International Journal of Agricultural Sciences ☞DOI:10.15740/HAS/IJAS/19.1/200-205
Volume 19 | Issue 1 | January, 2023 | 200-205 ■ ISSN : 0973-130X Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Preparation of value-added food products by the incorporation of chia seeds and sunflower seeds

Priyanka Gupta*, Alka Gupta **and** Ranu Prasad[1]
Department of Food Nutrition and Public Health, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India

Abstract : Super foods are foods that have a very high nutritional density. This means that they provide a substantial amount of nutrients and very few calories, which provides a clinically proven and documented health benefit and thus, an important source of in the prevention, management and treatment of chronic diseases of the modern age. The present study was undertaken with the objectives to develop a nutritious *Laddu* and *Gajak* by the incorporation of Chia and Sunflower seeds and to assess their organoleptic quality as well as nutritive value. Two value added products *"Laddu"* and *"Gajak"* were prepared by incorporation of chia and sunflower seeds at different levels, 5, 10 and 15 per cent, respectively. Sensory evaluation with respect to colour and appearance, body and texture, taste and flavour and overall acceptability was done by five panel members using the nine-point Hedonic scale. Chemical analysis of the developed food products for moisture, total ash, protein, crude fibre and fat were determined by AOAC (2005) method. Calcium and iron was estimated by colorimeter. The value of carbohydrate and energy was calculated by difference method. On the basis of results, it is concluded that Chia seeds and sunflower seeds was successfully incorporated in preparation of the products like *Laddu* and *Gajak*. The sensory attributes of the prepared products with different treatments T_2 (Ragi flour (40%), Chia seeds (10%), sunflower seeds (10%), *Ghee* (10%) and Jaggery (30%)) of *Laddu* and T_2 (Gingelly seeds, Chia seeds, Sunflower seeds and Jaggery) of *Gajak,* were highly accepted by the panel members, when compared to control *i.e.* T_0. Chemical analysis of this study concludes that the preserved products *Laddu and Gajak* made by the incorporation of Chia seeds and sunflower seeds were good sources of energy, calcium, fibre, protein and fat content. It is reveals that nutritive composition of the prepared products were significantly increased as the incorporation level increased. Cost of *Laddu* is slightly increased from control to treatments. T_3 has the highest cost and T_0 has the lowest cost. Cost of *Gajak* is also increased from control to treatments. T_3 has the highest cost and T_0 has the lowest cost.

Key Words : Chia seeds, Sunflower seeds, *Laddu, Gajak*, Nutritional composition, Value addition

View Point Article : Gupta, Priyanka, Gupta, Alka and Prasad, Ranu (2023). Preparation of value-added food products by the incorporation of chia seeds and sunflower seeds. *Internat. J. agric. Sci.*, **19** (1) : 200-205, **DOI:10.15740/HAS/IJAS/19.1/200-205.** Copyright@2023: Hind Agri-Horticultural Society.

Article History : Received : 03.08.2022**; Revised :** 07.11.2022**; Accepted :** 08.12.2022

INTRODUCTION

Functional foods are in high demand because of the changing lifestyle. A healthier lifestyle is necessary for overcoming various diseases like, cardiovascular disease, high blood pressure, obesity, diabetes, etc. These conditions are common for a person having busy lifestyle and improper diet where the daily food contains high

***Author for correspondence:**
[1]Ethelind College of Home Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India

amounts of saturated fatty acids. The total dietary fiber intake in the diet is important to overcome various health problems (Srivastava and Verma, 2014).

People consider nutritional seeds as supernatural food because of the high quantity of fibres, Omega 3-fatty acids, Omega 6-fatty acids, antioxidants and many important vitamins and minerals. These seeds have rich nutritional properties and can be easily used as ingredient. When consumed as part of a healthy diet, seeds can help reduce blood sugar, cholesterol and blood pressure.

