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QUALITY EVALUATION OF FUNCTIONAL BREAD DEVELOPED FROM GERMINATED CHICKPEA FLOUR AND PUMPKIN SEED POWDER

***Preeti Arora*[1]*, Manshi*[2] *and Neelam Chaturvedi*[3]**

[1,2] Research Scholar, Department of Food Science and Nutrition, Banasthali Vidyapith, Rajasthan, India

[3]Associate Professor, Portea health visata pvt. Ltd, Department of Food Science and Nutrition, Banasthali Vidyapith, Rajasthan, India

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ABSTRACT

Grains are a rich source of nutrition and photochemical compounds which make them a good source of antioxidants. These photochemical have a potential impact on human health. Plant products have been used in therapeutic medicine. The popularity of pumpkin consumed as both food and traditional medicine for several diseases as anti-diabetic, anti-hypertensive, anti-tumour, immunomodulatory, antibacterial, anti-hypercholesterolemia and anti-inflammatory, have focused the attention of several researchers on it. Breads with their varied taste and low cost are a favorite snack food consumed by a wide range of people The objective of the study was to supplement wheat flour with various level of germinated chickpea flour and pumpkin seeds powder for production of bread and to determined the nutritional value and antioxidant properties of functional bread, formulation of three different composite flour were prepared and out of which one composite formulation were opted for further analysis. A sensory evaluation was performed on the samples. Data revealed that, the formulation containing 20% chickpea flour and 20% pumpkin seeds had the highest ranking for the sensory attributes. The most acceptable functional bread was further carried out for proximate analysis and physiochemical analysis, results of proximate composition revealed that the moisture, ash, protein, fat and fiber content increased significantly at $p<0.05$ when compared to standard bread since carbohydrate content was found to be decreased. Results of photochemical revealed that the phenols and flavonoids content found to be higher when compared with control bread. Therefore, the functional breads are highly nutritious with high antioxidant and nutritional properties which plays a vital role in preventing innumerable health disorders.

KEYWORDS: *Functional Bread, Antioxidant Properties, Nutritional Analysis, Pumpkin Seed, Chickpea*

1. INTRODUCTION

Consumers presently lay a greater emphasis on consuming goods that boost their immune systems since they are more worried about their health. Consumers progressively prefer foods with high protein and fiber content to maintain their health and prevent numerous problems like cardiovascular disease, diabetes, weight gain, etc. Consequently, there is a new trend in the market to create a product that combines the health benefits with excellent sensory properties. (Bhatt and Gupta 2015)

Wheat-based bakery goods including bread, cakes, muffins, and biscuits are immensely popular yet contain little protein. All age groups consume bread worldwide, making it one of the oldest and most widely consumed foods. A fermented confectionary product, bread is made mainly using wheat flour, yeast, water, sugar, salt, and other ingredients as needed. It is done through a number of steps that include combining, kneading, proving, shaping, and baking (Dewettinck et al., 2008). Consumption of whole grain products reduces the risk of oxidative stress-related chronic diseases and age-related disorders such cardiovascular disease, carcinogenesis, type II diabetes, and obesity, according to epidemiological studies. (Okarter et al., 2010).

A rising amount of attention has been paid to seeds and nuts in recent years because of the high nutraceutical and therapeutic potential of their bioactive components. Pumpkins are grown all throughout the world for a variety of functions, including commercial, decorative, and agricultural usage. (Amin et al., 2019). The popularity of pumpkin in many systems of traditional medication has led researchers turning their attention to this crop (Pham et al., 2017). Since, most people believe pumpkin seeds to be agricultural waste, they actually serve as nutrient powerhouses with unique nutraceutical properties. Pumpkin seeds have a variety of biological and therapeutic benefits, including anti-inflammatory, antioxidant, anticancer, antiangiogenic, hypolipidemic, and antidiabetic actions. They are frequently employed as herbal and medicinal ingredients (Ayyildiz et al., 2019). Pumpkin (Cucurbita pepo L.) is a seasonal crop and belongs to the *Cucurbitaceae* family. Pumpkin seeds are densely packed with various nutrients and antioxidants. They are anti-helmintic, anti-diabetic, anti-depressive, antioxidant, anticancer, and anti-cytoprotective. These bioactive compounds may improve microbial infections, hepatic, and prostate diseases (Ceclu et al., 2020). Pumpkin seeds are discarded as an agricultural waste but are rich in vitamins, proteins, minerals as zinc content. Wheat (*Triticum aestivium*) is the principal crop used for bread making. Many research studies have been carried out on consuming whole wheat and indicated that whole wheat foods could reduce the risk of cancers, diabetes and coronary heart diseases (Venn et al., 2004, Truswell et al., 2002). Chickpea (Cicer aretinium L. plays a significant role in human diet and provides nutrients as dietary fiber (Devi et al., 2016) and they are low in fat, which helps maintain weight and reduce the risk of cardiovascular diseases (Venkidasamy et al., 2019). Chickpeas are a great source of macro- and micronutrients, mainly protein, which has a number of health benefits including activity against diabetes, hypercholesterolemia, cancer, and inflammation (Milán - Noris et al., 2018).

