

Nutraceutical Potential Of Chakli Prepared By Gluten-Free Composite Flour

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ABSTRACT

The aim of the study was to evaluate the nutritional, phytochemical and antioxidant properties of all ratios of gluten free composite flour based Chakli. Composite flour was the blend of Proso millet flour (PF), adzuki bean flour (AF) and basil seeds flour (BF). The variations of three composite flours were prepared as, A being (PF:AF:BF=50:45:5), B being (PF:AF:BF=60:35:5) and C being (PF:AF:BF=70:25:5) respectively. Moisture, ash, fat, fiber, protein and carbohydrate were analyzed in this study. Minerals like calcium, iron, phosphorus and zinc were also analyzed. The results of macronutrient of ratio C were moisture (7.1±0.2), ash (2.4±0.0), protein (8.6±0.2), fat (8.0±0.2), fiber (4.1±0.0) and carbohydrate (62.4±0.1g/100g) respectively. Micronutrients such as calcium (40.0±0.1), iron (3.1±0.2), zinc (2.7±0.1) and phosphorus (248.0±0.4 mg/100g) were also present in gluten free Chaklis. On the basis of current study, presence of different macro as well as micro nutrients is reported in gluten free Chaklis. It is also found that a number of phytochemicals like flavonoids, saponins, tannin, alkaloids, glycosides and steroids were present. The study result discovered that gluten free Chaklis have greater antioxidant activity. The overall good amount of all nutrients found in the C ratio. The sensory evaluation of chakli on a 9 point hedonic scale revealed that B ratio was more acceptable than the A and C ratio. Therefore, it can be valuable for situations like celiac diseases, anemia, hypertension and diabetes.

Keywords: Composite flour; Phytochemicals; gluten free Chakli; Macronutrients; Micronutrients

INTRODUCTION

The celiac disease is also called gluten intolerance which is an inherited disease and is autoimmune in nature. Gluten is a protein which significantly affects the elasticity of the dough which is helpful in the formation of the desired structure of the product, and as the result the overall appearance of product is affected [2]. There is damage in the lining of intestine when gluten is eaten in any form or in any food item. And once it gets damaged, it is very difficult for the body to absorb nutrients like fat and other important minerals [1]. The demand in the market for gluten free products is increasing and it has

become vital to meet the increasing demand. This constitutes an actual technological challenge with a wide possibility for investigation^[3, 4]. So, one of the ways to include gluten free products in the market is by the formation of composite flour and based products. Composite flour can be defined as a combination of wheat and non-wheat flour prepared from mixtures of flours from cereals, roots, tubers, legumes or other raw materials. Traditional and new products like vermicelli, chakli or cupcakes and muffins can be prepared. Composite flours have been broadly used in development of baked and extruded products because of the organoleptic acceptability and the advantages of functional properties^[5]. Proso millet, adzuki beans and basil seeds have been carefully selected for the formation of composite flour. Product developed has good nutritional and functional quality.

Whole grain is mainly used for the development of products made from composite flour so that we have most nutritional benefits and products with high nutritional value is primarily accepted by consumers so that they can provide high health benefits. Also, they make a positive input to the taste and texture of products^[6]. These products also provide necessary amount of vitamins and minerals such as calcium, Zinc, Copper, Niacin, thiamin and contain substantial amount of Crude Fiber. They also possess bioactivities including anti-oxidant, anti-carcinogenic, anti-bacterial, anti-fungal and anti-inflammatory^[7]. Thus, the main objective of the research is to evaluate prepared gluten free chakli with composite flour for its proximate composition, phytochemical and antioxidant activity that can further direct research towards its applications for gluten-free food product development in the market.

MATERIALS AND METHODS

Collection of plant material

The seeds of proso millet, adzuki beans and basil seeds were collected from the local market of Jaipur, India. The seeds were soaked and sun dried. Further, mechanical mixer blender was used to make a fine powder of seeds. It was stored in air tight containers in a refrigerator. Chakli were prepared from composite flour for further analysis.

