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NUTRITIONAL COMPOSITION AND ANTI-OXIDANT PROPERTIES OF CHIA SEED (SALVIA HISPANICA L.)

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ABSTRACT

Chia (Salvia Hispanica L.) is a herbaceous plant belongs to Lamiaceae family. The seed colour are black, grey and spotted black seed with size ranging from 1 to 2 mm. Chia is planted in April or May and harvested in October. The objective of the study is to determine the nutritional analysis and antioxidant properties of Chia seed. Nutritional analysis was done for moisture, protein, fat, carbohydrate, calcium, iron, total ash and crude fibre. Determination of antioxidant activity of Chia seed was done for Percent (%) anti radical activity (DPPH), Total phenolic content and Total Flavonoid Content. In proximate composition of Chia seed powder (per 100g) showed energy content 397.85 kcal, carbohydrate 10.36 g, protein 18.34 g, total fat 31.45g, moisture 6.60 g, total ash 4.74g, crude fiber 28.51 g, calcium 573.89 mg, iron 6.80 mg, Total Phenol content 8.21 mgGAE. Hence, Chia seed powder found higher in protein, calcium, crude fiber, iron and lower in carbohydrate. Chia seeds have enormous nutritional capability hence further research may be envisaged to prepare in combination with other super foods different health supplement which can be beneficial to different age group people as per needs of their age. Research could be advanced to bring down the cost chia seeds within the reach of the common people through development of different breeds and varieties of chia seeds using genetic engineering.

Keywords: *Chia (Salvia Hispanica L.), Nutritional analysis, Antioxidant properties*

1. INTRODUCTION

Chia *(Salvia hispanica L.)* is a plant which comes under herb category and is harvested annually. It belongs to the *Lamiaceae* or *Labiatae* family[1]. Native Mexico and Guatemala, along with Bolivia, Nicaragua Ecuador, Northwest of Argentina, Parts of Australia, and the south-western United States grows it and consumes it and its commercial use is also done .Locally recognized for its medicinal uses. The Indigenous South American people of the pre-Columbian and Aztec eras gave *Salvia hispanica L.* its common name chia**[2].** Chia is cultivated in April and May and harvested in the month of October. It can grow up to 1.75 metres (5.7 feet) tall, with opposite leaves that may be 4–8 cm (1.6–3.1 in) in length and 3–5 cm (1.2–2.0 in) in width. It bears flowers which are purple or white in colour and are produced in numerous clusters in a spike at the end of each stem. The seed may be of black, grey, and black spotted to white, and is oval in shape with size range of 1 to 2 millimetre. Mexico, Argentina and the south-western United States consume chia seeds[1]. It has been proposed as an alternative crop for the field crop industry because it can even grow in arid environments[3]. Light to medium clay or sandy soils

suits the cultivation of *S. hispanica L*. Well-drained, moderately fertile soil is preferable but it can cope with acid soils and even moderate drought[4]. Moisture is needed for seedling establishment when chia seeds are sown, while wet soil is not suitable for the maturing chia plant during growth. The risk of chronic degenerative diseases is reduced by the nutritional value inherent in chemical compositions of functional foods in addition to health benefits which they offer[5].

2. MATERIALS AND METHOD

The present research study entitled **"Nutritional Composition And Anti-Oxidant Properties Of Chia Seed *(Salvia Hispanica L.)*"** was carried out in Allahabad city to attain the objectives of Research by using following methodology.

1. **Experimental site:** The present investigation was carry out in the Nutrition Research Laboratory, Food Nutrition and Public Health, Ethelind College of Home Science.
2. **Procurement of Chia Seed**: Chia seed was purchased from supermarket of Allahabad.
3. **Preparation of Chia Seed Powder:** The seeds will be cleaned to remove the dust and impurities. The Chia seed are then grinded to homogeneous powder.
4. **Analysis of nutritive value of Chia Seed**

(a) Determination of moisture-Sample is heated at specified temperature of specific period of time and the loss in weight was recorded as moisture content of the sample.

(b) Determination of protein by (Lowry's method)- Protein reacts with the Folin- Ciocalteu reagent (FCR) to give a blue coloured complex. The colour so formed is due to the reaction of the alkaline copper with the protein as in the biuret test and the reduction of Phosphomolybdic – phosphotungste components in FCR by amino acid tyrosine and tryptophan present in the protein. The intensity of the blue colour is measured colometrically at 66 nm. The intensity of the colour depend on the amount of these aromatic amino acids present and will vary for different protein.

