



## ENORMOUSLY BENEFICIAL CHIA SEEDS IN MODERN FOOD REGIMEN

Upma Singh<sup>1</sup>, Monika Chamoli<sup>2</sup>, KP Singh<sup>3</sup>, Lalit Mohan<sup>4</sup> and Raaz K. Maheshwari<sup>5\*</sup>

<sup>1</sup>Department of Applied Chemistry, School of Vocational Studies & Applied Sciences, Gautam Buddha University, Gautam Buddha Nagar, Greater Noida, Uttar Pradesh, India

<sup>2</sup>Department of Applied Sciences, Pt LR College of Technology, Faridabad, Haryana, India

<sup>3</sup>Department of Genetics & Plant Breeding, School of Agriculture Jaipur National University, Jaipur, Rajasthan, India

<sup>4</sup>Department of Zoology, Dayalbagh Educational Institute, Agra, Uttar Pradesh, India

<sup>5</sup>Department of Chemistry, SBRM Govt PG College, Nagaur, Rajasthan, India

Received on: 18.02.2022

Revised on: 26.02.2022

Accepted on: 09.03.2022

### Abstract

Chia seed is a potential source of antioxidants with the presence of chlorogenic acid, caffeic acid, myricetin, quercetin, and kaempferol which are believed to have cardiac, hepatic protective effects, anti-ageing and anti-carcinogenic characteristics. Chia seed possesses higher proportion of  $\alpha$ -linolenic acid makes chia the superb source of  $\omega$ -3 fatty acid (~65 % of the oil content). It is also a great source of dietary fibre with higher concentration of beneficial unsaturated fatty acids, gluten free protein, vitamin, minerals and phenolic compounds. Therapeutic effects of chia in the control of diabetes, dyslipidaemia, hypertension, as anti-inflammatory, antioxidant, anti-blood clotting, laxative, antidepressant, anti-anxiety, analgesic, vision and immune improver is scientifically established. This comprehensive review paper describes the huge nutritional and therapeutic potential of chia seed to make it the part of an average diet for better healthcare.

### Keywords

$\omega$ -3 fatty acids, Laxative, Anti-inflammatory,  $\alpha$ -linolenic acid, Chlorogenic acid, Kaempferol, Widdrol

### INTRODUCTION

Chia seeds are tiny black and white seeds from the *Salvia Hispanica* L. plant that are also a member of the mint family (Labiatae). Chia seeds were originally grown in Central and South America, and were considered a major food crop in Mexico and Guatemala. The word chia is derived from a Spanish word chian which means oily, it is oilseed, with a power house of  $\omega$ -3 fatty acids, superior quality protein, higher extent of dietary fibre, vitamins, minerals and wide range of polyphenolic antioxidants which safeguard the seeds from chemical and microbial breakdown. Chia can grow up to 1 m tall and has opposite arranged leaves. Chia flowers are small flower (3-4 mm) with small corollas and fused flower parts. The seed color varies from black, grey, and black spotted to white, and the shape is oval with size ranging from 1 to 2 mm. [1-2] Prominently, grown for its seeds, *Salvia hispanica* also produces white or purple flowers. Recently,

chia has regained its popularity by becoming one of the main oil sources that contains high levels of PUFA. Chia, which used to be the major food crop of the indigenous peoples of Mexico and Guatemala, is now widely cultivated and commercialized for its (omega)  $\omega$ -3 alpha-linolenic acid (ALA) content and antioxidant properties. Today, its cultivation is not only limited to the Americas but is also extended to other areas such as Australia and Southeast Asia. Chia sprouts are used in salads, chia seed is used in beverages and cereals based foods and it can be consumed in raw form. Traditionally seeds have been used as a food, in a wide range of folk medicines, primary cosmetics and a part of religious rituals in pre-Columbian societies. The diets in pre-Columbian regimes were as nutritious as today. The chia seed is widely used in many countries since thousands of years due to its massive nutritional and therapeutic potential. [3-5] Existence of chia as an integral part of the pre-Columbian diet

had made their diets even superior to today's diet which is also admitted by the modern science. The massive nutritional and therapeutic potential of chia offers a great future perspective for pharmaceutical sector. In present times, there exists a cumulative consideration and dispersal of the seeds of the plant for the advantages and uses in cookery. The seeds are known as the very rich foundation of nutrients, first of all, the polyunsaturated omega-3 fatty acids which secure your

health from inflammation, advance the reasoning presentation and decrease the level of cholesterol. Additionally, sugars founded fibers which exist at high attentiveness level, are linked with decreasing inflammation, dropping cholesterol and adaptable bowel functions which eventually lead to healthy life. This appraisal recapitulates the present in-formation on the photochemistry and pharmacological characteristics of the seeds of chia plant. [5-7]



Figure 1: Chia plant.



