

## Effect of Chia Seeds (Salvia Hispanica) Supplementation on Buckwheat Flour in the Development of Gluten Free Bread

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**Citation:** Shagun Pal (2017) Effect Of Chia Seeds (Salvia Hispanica) Supplementation On Buckwheat Flour In The Development Of Gluten Free Bread. Int J Nutr Sci & Food Tech 3:2, 50-52

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**Received:** May 29, 2017; **Accepted:** June 15, 2017; **Published:** September 15, 2017.

### Abstract

Bread is the most often consumed cereal item, hence study was conducted to develop a bread which is most suitable to all types of person having disease such as celiac disease as well as other diseases. Most of the available reports on Celiac Disease are from northern India (Punjab, Haryana, Delhi, Rajasthan, and Uttar Pradesh) where wheat is the staple cereal in the diet. Therefore, the study was conducted to see the effect of chia seeds supplementation in the development of gluten free buckwheat bread. Chia seeds belongs to the mint family (Labiatae) and are considered a pseudo cereal. Chia seed is usually rich in omega 3 (ALA), protein and fat and its completely gluten free, chia seeds also have high levels of minerals such as calcium, iron, magnesium and phosphorus. And it's rich in dietary fiber (up to 30% of the total weight Chia seed is considered as a Dietetic Nutritional Supplement by the Food and Drug Administration (FDA). Chia seed and ground whole chia seed as a novel food ingredient intended for use in bread (EFSA, 2005) common buckwheat flour which is also equally nutritionally adequate were integrated at different proportions, with the aim of improving the nutritional value of buckwheat bread. The Buckwheat bread was optimized first with a different proportions of Rice flour (Buckwheat flour: Rice flour, 50:50, 60:40, 70:30, 80:20) and subjected to sensory evaluation, results indicate that 50:50 was overall most acceptable optimized proportion as compare to other proportions, hence 50:50 was selected as control in which chia seeds were supplemented at three different levels (5%, 10% and 15%). These breads were subjected to sensory evaluation and it was found that buckwheat bread (50:50) with 10% chia seeds was most acceptable as compare to control bread. Both breads control and buckwheat bread enriched with 10% chia seeds were analyzed for proximate composition, total antioxidant activity, specific volume and microbiological quality. Shelf life study was investigated at two different temperatures i.e. at room temperature (30-32°C) and refrigeration temperature (7°C) in which their moisture content, total antioxidant activity were assessed along with microbiological quality. The results showed that chia seeds supplementation at 10% has increased proximate composition of bread like protein, ash content, total antioxidant activity, and this supplementation also has increased the specific volume of bread. Hence incorporation of chia seeds at 10% is suggested. The shelf life estimated was 6 days at room temperature and 14 days at refrigeration temperature.

**Keywords:** BIS, GFB (Gluten free bread), LDPE, IS, TAA, Celiac Disease

### Introduction

As rightly said by Hippocrates 'LET food be thy medicine and medicine be thy food', is certainly the tenet of today. Generally, wheat bread is a good source of irreplaceable nutrients and energy for the human body but people with celiac disease are unable to consume white bread because of the presence of gluten. Therefore with increasing awareness of the disease and importance of proper nutrition and healthy lifestyle there is a growing need for products that have improved nutritional composition with potentially preventive effects on health. Buckwheat is pseudocereal which does not contain gluten therefore can be used in the production of gluten-free products. The removal of gluten from bakery products im-

pairs dough's capacity to properly develop during leavening and baking, which results in poor loaf volume and structure because of batter like consistency of gluten free bread dough.

The main aim of this research is to produce gluten free buckwheat bread with supplementation of chia seeds, which has good loaf volume, and high nutrition value. Furthermore, extensive research on interfacing food science, nutrition, and health is needed so that a GFB (Gluten Free bread) with both good technological and nutritional properties can be prepared and made more available to those with celiac disease, which will help them adhere to a strict gluten-free diet, so as to increase their social inclusion, and improve

their quality of life. Therefore it evolved the idea of developing buckwheat bread which is supplemented with chia seeds to exalt the quality of gluten free bread.