(c) Determination of Crude fibre- The dry fat free material is boiled successively with the diluted acid and the dilute alkali for a specific time period and filtered. The residue was dried and ignited. The loss in weight on ashing gives crude fibre. This consists of cellulose and lignocelluloses.

(d) Determination of Total Ash- Ash comprises the mineral contents of feeds, foods and feeding stuff which can be determined by igniting a known amount of dried material (moisture free) in a muffle furnace.

(f) Determination of Crude Fat- The sample of dried food stuff is placed in a continuous extractor (Soxhlet) and subjected to extraction with the ether. The ether soluble substance thus removed and collected in a flask, dried and weighed. The material extracted includes besides triglycerides, materials such as phospholipids, essential oils, pigments, waxes etc hence term 'crude fat'.

(g) Estimation of calorific value or energy value by calculation method (AOAC, 2007) - ENERGY= CHO×4+FAT×9+PROTEIN×4

(h) Estimation of Calcium

Preparation of Mineral Extract

Samples (500mg) were taken in a 100 ml conical flask and 5ml concentrated nitric acid was added. The mixture was evaporated in fume hood to dryness. After cooling 10 ml tertiary mixture (H_2SO_4: HCL: HNO_3= 1:4:10) was added and again evaporated to dryness and then cooled. Concentrated HCL (5ml) added and filtered. Volume makeup to 100ml with distilled water and then further analysis was done for mineral estimation.

Determination of Calcium

The extract(5ml) was added to distilled water(20ml) followed by 10 drops of sodium cyanide(1%),10 drops of hydroxylamine-HCL and one drops of 1% potassium ferricyanide solution which results into yellow colour development. Sodium hydroxide solution10% added till yellow colour disappeared. A pinch of mureoxide (ammonium perpurate) powder was added to the resultant solution. Titration was carried out with EDTA (0.02N).The end point is colour change from pink to purple. The amount of EDTA consumed is equivalent to the amount of calcium present in the sample, expressed as g/100g of sample.

(i) Determination of iron- Ferrous iron in acid solution reacts with the potassium thiocynate to form an intense red compound of ferric thiocynate. The compound was extracted with the organic potassium persulphate and measured colorimetrically at 560 nm.

5. Estimation of Antioxidants

(a) Determination of anti-oxidant activity: -.

Percent (%) anti radical activity

10 mg sample was weighed and dissolved in 10 ml of acidified methanol. Sample solution was further heated for 20 min at 40°C in boiling water bath and centrifuged.

100 µl of sample extract was taken in test tube and 150 µl of DPPH solution added. The final volume was made up to 3 ml with pure methanol. Solution was incubated for 15 min at room temperature and read the absorbance at 515 nm.

(b) Total phenolic content (TPC)- The total phenolic content (TPC) in different extracts was estimated[6] and expressed as gallic acid equivalents (GAE) mg/g on a dry weight basis.

The Folin–Ciocalteu (F–C) reagent is sensitive to reducing compounds, polyphenols and thus produces a blue colour complex. The F-C assay relies on the transfer of reducing equivalents (electrons), in the alkaline medium, from phenolic compounds to phosphomolybdic/phosphotungstic acid complexes, manifested in the formation of blue colour complexes [possibly $(PMoW_{11}O_{40})^{4-}$] that are determined on

a UV-visible spectrophotometer (Thermo Fischer model Evolution 201) by monitoring the absorbance at 765 nm. Gallic acid was used as the reference compound for comparison and values are evaluated as the mg equivalent of gallic acid per gm of extract.

(c) Estimation of Total Flavonoid Content- Total flavonoid content (TFC) was estimated[7] and expressed as mg quercetin equivalent (QE)/g extract.

The principle involved in Aluminium chloride ($AlCl_3$) colorimetric method is that $AlCl_3$ forms acid stable complexes with the C-4 keto groups and either the C-3 or C-5 hydroxyl group of flavones and flavonols. In addition it also forms acid labile complexes with the ortho-dihydroxyl groups in the A- or B-ring of flavonoids. For building the calibration curve, quarcetin is used as a standard material. Various concentrations of standard quercetin solution were used to make a standard calibration curve[8].

STATISTICAL ANALYSIS

The collected data will be analysed by using analysis of variance (ANOVA) ,chi-square test and other appropriate statistical tools as per objectives of the study. The collected data was analyzed with the help of appropriate statistical techniques.

TOOLS & DATA COLLECTION

The latest literature from Books, Journals will be collected for Research work. The data obtained from sensory evaluation were statistically analyzed by using analysis of variance technique (one way classification).