Figure 2: Chia seeds.

The chia's main fats are  $\alpha$ -linolenic acid (ALA) and linoleic acid (LA), with a smaller numbers of (saturated fatty acids), oil (omega-9), and stearic (saturated) acids. The most popular lipids are a  $\alpha$ -linolenic acid. ALA and LA are the two only essential fatty acids which individuals have to put into their diet, as they cannot be synthesized by their bodies. For chia, ALA, fatty acids are  $\sim 60\%$ , LA is about  $20\%$ . ALA is a source of many benefits, as well as the correlation of cardiovascular and neurological health, to the long-chain Omega-3 fatty acids DHA and Eicosatetraenoic (EPA) In addition, chia seeds are also used in the preparation of cake for example as healthy supplements with oil, and can be used in beverages, cereal and salads. [8-9] Chia seeds in bread products at a value of no more than 5 per cent, including breakfast, cookies, fruit juices and yogurt, have already been permitted in the European Committee. The seeds of chia contain high fiber content (18 - 30 g/100 g). It has been reported that their use can encourage proper intestinal functioning, reduce the level of blood cholesterol and glucose due to the use of chia seed. Such fatty acids are responsible for the effective functioning of the vision, cardiovascular diseases, cancer, autoimmune and inflammatory diseases, and also for prevention. These fatty acids are not only nutritionally important for health, but also helpful to people with heart disease, and diabetes. [10-11]

#### PHYTOCONSTITUENTS AND NUTRITIONAL ATTRIBUTES

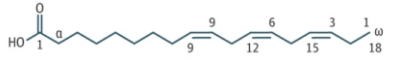
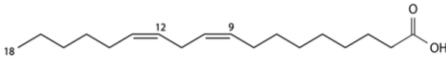
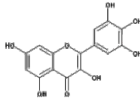
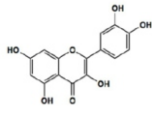
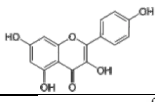
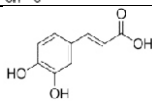
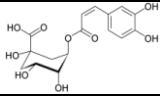
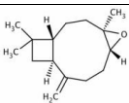
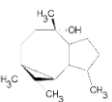
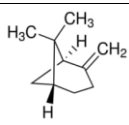

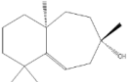
The seed contains  $\omega$ -3  $\alpha$ -linolenic acid ( $\omega$ -3ALA) and  $\omega$ -6 linoleic acid ( $\omega$ -6LA). Both (PUFAs) Polyunsaturated fatty acids are essential fatty acids required by the human body for

good health, and they cannot be artificially synthesized. The protein, fat, carbohydrate, dietary fibre, ash and dry matter contents of chia seeds ranged from 15 to 25 %, 30–33 %, 41 %, 18–30 %, 4–5 % and 90–93 % with a wide range of polyphenols, respectively. The protein content of chia seed grown in different habitats ranged from 18.8 % to 21.5 %, the variation in protein content was probably be due to agronomic, climatic and soil conditions. In another study regarding the nutritional characterization of chia seed; medicinal characteristics of chia seed reported that seed exhibited 20 % protein, 25 % fibre and 34 % oil. The high fibre content of chia seed as health perspective, fibre increases stool volume, prevent from diverticulosis and cancer. [12-14] Chia is considered as a safe food with no potentially harmful effects and widely used in baked goods, nutritional supplements, cereal bars, cookies, bread, snacks etc. Chia seed contains appreciable amount of fibre, which can absorb up 15x water the weight of seed. The presence of higher extents of fibre help in diabetes mellitus by slowing down the digestion process and release of glucose, it also improves the peristaltic movement of intestine and reducing plasma cholesterol. The biological value of chia is superior to cereals and higher content of calcium, magnesium and potassium than milk. It is revealed from the studies that chia seed had a higher concentration of phytosterols which have and cancer and cardio-protective effect with antimicrobial activities. Recently, it is established that mucilage of chia seed can be utilized as a functional coating with improved functional properties. The leaves of chia contain an essential oil that contains  $\beta$ -caryophyllene, globulol,  $\gamma$ -muroleno,  $\beta$ -