Though a lot of gluten free bread is already available in the market but the present research has been undertaken to develop bread which is culture specific and relevant in Indian context. Therefore blends of buckwheat and rice flours were prepared at different proportions. Therefore there is a need of preparing a gluten-free product which would contain rice and buckwheat flour and chia seeds which is known as nutritionally improved one because they contain high amount of fiber, protein minerals, and antioxidants. A bread rich in protein, antioxidants, polyphenols and mineral content which is not only suitable for celiac disease patient but to all kind of diseases, by virtue of incorporation of buckwheat and chia seeds which is in itself nutritionally suffice.

In this study we have also seen the effect of chia seeds in the development of gluten free buckwheat bread, because generally gluten free breads have poor bread loaf volume due to the absence of gluten which helps in retaining the structure of wheat or refined flour, so this study was carried out in order to improve the nutritive value and volume of gluten free bread. Shelf life of bread using physicochemical and microbiological analysis of bread at two different temperatures (Room temperature 30-32°C and refrigeration temperature 7°C) were also identified. The acceptability of product by consumer preference trials were also assessed.

### Material and Methods

The present study was conducted to develop the gluten free bread using buckwheat, rice flour, and chia seeds as major raw materials. The ratio of rice and buckwheat flour (50:50), (60:40), (70:30), (80:20) was optimized for making breads with different variations and the optimized bread were then taken as a control. After optimization of control bread, the optimized control bread was then incorporated with chia seeds at different variation (5%, 10% and 15%) to get the most desired product, which had a nice crumb and texture and flavor and overall enhanced nutritional quality, which were taken as experimental bread.

### Material

Buckwheat flour and Rice flour was analyzed for water absorption power. Yeast (compressed) was analyzed by using (IS: 1320-1988), yeast Dispersibility in water was determined by using (IS: 1320-1988). Dough raising capacity was also determined by using (IS: 1320-1988). Sugar was analyzed for its purity by analyzing its Sucrose content and Sulfur dioxide content. Salt was also analyzed for its purity by analyzing its Sodium chloride content. Calcium propionate was analyzed by (IS 6031:1997). Polypouches made of low density polypropylene of 160 gauges were used.

### Methods

CHEMICAL ANALYSIS of procured raw material and developed bread were analyzed by using Proximate Composition such as Moisture Content (AOAC, 1999), Total Ash (AOAC, 1999), Protein Content (AOAC, 1999), Crude Fat Content (AOAC, 1999), Total Antioxidant Activity (Akowuah et al., 2005), volume/mass ratio of breads were also assessed (IS 12711: 1989).

Microbiological Analysis were determined according to proce-

dures given in ISI handbook of food analysis (Part 1 general methods.) Microbiological counts were determined according to the procedure given in: IS 5402: 2002 for total plate count, IS 5401 (Part 1): 2002 for coliform count, IS 1439:1996 for E.coli, and IS 5403:1999 for yeast and mould count. Organoleptic evaluation: -Over all acceptability of product was rated on hedonic scale (9 point scale).

### Shelf –Life Study of The Product

The samples were packed in Low Density Poly Propylene bags of 160 gauge and were analyzed on 0,1,2,3,4,5,6,7,8 days (at room temperature) for Moisture Content (AOAC, 2000), Microbiological parameters such as (Total plate count (TPC) (IS:5402:2002), Escherichia coli (E. coli) (IS: 14397:1996), Coliform count (IS: 5401 Part 1, 2002, Yeast and Mould (IS:5403-1999) along with Total Phenolic Content. The shelf life was also assessed at Refrigeration temperature, for Moisture Content, microbiological quality and Total Phenolic Content of the product on alternate days.

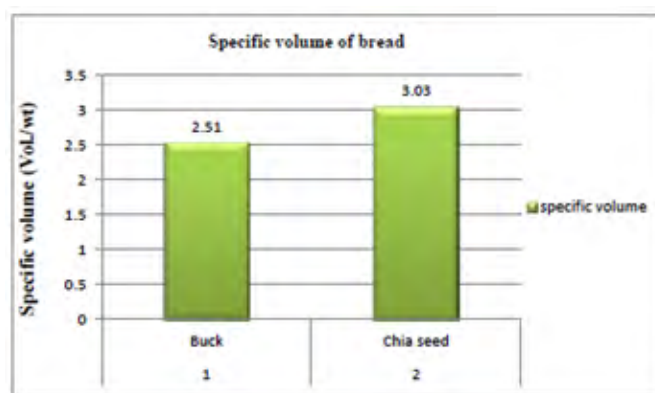
### Result

The process were standardized, and breads were prepared with different proportions of (Buckwheat flour: Rice flour) 50:50, 60:40, 70:30 and 80:20 while other basic raw materials, and processing conditions were kept constant. Breads were then subjected to sensory evaluation by a selected group of panelists and it was found that 50:50 proportion of Buckwheat flour: Rice flour gained maximum acceptance score.