Chia is known as super food as it contains highly concentrated amounts of essential fatty acids, dietary fibres, vitamins and antioxidants. The seeds also contain the essential minerals, phosphorus, manganese, calcium, potassium and sodium (Anonymous, 2010).

Therapeutic effects of Chia in control of hypertension, dyslipidemia, as antioxidant, anti-inflammatory, antithrombotic, hepato-protective, antidiabetic, cardio protective, anticancer, antidepressant, antianxiety and as immune improver is scientifically established. Bactericidal and antifungal activities in plant extracts have been also well documented (Bidgoli *et al.,* 2010 and Capitani *et al.*, 2012).

Sunflower seeds are highly popular in food mixes, multi-grain bread and bars and are thought to be nutritionally beneficial. These seeds are rich in healthy fats, useful plant compounds and many vitamins and minerals. These nutrients may play a role in reducing the risk of developing common health problems (Anjum *et al.,* 2012 and de Lamo and Gomez, 2018). 100g of sunflower seeds contain moisture 5.5%, protein 19.8g, fat 52.1g, fibre 1g, carbohydrate 17.9g, energy 620 kcal, calcium 280mg, phosphorus 670mg and iron 5 mg (Gopalan *et al.*, 2007).

The nutritional composition of sunflower seeds and oil has dictated their functional properties, also effective in preventing or controlling human diseases such as diabetes, cancers, hypertension, hypercholesterolemia, and coronary heart disease (Katsarou *et al.,* 2015).

MATERIAL AND METHODS

The present study entitled Preparation of value-added food products by the incorporation of Chia seeds and sunflower seeds was conducted in Department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh.

Procurement of raw materials:

The raw materials for the preparation of value-added food products like Chia seeds and sunflower seeds and other ingredients were procured from the local market of Prayagraj.

Flow chart for the prepatation of chia seed powder:

Chia seeds
↓
Cleaning
↓
Sun drying (2 days)
↓
Roasting (5 min.)
↓
Grinding
↓
Chia seed powder
↓
Pack in airtight container

Source: Srivastava and Kumar (2003).

Flow chart for the preparation of sunflower seed powder:

Sunflower seed
↓
Cleaning
↓
Sun drying (2 days)
↓
Roasting (5 min.)
↓
Grinding
↓
Sunflower seed powder
↓
Pack in airtight container

Source: Srivastava and Kumar (2003).

Development of value-added food products:

Laddu and *Gajak* were developed by the

incorporation of chia seeds and sunflower seeds. The standard recipe of selected products was served as control. The treatment combination was fixed on trial basis.

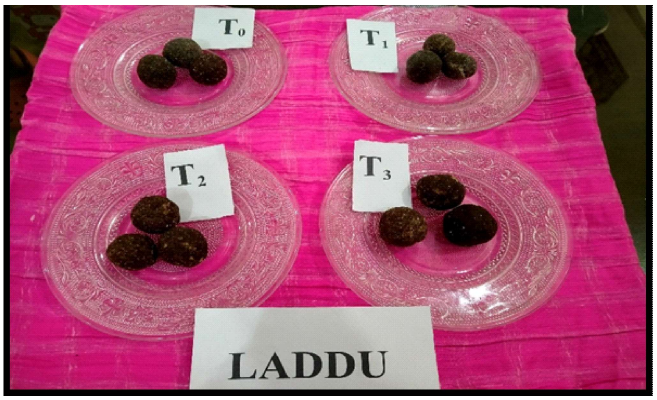
Preparation of *Laddu* with incorporation of Chia seeds and sunflower seeds powder :

– T_0 (control) - The product was prepared by using 60g Ragi flour, 10g *Ghee* and 30 ml of Jaggery syrup.

– T_1 - The product was prepared by using 50g Ragi flour, 5g Chia seed powder, 5g sunflower seed powder, 10ml *Ghee,* 30ml Jaggery syrup.

– T_2 -The product was prepared by using 40g Ragi flour, 10g Chia seed powder, 10g sunflower seed powder, 10ml *Ghee*, 30ml Jaggery syrup.