Determination of proximate composition

Chakli flour was taken in a clean, dry and weighed crucible. It was oven dried later on at 110⁰ C. It was weighed repeatedly until a constant weight was acquired. The crucible was cool down in desiccators every time before weighing. Proximate analysis included the estimation of moisture ash, fat, protein, crude fiber and carbohydrate of flour. Total ash was estimated by weighing the furnace in incinerated residue at 550°C for 12 hours. Protein was analyzed by using micro-Kjeldahl distillation method. Carbohydrate content was determined by the difference method.

Determination of minerals

Chemical estimations were carried out for determining calcium (Ca), iron (Fe) and zinc (Zn). The estimation of Ca, Fe, Mg, and Zn was done by using atomic absorption spectrophotometer (AAS) (model VGP 210, Buck Scientific, USA).

Phytochemical and antioxidant screening

The Chakli flour was screened for phytochemicals (flavonoids, saponins, tannin, glycosides and steroids) according to the procedure as described by [8, 9]. Antioxidant analysis was done on FRAP (ferric reducing ability of plasma) and Total phenol compounds [10, 11, 12].

RESULTS AND DISCUSSION

Table 1: Proximate composition of gluten free Chakli

Variants	Moisture (g)	Ash (g)	Protein (g)	Fat (g)	Fiber (g)	Carbohydrate (g)
Standard	8.0±0.8	0.2±0.5	8.1±0.1	6.7±0.9	0.5±0.0	66.0±0.3
A	6.2±0.4 ^S	1.5±0.4 ^S	11.8±0.3 ^S	7.1±0.1 ^S	2.3±0.1 _s	60.5±0.2 ^S
B	6.6±0.0 ^S	2.1±0.0 ^S	9.7±0.0 ^S	7.4±0.4 ^S	3.1±0.3 _s	61.1±0.1 ^S
C	7.1±0.2 ^S	2.4±0.0 ^S	8.6±0.2 ^S	8.0±0.2 ^S	4.1±0.0 _s	62.4±0.1 ^S

Each value is a mean of three determinations ± standard deviation, ^S Significant, ^{NS} Non significant at the level of (p< 0.05)

Standard = 100% Wheat flour	A = 50% Proso millets+45% Adzuki beans+5% Basil seeds
B = 60% Proso millets+35% Adzuki beans+5% Basil seeds	C = 70% Proso millets+25% Adzuki beans+5% Basil seeds