Therefore 50:50 proportions were selected for supplementation of chia seeds at different proportions (5%, 10% and 15%). The buckwheat bread with a ratio of 50:50 was prepared differently in which chia seeds were supplemented at 3 different levels (5%, 10% and 15%) and other raw materials processing conditions were constant.

Graph 1: Graphical representations of effect of (10%) chia seeds supplementations in the development of buckwheat bread (50:50) in specific volume of bread.



The prepared breads with 3 different levels of chia seeds were subjected to sensory evaluation by a group of panelists and buckwheat bread (50:50) with a ratio of 10% of chia seeds was most acceptable. The prepared breads control (50:50, Buckwheat flour: Rice flour) and buckwheat bread (50:50, Buckwheat flour: Rice flour) with 10% chia seeds were analyzed for proximate composition, microbiological quality along with total antioxidant and total phenolic content. Shelf life of the product was evaluated at two different temperature i.e. room temperatures (30-32°C) and at refrigeration temperature (7°C). During the shelf life study of the product the product was analyzed for moisture content, microbiological quality and total phenolic content and the salient findings are as follows:-

S. no.	Sample	Moisture Content (%) <sup>a</sup>	Ash Content (%) <sup>a</sup>	Protein (%) <sup>a</sup>	Total Phenolic content (GAE/100g) <sup>a</sup>	TAC (%) <sup>a</sup>	Peroxides *	Total Solids (%)
1	Control <sup>a</sup>	38.55±0.35	3.775±0.021	3.245±0.049	1.946±0.002	74	0.445±0.035	61.7
2	Experimental bread <sup>b</sup>	47.7±0.1	4.63±0.02	4.65±0.353	2.13415±0.002	83	0.25±0.014	52.4

\*Values indicate Mean ± SD of duplicate readings.

a-Indicate Buckwheat bread (50:50, Buckwheat flour: Rice flour), b-Indicate experimental bread with (50:50, buckwheat: rice flour, with 10% chia seeds.)

### Summary and Conclusion

The chia seeds bread has maximum amount of moisture, ash, protein total phenolic and total antioxidant properties (47.7±0.141, 4.63±0.028, 4.65±0.353, 2.13415±0.002 respectively) as compared to control bread (38.55±0.353553, 3.775±0.021213, 3.245±0.049497, 1.946±0.002828 respectively). Whereas specific volume was least in control bread as compare to buckwheat bread with 10% chia seeds (2.51ml/g, 3.03ml/g respectively). And results shows that at room temperature chia seeds supplemented buckwheat bread has maximum amount of retention of TP content (1.0059±0.004243) as compare to control breads (1.0175±0.009) during the shelf life study of 7 days. At refrigeration temperature on 7th day (14 days alternatively) buckwheat bread supplemented with 10% chia seeds has maximum amount of total phenolic content 1.0065±0.003 as compare to control bread 0.747±0.00282.

The TP content was higher for chia seeds (10%) supplemented buckwheat bread as compare to control breads during the shelf life study period at both temperatures.

Microbiological quality indicates that all microbiological parameters assessed at two different temperatures were within the specification range given by the EUROPEAN standards. And it can be infer that shelf life of the product was 7 days on storage at room temperature, while the shelf life has increased up to 14 days during storage of breads at refrigeration temperature.

The prepared buckwheat bread dough with chia seeds supplementation was analyzed for gluten content by ELISA testing and it was found that the prepared bread dough has 7ppm or 7mg/kg of gluten which is much below than the recommended by CODEX and FDA (min 20ppm) which implies that the raw materials used i.e. chia seeds and buckwheat flour were free of gluten, and due to which the developed bread were completely free of gluten. Cost of the product has been estimated as Rs. 30

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