– T_3 -The product was prepared by using 30g Ragi flour, 15g Chia seed powder, 15g sunflower seed powder, 10ml *Ghee,* 30ml Jaggery syrup.

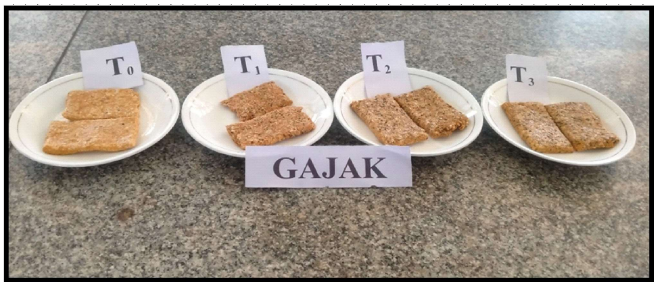


Preparation of *Gajak* with incorporation of Chia seeds and sunflower seeds powder :

– T_0 (control): The product was prepared using 40g sesame seeds and 60g Jaggery.

– T_1 -The product was prepared using 30g sesame seeds, 5g Chia seed powder, 5g sunflower seed powder, 60g Jaggery.

– T_2 -The product was prepared using 20g sesame seeds, 10g Chia seed powder, 10g sunflower seed powder, 60g Jaggery.



– T_3 -The product was prepared using 10g sesame seeds, 15g Chia seed powder, 15g sunflower seed powder, 60g Jaggery.

Sensory evaluation :

Sensory evaluation of the developed food products for their acceptability was done by a panel of 5 judges, from the department of Food Nutrition and Public Health. The score card based on the 9-point Hedonic Scale was used for sensory evaluation on the basis of attributes like colour and appearance, body and texture, taste and flavour and overall acceptability (Srilakshami, 2018).

Chemical analysis :

A standardized procedure of AOAC (2005) were followed to estimate for moisture, ash, total carbohydrates, fat, and protein, calcium, Iron, fibre and total energy of the developed food products.

Cost calculation:

Cost of the prepared food products was calculated by taking into account the cost of individual raw ingredients used in the preparation of food products as the prevailing market price.

Statistical analysis :

The data were analyzed by analysis of variance technique (ANOVA), two way classifications with 'n' observation per cell and critical difference also found (Gupta *et al.,* 2002).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Sensory evaluation :

Table 1 shows the mean of sensory scores obtain and analyzed for *Laddu.* According to the different sensory attributes, T_2 has the highest scores, regarding the colour and appearance, it gains 7.983, for body and texture it gains 8.2, for taste and flavour 8.63 and for overall acceptability it obtained 8.583 scores.

The result is supported by the findings of Zaki *et al.* (2018), it was concluded that Camel burger formulated with 3% chia seeds recorded higher score in sensory

attributes compared with control burger.

According to Škrbiæ and Filipèev (2008), Muttagi *et al.* (2014) and de Lamo and Gomez (2018), the incorporation of oilseeds modifies the rheology of the doughs and the volume and texture of the products, affecting their organoleptic characteristics and their acceptability.

Table 2 shows the mean of sensory scores obtain and analyzed for *Gajak.* According to the different sensory attributes, T_2 has the highest scores, regarding the colour and appearance it gains 8.15, for body and texture it gains 10.93, for taste and flavour 8.25 and for overall acceptability it gains 8.516 scores.

The result is supported by the findings of Goyat *et al.* (2021). It was concluded that substitution of 10% chia and 15% quinoa seed flour resulted in the cookies with best sensory acceptability and high nutritional quotient.

The similar study is also supported by the findings of Singh (2021), reveals that chia seed incorporation in four products increase the sensory properties of the products.

According to Golembovska (2018), fish cutlets with the addition of chia seeds increase the overall acceptability.