pinene,  $\alpha$ -humoleno, germacren-B, and widdrol. [15-18] These compounds are believed to have strong repellent characteristics to a wide range of insects. Two tablespoons of this super-seed contain around 140 calories, 4 grams of protein, 11 grams of fiber, 7 grams of unsaturated fat (omega-3 fatty acids) and contain over 18% of your RDA for calcium. They're also a good source of trace minerals like copper and

zinc. They contain all nine essential amino acids necessary as the building blocks for protein in the body. [19-23] Not only are chia seeds high in calcium, but they are also loaded with manganese and phosphorous, two crucial minerals involved in bone health. Chia seeds also help us get full, faster, due to their high tryptophan content, also helping to regulate appetite, sleep, and improve our mood!

**Table 1: Chemical structure of phytoconstituents occurring in Chia Seed and leaf.**

$\omega$ -3ALA (18:3)	
$\omega$ -6LA (18:2)	
Myricetin	
Quercetin	
Kaempferol	
Caffeic acid	
Chlorogenic acid	
$\beta$ -caryophyllene	
Globulol	
$\beta$ -pinene	
Germacren-B	
Widdrol	

### CULINARY USES

The European Commission approved the use of chia seed (<5%) in bread products. Other than bread, the food industry of various countries around the world including US, Canada, Chile, Australia, New Zealand, and Mexico has widely used chia seeds or its oil for different applications such as breakfast cereals, bars, cookie snacks, fruit juices, cake, and yoghurt. At present, chia

seed is used as a healthy oil supplement and is commonly consumed as salad from chia sprout, in beverages, cereals, and salad dressing from the seed, or it is eaten raw. Biscuits, pasta, cereal bars, snacks and yoghurt and cake are usually supplemented with chia seed. Chia is one of the few medicinal plants that produce essential oil in a great concentration, which is used for the preparation of omega-3 capsules.

## CONCLUSION

Seed from *Salvia hispanica* L. or more commonly known as chia is a traditional food in central and southern America. Currently, it is widely consumed for various health benefits especially in maintaining healthy serum lipid level. This effect is contributed by the presence of phenolic acid and omega 3/6 oil in the chia seed. Isolated polyphenolics from chia seed are chlorogenic acid, caffeic acid, myricetin, quercetin and kaempferol. Quercetin, chlorogenic acid, caffeic acid are believed to have anti-carcinogenic, antihypertensive, neuron protective effects. It is already well established that chia does not have anti-allergic, anti-nutritional and toxic effect on human health. Although the presence of active ingredients in chia seed warrants its health benefits, however, the safety and efficacy of this medicinal food or natural product need to be validated by scientific research.