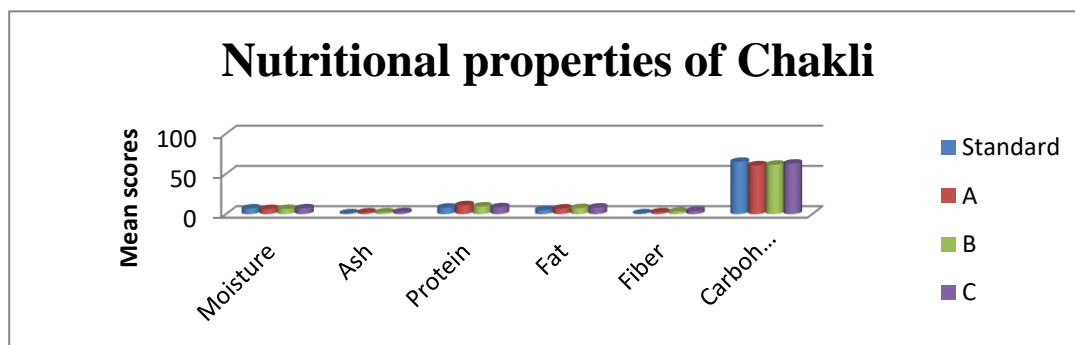


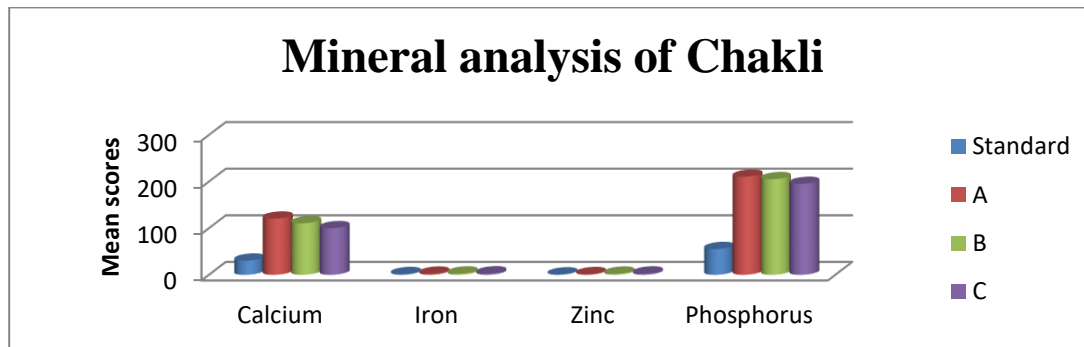
Table 1 shows the proximate analysis of standard and products at different ratios of composite flour. The result of the analysis shows that compared to all the ratios, C ratio had higher amount of moisture, ash, fat, fiber and carbohydrate as compared to all other ratios. With the increase in amounts of proso millet in composite flour the macro nutrients also increased. This is because prosomillets has good amount of nutrient composition as compared to other gluten free cereals like maize, sorghum, brown rice and pearl millet [13]. Wheat flour based chaklis having highest amount of moisture and carbohydrate.

Table 2: Mineral composition of gluten free Chakli

Variants	Calcium (mg)	Iron (mg)	Zinc (mg)	Phosphorus (mg)
Standard	26.4±0.5	1.6±0.1	0.8±0.3	120.3±0.2
A	45.6±0.2 ^S	2.5±0.3 ^S	2.3±0.1 ^S	254.6±0.6 ^S
B	42.7±0.4 ^S	2.8±0.2 ^S	2.5±0.3 ^S	252.2±0.0 ^S
C	40.0±0.1 ^S	3.1±0.2 ^S	2.7±0.1 ^S	248.0±0.4 ^S

Each value is a mean of three determinations ± standard deviation, ^S Significant, ^{NS} Non significant at the level of (p< 0.05)

Standard = 100% Wheat flour	A = 50% Proso millets+45% Adzuki beans+5% Basil seeds
B = 60% Proso millets+35% Adzuki beans+5% Basil seeds	C = 70% Proso millets+25% Adzuki beans+5% Basil seeds



The mineral content of standard and all different ratios of Chakli is shown in Table 2. Highest amount of mineral content are found in ratio C of Chakli flour. It is found due to the percentage increase of proso millet because it contain a good amount of minerals as compared to other type of gluten free cereals and pseudocereals such as quinoa, amaranth, buckwheat, maize, brown rice and sorghum [14, 15].

Table 3: Phytochemical screening of gluten free chakli

Phytochemical	Standard	A	B	C
Flavonoids	+	+	+	+
Saponin	+	+	+	+
Tannin	+	+	+	+
Glycosides	+	+	+	+
Steroids	+	+	+	+
Alkaloids	-	+	+	+

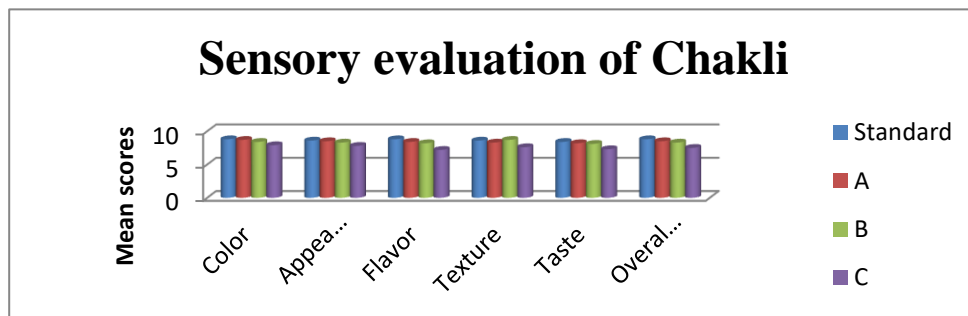
Phytonutrients are the other name for Phytochemicals. They are non-nutritive plant chemicals. They have protective properties against many chronic diseases such as cardiovascular diseases (CVDs), osteoporosis, cancer, diabetes and vision diseases [16]. Epidemiological and animal studies recommend

that there is low and decreased risk of chronic diseases related with oxidative damage with the regular consumption of whole grains, vegetables and fruits. The qualitative phytochemical analysis of the aqueous extracts of gluten free chakli was done. It showed positive results for the presence of flavonoids, saponin, tannin, glycosides and steroid which are shown in Table 3.

