on *Salvia hispanica* on cardiometabolic disease risk factors.

Chia seeds have a unique chemical constitution and rich nutritional content that make it a rare and expensive ingredient in the food industry. Nanotechnology is utilised to maintain the nutritional quality of the chia seeds by improving the quality of the seeds, bioavailability, safety, controlled release, and precise targeting. Nanocarriers are formed from the nanoemulsions obtained from the seed oils, that act as a vehicle for biologically active compounds. Encapsulated oil seeds have demonstrated elevated bioavailability and prevention of adverse effects. Recent researches have shown that chia seeds based nanoemulsions and nanoliposomes have health enhancing therapeutic applications [5] [6].



Fig. 1: *Salvia Hispanica* Seeds [7]

II. BIOACTIVE COMPOUNDS IN CHIA SEEDS

Chia seeds contain large amounts of dietary fibre and polyunsaturated fatty acids (PUFA). Furthermore, the seeds are also rich in proteins, phenolic compounds, micro-elements, and vitamins. According to past research, the nutritional constitution of chia seeds may alter depending on the plant origin, harvest time, drying, storage, land, germination, bioavailability, and rainfall [8] [9].

Salvia hispanica seed oil contains ~30% fatty acids, from which 80% are essential fatty acids (EFAs), particularly Polyunsaturated fatty acids (PUFA). *Salvia hispanica* has the highest content of Alpha-Linolenic acid (ALA), contrary to other plant sources. ALA, an omega-3 fatty acid (60%) and linoleic LA, an omega-6 fatty acid (20%) are two prominent oils found in *Salvia hispanica* seeds. It has a balanced omega 6 to omega 3 ratio. Omega 9 fulfills 10% amino acid content in *Salvia hispanica* seeds, oleic acid being the most prevalent. Saturated fatty acids contain 10% fatty acid content, palmitic and stearic acid being the most prominent [5]. Carbohydrates comprise upto 40% weight of Chia seeds [10]. Fungus with nutritional significance grows on dead wood, but it can be artificially cultivated on agricultural wastes (coffee husks, eucalyptus sawdust, corncobs and sugar cane bagasse. The fibres (30-34%) made up of oligosaccharides and polysaccharides i.e. cellulose, hemicellulose, pectin and gums [11].

Proteins comprise 15-25% chia seed weight, out of which, globulin (52%) has the highest content, followed by albumins (17%), glutelins (14%), and prolamins (12%). Digestability of *Salvia hispanica* protein is 78.9%, very close to casein, whose digestability is 88.6%, more than other day to day grains. Most abundantly found endogenous amino acid in chia seeds is glutamic acid (Glu). Exogenous amino acids found in *Salvia hispanica* seeds are arginine (Arg), phenylalanine (Phe), histidine (His), isoleucine (Ileu), leucine (Leu), lysine (Lys), methionine (Met), threonine (Thr), tryptophan (Trp), and valine (Val) [12].

Chia seeds are rich in polyphenols such as phenolic acids, depsides (chlorogenic acid, rosmarinic acid), flavonoids (apigenin, kaempferol, quercetin, myricetin, rutoside), isoflavones (daidzein, glycitin, genistein, genistin), and catechin derivatives. 0.5 µg/g Carotenoids (carotenes and xanthophylls) and traces of tannins and phytates are also found in the seeds of *Salvia hispanica* [13] [14].

Chia seeds also contain sterol compounds like β-sitosterol (2057 mg/kg), stigmasterol (1248 mg/kg), campesterol (472 mg/kg), and Δ5-avenasterol (355 mg/kg). Chia seeds also contain macroelements like phosphorus (P), iron (Fe), manganese (Mn), calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), or sulfur (S), and microelements like zinc (Zn), copper (Cu), molybdenum (Mo), and selenium (Se). Chia seeds are particularly abundant in Calcium (upto 800 mg/100 g) and Magnesium (upto 460 mg/100 g) [9]. They are also rich in Vitamin B complex, A, C and E [15]. Chia seeds can be a perfect food additive for celiac patients as it is gluten free [16].

III. THERAPEUTIC PROPERTIES OF CHIA SEEDS

The nutritional bioactive compounds like linolenic acid, carotenoids and rosmarinic quercetin found in *Salvia hispanica* seeds have anti-cancer, antioxidant, anti-inflammatory effects [6] [17] the endogenous antioxidants of an underexplored

bakery product might show different responses regarding free radical scavenging/resistance to forced oxidation than what is expected for other foods previously reported in the literature. In this context, a Box-Behnken design and correlation studies were applied in order to obtain more information about how specific antioxidants affect the total antioxidant activity (TAC). Tocopherols exhibit anti-inflammatory, anti-oxidant, anti-ageing and anti-cancer properties [15]. High fibre content present in chia seeds prevents circulatory and digestive diseases. It also works efficiently against diabetes, kidney stones, haemorrhoids, colorectal cancer and metabolic disorders [11]. Phenolic compounds provide strong evidence against cardiovascular diseases and diabetes. They also have anti-diabetic, anti-carcinogenic, anti-hypertension, and antioxidant properties. Gallic acid has anti-oxidant, anti-diabetic, anti-leukemic, anti-inflammatory, and anti-neoplastic properties. Caffeic acid possesses hypoglycaemic, neuro-protective, anti-carcinogenic, anti-hypertensive, and antioxidant activity [18].

IV. CONCLUSION

Salvia hispanica (Chia) seeds are gaining popularity due to their high protein and lipid content, along with abundance of vitamins, minerals, antioxidants, and phytochemicals. The health benefits of chia seed, puts it in the category of super foods. It holds an important place when making new recipes with high nutritional value. It is gluten free, which makes it perfect for celiac patients. Further, exploration of the potential of *Salvia hispanica* seeds need to be studied in much detail for better utilisation of its benefits.

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