## REFERENCES

1. Cahill JP, Provance MC (2002) Genetics of qualitative traits in domesticated chia (*Salvia hispanica* L.) *J Heredity* 93(1):52–55.
2. Reales A, Rivera D, Palazón JA, Obón C (2004) Numerical taxonomy study of *Salvia* sect. *Salvia* (*Labiatae*) *Bot J Linn Soc* 145(3):353–371.
3. Ullah R, Nadeem M, Khalique A, Imran M, Mehmood S, Javid A, Hussain J (2015) Nutritional and therapeutic perspectives of Chia (*Salvia hispanica* L.): A review. *J Food Sci Technol* 2016 Apr; 53(4): 1750–1758. doi: 10.1007/s13197-015-1967-0
4. Ali NM, Yeap SK, Ho WY, Beh BK, Tan SW, Tan SG (2012) The Promising Future of Chia, *Salvia hispanica* L. *J Biomed Biotechnol* 171956. doi: 10.1155/2012/171956.
5. Bresson JL, Flynn A, Heinonen M et al. (2009) Opinion on the safety of Chia seeds (*Salvia hispanica* L.) and ground whole Chia seeds as a food ingredient. The Eur Food Safety Auth J 996:1–26.
6. Peiretti PG, Gai F (2009) Fatty acid and nutritive quality of chia (*Salvia hispanica* L.) seeds and plant during growth. *Ani Feed Sci Technol* 148(2–4):267–275.
7. Ixtaina VY, Nolasco SM, Tomás MC (2008) Physical properties of chia (*Salvia hispanica* L.) seeds. *Indus Crops Prod* 28(3):286–293.
8. Ayerza h R, Coates W (2011) Protein content, oil content and fatty acid profiles as potential criteria to determine the origin of commercially grown chia (*Salvia hispanica* L.) *Indus Crops Prod* 34(2):1366–1371.
9. Ayerza h R (1995) Oil content and fatty acid composition of chia (*Salvia hispanica* L.) from five northwestern locations in Argentina. *J Am Oil Chemists' Soc* 72(9):1079–1081.
10. Vedtofte MS, Jakobsen MU, Lauritzen L et al. (2011) Dietary alpha linoleic acid, linoleic acid and n-3 long-chain PUFA and risk of ischemic heart disease. *The American Journal of Clinical Nutrition*. 2011;94:1097–1103.
11. Ixtaina VY, Nolasco SM, Tomás MC (2012) Oxidative Stability of Chia (*Salvia hispanica* L.) Seed Oil: effect of Antioxidants and Storage Conditions. *J Am Oil Chemists' Soc* 89:1077–1090.
12. Capitani MI, Spotorno V, Nolasco SM, Tomás MC (2012) Physicochemical and functional characterization of by-products from chia (*Salvia hispanica* L.) seeds of Argentina. *LWT—Food Sci Technol* 45(1):94–102.
13. Ixtaina VY, Mattea F, Cardarelli DA, Mattea MA, Nolasco SM, Tomás MC (2011) Supercritical carbon dioxide extraction and characterization of Argentinean chia seed oil. *J Am Oil Chemists' Soc* 88(2):289–298.
14. Uribe JAR, Perez JIN, Kauil HC, Rubio GR, Alcocer CG (2011) Extraction of oil from chia seeds with supercritical CO<sub>2</sub>. *J Supercrit Fluids*. 56(2):174–178.
15. Ixtaina VY, Vega A, Nolasco SM, et al. (2010) Supercritical carbon dioxide extraction of oil from Mexican chia seed (*Salvia hispanica* L.): characterization and process optimization. *J Supercrit Fluids* 55(1):192–199.
16. Borneo R, Aguirre A, León AE. Chia (*Salvia hispanica* L) gel can be used as egg or oil replacer in cake formulations. *Journal of the American Dietetic Association*. 2010; 110(6): 946–949.
17. Olivos-Lugo BL, Valdivia-López MÁ, Tecante A (2010) Thermal and physicochemical properties and nutritional value of the protein fraction of mexican chia seed (*Salvia hispanica* L.) *Food Sci Technol Int* 16(1):89–96.
18. Illian TG, Casey JC, Bishop PA. Omega 3 chia seed loading as a means of carbohydrate loading. *J Strength Conditioning Res* 2011;25(1):61–65.
19. Ayerza R, Coates W (2007) Seed yield, oil content and fatty acid composition of three botanical sources of ω-3 fatty acid planted in the Yungas ecosystem of tropical Argentina. *Trop Sci* 47(4):183–187.
20. Coates W, Ayerza R (1996) Production potential of chia in northwestern Argentina. *Indust Crops Prod* 5(3):229–233.
21. Baughman WF, Jamieson GS (1992) Chia seed oil. *Oil Fat Indust* 6(9):15–17.
22. Basuni AM, Arafat SM, Hikal DM (2021) Chia (*Salvia hispanica* L.) Seed Oil Rich in Omega-3 Fatty Acid: A Healthy Alternative for Milk Fat in Ice Milk. *Food Nut Sci* 12:479-493.
23. The Chia Company. Request for scientific evaluation of substantial equivalence application for the approval of Chia seeds (*Salvia hispanica* L.) from the Chia Company for use in bread. Food Law Consultants, 2010, <http://www.food.gov.uk/multimedia/pdfs/thechiacompany.pdf>.