Chemical analysis :

Table 3 depicts the chemical components of *Laddu* (T_0) control and (T_2). It shows that the energy content of the value added product *i.e. Laddu,* (T_2) got increased to 446 kcal in comparison to the control (T_0) which was 352. The iron and calcium content of the value added product also got increased to 4.6 mg from 3.13 and 252.7mg from 230.4 mg, respectively in control. The moisture, ash, protein, fats, fibres and carbohydrates also got increased in the value added product in comparison to control.

The result is supported by the findings of Romankiewicz *et al.* (2017), revealed that protein, ash, dietary fibre in chia seeds contributed to an increase of the content of these components in the bread. The breads with the addition of chia seeds were characterized by a significantly higher values of these components in comparison with the control sample. Thus, the addition of chia seeds to bread had a positive effect on nutritional values of the product.

The studies of Iglesias-Puig and Haros (2013), also described a similar trend, but it was not significant statistically.

The similar study is also supported by the findings of Hirpara *et al.* (2020), revealed that on comparison between Jaggery and sugar, Jaggery is a better choice as compared to sugar.

According to Nath *et al.* (2015), gur is high calorie sweetener and as it contains minerals, protein, glucose and fructose, it is known to be healthier in comparison to white sugar.

Table 4, depicts the chemical components of *Gajak* (T_0) control and (T_2). It shows that the fibre content of the value added product *i.e. Gajak* (T_2) got increased to 5.2g in comparison to the control (T_0) which was 1.16g. The protein content of the value added product also got increased to 8.5 g from 7.56 g in control. The moisture per cent, ash, carbohydrates, iron and calcium also got increased in the value added product in comparison to control.

The result is supported by the findings of Saad *et al.* (2020). It was concluded that sunflower seeds contained the highest amount of protein, fat, energy and also contained the highest amount of iron, copper and magnesium.

According to Man *et al.* (2017), it was concluded that the sunflower seeds flours supplemented wheat flour significantly improved the chemical composition (ash, crude fat and crude protein) of biscuits as well as consumer's acceptability.

The studies of Eman *et al.* (2012) also described a similar trend. It is concluded that the utilization of sunflower seeds in preparing the tested cake samples (in 5, 10 and 15% amounts) led to enhance the latter (protein, ether extract, fibre and ash) components and lowered the former one (the carbohydrate). It could be also detected that the enhancement and decrement were gradually increased as increasing the sunflower seeds amounts in the cake ingredients.

Cost calculation:

The total cost of *Laddu* per 100g, for treatments T_0 is Rs. 9.09, T_1 is Rs. 16.69, T_2 is Rs. 24.29 and T_3 is Rs. 31.89. It is, therefore, concluded that the treatment T_3 (Ragi flour + Chia seeds+ Sunflower seeds + *Ghee* + Jaggery) has the high cost and T_0 (Ragi flour + *Ghee* + Jaggery) has the low cost.

The total cost of *Gajak* per 100g for treatment T_0 is Rs. 19.68, T_1 is Rs. 23.68, T_2 is Rs. 27.68 and T_3 is Rs. 31.68. It is, therefore, concluded that the treatment

T_3 (Gingelly seeds + Chia seeds + Sunflower seeds + Jaggery) has the high cost and T_0 (Gingelly seeds + Jaggery) has the low cost.

Organoleptic characteristics of *Laddu*:

Table 1: Average sensory scores for different attributes of control and treated samples of *Laddu*

Control and treatment	Attributes			
	Colour and appearance	Body and texture	Taste and flavour	Overall acceptability
T_0	7.083	7.283	7.7	7.433
T_1	7.433	7.583	8.066	7.75
T_2	7.983	8.2	8.633	8.583
T_3	7.53	7.583	7.316	7.56
F – Test	S	S	S	S
C.D	NS	NS	NS	NS

S= Significant, NS= Non-significant

Organoleptic characteristics of *Gajak*:

Table 2 : Average sensory scores for different attributes of control and treated samples of *Gajak*