Formula used for statistical analysis:

Analysis of variance: $G = T_1 + T_2 + T_3 \ldots\ldots\ldots\ldots\ldots\ldots + T_n$

$G = R_1 + R_2 + R_3 \ldots\ldots\ldots\ldots\ldots + R_n$

1. Correction factor (C.F) $= G^2/rt$

2. Treatment S.S= $\frac{T12+T22+T32\ldots\ldots+Tn2}{r}$ – C.F

3. Replication S.S= $\frac{R12+R22+R32\ldots\ldots+Rn2}{r}$ – C.F

4. Total S.S=Sum of each observation-C.F

5. Error S.S= Total S.S-S.S due to treatments –S.S due to replications

G= Ground total

t = Treatment

r =Replication

S.S= Sum of squares

Critical difference (C.D)=$\sqrt{2} \times E.M.S.S/r$

C.D=S.E× t(5%) on error d.f

Where, S.E=Standard error

✓ E.M.S. S=Error mean sum of square

Source of variation	d.f	S.S	M.S.S	F Calculated	F total (5%)	R cal.
Due to treatment(T)	t-1	S.S.tr	S.S Tr /t-1	M.S.S.Tr/E.M.S.S		S/NS
Due to replication(R)	r-1	R.S.S	R.S.S /r-1	M.R.S.S/E.M.S.S		
Due to error	(t-1) (r-1)	E.S.S	E.S.S / (t-1) (r-1)			
Total	(rt-1)	t.S.S				

3. RESULT & DISCUSSION

The result pertaining to the research **"Nutritional Composition And Anti-Oxidant Properties of Chia Seed *(Salvia Hispanica L.)*"**are presented and discussed under following phases -

3.1 Proximate and micronutrient composition of Chia Seed Powder

3.2 Antioxidant composition of Chia Seed Powder

3.1 PROXIMATE AND MICRONUTRIENT COMPOSITION OF CHIA SEED POWDER

Table 3.1 Proximate composition and mineral of Chia seed powder (100g)

Nutrients	**Chia seed powder**
Energy kcal/100g	397.85±0.4
Protein g/100g	18.34±0.2
Fat g/100g	31.45±0.01
Carbohydrate g/100g	10.36±0.3
Moisture %	6.60±0.2
Calcium mg/100g	573.89±0.05
Iron mg/100g	6.8 ±0.4
Total ash g/100g	4.74±0.05
Crude fiber g/100g	28.51±0.03

mean ±SD significant at 5% and 1 level of significance%

Table 3.1 shows that Chia seed is rich in protein which is 18.34 g/100gm, highly rich in Calcium i.e., 573.89 mg which makes it good source for growing children (adolescent) pregnant, lactating women and old age people. High in fiber which is 28.51gm, that almost fulfils the recommended dietary allowance. Rich in iron i.e., 6.8 mg that again can be used as a source of iron for pregnant and lactating women.

3.2 ANTIOXIDANT COMPOSITION OF CHIA SEED POWDER

Table 3.2 Antioxidant composition of Chia seed powder (100g)

Nutrient	Chia Seed Powder
DPPH (%)	96.72±0.05
Total Phenolic Content (mgGAE/100g)	8.21±0.04
Total Flavanoid content (mgGAE/100g)	0.58±0.04

mean ±SD significant at 5% and 1 level of significance%

Table 3.2 shows that Chia seed is high in antioxidants DPPH is 96.72 % and TPC is 8.21 mgGAE/100gm.

4. CONCLUSION

Thus, the present research concludes that proximate composition of Chia seed powder (per 100g) showed energy content 397.85 kcal, carbohydrate 10.36 g, protein 18.34 g, total fat 31.45g, moisture 6.60 g, total ash 4.74g, crude fiber 28.51 g, calcium 573.89 mg, iron 6.80 mg, Total Phenol content mg and total Flavonoid content mg. Hence, Chia seed powder found higher in protein, calcium, crude fiber, iron and lower in carbohydrate.

And with establishment of nutritional superiority of chia seeds and its suitability for alleviating nutritional challenges prevalent in India .There is sufficient evidence to draw the attention of government to include chia seeds in its plan of things and provide impetus by way of policy and program implementation so that it may be used as super food in India and enable India to emerge as prominent player in its lucrative trade. It can also be used to increase the farmer's income as it is sold between 8000 per quintal to rs 100000 per quintal which is huge compared to the conventional crop price which they avail. Invariably yield per hectare is about 3000kg and input cost is low with nearly pest free cropping this is certainly an opportunity for even marginal farmers to get out of vicious cycle of poverty and distress. Presently in India cultivation at small scale has kick started in parts of Karnataka and Rajasthan which should be expanded in acreage and yield through investment and research.

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