According to prior studies, Glycosides and flavonoids are evident for a broad range of biological activities such as anti-allergic, antimicrobial and anti-inflammatory^[17]. Flavonoids can be helpful in prevention of atherosclerosis as it can oxidize low density lipoprotein. Anti-bacterial activity is the prominent feature for steroids. Saponins have analgesic, anti-nociceptive, antifungal and antiviral effect on cold blooded animals^[18]. Several studies confirm that anti-microbial and anti-inflammatory properties are shown by tannins. The usage of tannins rich food has lots of remedial and beneficial effects on human being, for eg, it is helpful to stop bleeding from cuts^[19].

Table 4: Sensory quality attributes of gluten free Chakli

Variants	Color	Appearance	Flavor	Texture	Taste	Overall acceptability
Standard	8.8±0.2	8.6±0.1	8.8±0.6	8.6±0.1	8.4±0.4	8.8±0.9
A	8.3±0.0 ^S	8.4±0.6 ^S	8.2±0.3 ^S	8.2±0.5 ^S	8.2±0.1 ^S	8.2±0.4 ^S
B	8.6±0.5 ^S	8.6±0.4 ^S	8.2±0.1 ^S	8.1±0.4 ^S	8.2±0.0 ^S	8.4±0.7 ^S
C	7.9±0.4 ^S	7.8±0.2 ^S	7.2±0.0 ^S	7.6±0.0 ^S	8.1±0.7 ^S	7.7±0.1 ^S



The mean sensory scores for colour, appearance, flavor, texture, taste and overall acceptability are presented in Table 4. Control was the most acceptable for all the attributes. Variant B was the most acceptable for all the attributes among the all three variants of composite flour.

Fig. 1: Image depicting physical appearance of gluten free Chaklis



Table 5: Ferric acid reducing power of gluten free Chaklis

Standard	A	B	C
11.39 $\mu\text{g/g}$	14.34 $\mu\text{g/g}$	15.94 $\mu\text{g/g}$	16.77 $\mu\text{g/g}$

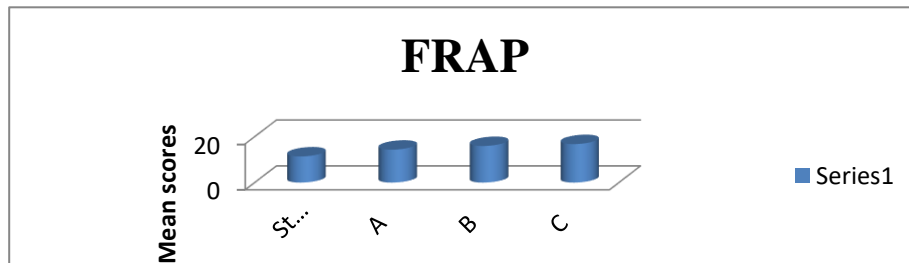


Table 5 shows ferric acid reducing power for gluten free Chakli. The results revealed that C ratio exhibited highest activity i.e (17.77 $\mu\text{g/g}$) when compared with other respective ratios and standard. On contrary, reported by ^[20,21] composite flour had highest ferric acid reducing power (47.40 $\mu\text{g/g}$).

CONCLUSION

From this study, we can conclude that composite flour based products is beneficial for celiac patients or for the people suffering from gluten intolerance. In comparison to the Chaklis prepared of wheat flour, a chosen ratio fulfills the nutritional requirement. The Chaklis have been preferred due to its likeliness by people of all the ages and its easy availability. It also has a longer shelf life as it is extruded product. The combination of millet, bean and seeds make these chaklis good for therapeutic advantages. Prepared chaklis contain good amount of macro and micronutrients, antioxidants and phytochemicals which makes it a nourishing and wholesome food item. Sensory evaluation shows that the Chakli were acceptable by panelist and were satisfactory in taste.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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