Control and treatment	Attributes			
	Colour and appearance	Body and texture	Taste and flavour	Overall acceptability
T_0	6.816	7.06	7.1	7.283
T_1	7.23	7.63	7.36	7.86
T_2	8.15	10.93	8.25	8.516
T_3	7	6.86	7.616	7.6
F – Test	S	NS	S	S
C.D	NS	NS	NS	NS

S= Significant, NS= Non-significant

Chemical analysis of value added products:

Table 3 : The average nutritional composition of control and the best treatment samples of "*Laddu*" per 100g

Nutrients	Control (T_0)	Treatment (T_2)	T. Cal	T. tab
Moisture (%)	14.6	18	28.09	3.287
Ash (g)	10.25	12	46.95	3.287
Protein (g)	4.5	6.66	63.22	3.287
Fat (g)	10.81	22.8	353.43	3.287
Fibre (g)	2.16	6.34	395.28	3.287
Carbohydrates (g)	71.7	63.35	141.70	3.287
Energy (kcal)	352	446	115.1	3.287
Calcium (mg)	230.4	252.7	18.23	3.287
Iron (mg)	3.13	4.5	7.17	3.287

Table 4 : The average nutritional composition of control and the best t samples of "*Gajak*" per 100g

Nutrients	Control (T_0)	Treatment (T_2)	T. Cal
Moisture (%)	11.2	12.6	10.42
Ash (g)	11.6	13.8	6.82
Protein (g)	7.56	8.5	16.12
Fat (g)	17.38	17	0.74
Fiber (g)	1.16	5.2	45.20
Carbohydrates (g)	67	68.7	5.06
Energy (kcal)	451	455	6.12
Calcium (mg)	628	653	30.61
Iron (mg)	4.30	5.81	12.8

Conclusion :

On the basis of findings, it is concluded that Chia seeds and sunflower seeds was successfully incorporated in preparation of the products like *Laddu* and *Gajak*. The sensory attributes of the prepared products with different treatments T_2 (Ragi flour (40%), Chia seeds (10%), sunflower seeds (10%), *Ghee* (10%) and Jaggery (30%)) of *Laddu* and T_2 (Gingelly seeds, Chia seeds, sunflower seeds and Jaggery) of *Gajak,* were highly accepted by the panel members, when compared to control *i.e.* T_0. Chemical analysis of this study concludes that the preserved products *Laddu and Gajak* made by the incorporation of Chia seeds and sunflower seeds were good sources of energy, calcium, fibre, protein and fat content. It is reveals that nutritive composition of the prepared products significantly increased as the incorporation level increased. Cost of *Laddu* is slightly increased from control to treatments. T_3 has the highest cost and T_0 has the lowest cost. Cost of *Gajak* is also increased from control to treatments. T_3 has the highest cost and T_0 has the lowest cost. Chia seeds and Sunflower seeds can be successfully incorporated to the products for enhancement of nutritional qualities as well as for better sensory properties. These combinations may be suggested to be incorporated in any daily preparation of meal of an individual so that one can avail the multiple benefits under normal as well as in therapeutic conditions, preventing risk factors of cardiovascular diseases like blood pressure and diabetes conditions.

REFERENCES

Anonymous (2010). *Nutrition facts for seeds: chia seeds,* dried; Nutrition Data, USDA SR-21, 2010.

Bidgoli, S.A., Ahmadi, R. and Zavarhei, M.D. (2010). The role of hormonal and environmental factors on the early incidence

of breast cancer in Iran. *Science Total Environment,* **408** : 4056 - 4061.

Capitani, M.I., Spotorno, V., Nolasco, S.N. and Tomas, M.C. (2012). Physico-chemical and functional characterization of by-products from chia (*Salvia hispanica* L.) seeds of Argentina. *LWT- Food Sci Technol,* **45** : 94–102.

Eman, M. Salem, Najlaa, A. Hamed and Ohaad Fahad A. Awlya (2012). Implementation of the sunflower seeds in enhancing the nutritional values of cake. *J. Applied Sciences Research,* **8** (5) : 2626-2631.

Goyat, J., Passi, S.J., Suri, S. and Dutta, H. (2018). Development of Chia (*Salvia hispanica* L.) and Quinoa (*Chenopodium quinoa* L.) seed flour substituted cookies-physico-chemical, nutritional and storage studies. *Current Research in Nutrition & Food Science,* **6** (3) : 757-769.

Gupta, A. K. (2002). Monitoring and modelling of ambient air and marine water quality for a port and harbour region, Ph.D. Thesis, Centre for Environmental Science and Engineering, IIT Bombay, India.

Hirpara, P., Thakare, N., Kele, V.D. and Patel, D. (2020). Jaggery: A natural sweetener. *J. Pharmacognosy & Phytochemistry,* **9** (5) : 3145-3148.

Iglesias-Puig, E. and Haros, M. (2013). Evaluation of the performance of dough and bread incorporating chia (*Salvia hispanica* L.). *European Food Research & Technology,* **237** (6) : 865-874.

Katsarou, A.I., Kaliora, A.C., Papalois, A., Chiou, A., Kalogeropoulos, N., Agrogiannis, G. and Andrikopoulos, N. K. (2015). Serum lipid profile and inflammatory markers in the aorta of cholesterol-fed rats supplemented with extra virgin olive oil, sunflower oils and oil-products. *Internat. J. Food Sci. & Nutr.,* **66** (7) : 766– 773.

Malik, M.A. and Saini, C. S. (2018). Improvement of functional prop-erties of sunflower protein isolates near isoelectric point: Application of heat treatment. *LWT,* **98** : 411–417.

Man, S., Paucean, A., Muste, S., Pop, A., Sturza, A., Muresan, V. and Salanta, L.C. (2017). Effects of incorporation of sunflower seed flour on the chemical and sensory characteristics of cracker biscuits. *Bulletin UASVM Food Science & Technology,* **74** (2) : 2017.

Nath, A., Dutta, D., Kumar, P. and Singh, J.P. (2015). Review on recent advances in value addition of Jaggery based products. *J. Food Processing & Technology,* **6** : 4.

Romankiewicz, D., Hassoon, W.H., Pietrzak, G.C., Sobczyk, M., Wojdy, Ba, M.W., Cegli Nska, A. and Dziki, D. (2017). The effect of chia seeds (*Salvia hispanica* L.) addition on quality and nutritional value of wheat bread. *J. Food Quality,* 2017, Article ID 7352631, 7 pp.

Salima, S.S., Ali, A.E., Amal, A., Souad, E.M., Ebtihal, A.M., Ibthal, A., Omaymah, A. and Salah, A.M.B. (2020). Approximate composition analysis and nutritive values of different varieties of edible seeds. *Asian J. Med. Sci.*,12 (6).

Singh, S. (2021). A study to assess the physio-culinary quality of chia seeds. *Internat. J. Health Sci. Res.,* **11**(7) 119-123.

Škrbíc, B. and Filipèev, B. (2008). Nutritional and sensory evaluation of wheat breads supplemented with oleic-rich sunflower seed. *Food Chem.,* **108** : 119–129.

Srivastava, A. and Verma, A. (2014). Nutritional composition of sunflower seeds flour and nutritive value of products prepared by incorporating sunflower seeds flour. *Internat. J. Pharmaceutical Research & Allied Sciences,* **3** (3) : 45-49.

Wanjari, N. and Waghmare, J. (2015). Phenolic and antioxidant potential of sunflower meal. *Adv. Appl. Sci. Res.,* **6** : 221– 229.

Zaki, E. (2018). Impact of adding chia seeds (*Salvia hispanica*) on the quality properties of camel burger "Cam burger" during cold storage. *Internat. J. Current Microbiol. & Appl. Sci.,* **7** (3) : 1356-1363.