In recent years, composite flour has been used to make bread in an effort to enhance the nutritional value of diets, for example, enhancing the balance of important amino acids and carbohydrate content. Legume flour can be used to supplement cereal flour in impoverished nations to increase the nutritious content of certain baked goods. In the present study, composite flour bread was prepared using whole wheat flour, germinated chickpea flour and pumpkin seeds powder with an aim to formulate enriched flour which is high in protein, unsaturated fatty acids and fiber. Captivating into account its nutritional value, the pumpkin seeds can be a good supplement to incorporate with wheat flour which can be used in formulation of the composite flour in order to improve the quality of bread (Syed et al., 2019).

2. MATERIALS AND METHODS

2.1 Collection of raw Materials

Wheat flour, chickpeas, pumpkin seeds and other minor ingredients like salt, sugar, calcium propionate (food additive) and yeast were procured from the local supermarket of Rampur, India.

2.2 Germination of Chickpea

There are several ways to sprout seeds, the most common one is the "**soak, rinse, and drain" method.** The chickpeas were washed and soaked overnight at room temperature in a dark place. After that drained seeds were germinated for 48 hours in a dark place. During germination, they were sprayed with tap water every 12h, the germinated chickpeas were kept for oven drying at 50°C for 16 hours and then were milled with slight modifications (Yaver, 2022).

Figure 1:

2.3 Preparation of Composite Flours (CF) for Development of Functional Bread

The experimental formulations of composite flours were formulated using wheat flour, germinated chickpea flour and pumpkin seeds powder. Three different proportions of composite flours were used as given in table 1

Table 1: Preparation of Composite Flours in Different Treatments (T)

Ingredients (%)	T1	T2	T3
Wheat flour	60	60	60
Germinated chickpea flour	30	25	15
Pumpkin seeds powder	10	15	20

2.4 Bread Preparation (Straight Dough Method)

The straight dough method is the easiest of the dough making methods. All raw materials were mixed with varying inclusions given in table 1. then water compressed yeast and sugar was mixed properly in a separate bowl with composite flours were mixed with rest of baking ingredients (sugar powder, yeast, salt, oil and other ingredients like calcium propionate (food additive) in a mixer to form a dough, and kneaded for 10 min into consistent dough and the resulting dough was molded and placed in a pre-oiled baking bowl. The dough was proofed for 40 min at 35°C and then baked in the oven for 35 min at 217°C according to Ndife et al. (2011).

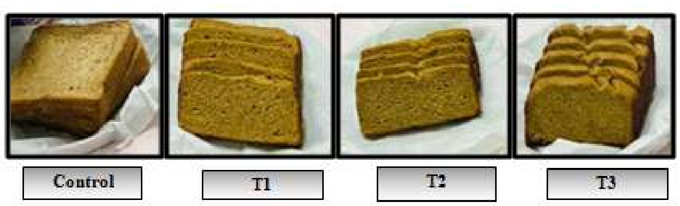

Figure 2:

2.5 Organoleptic Evaluation

Bread samples were allowed to cool for 1-2 hours at room temperature then sliced into pieces. The organoleptic evaluation of the breads was determined by a sensory panel. The panelist was from the members of the post-graduation of food science and nutrition of Banasthali Vidyapith. Sensory evaluation of the functional bread was carried out by a 30 semi trained panelist on 5 – point composite score and 9 – point hedonic scale for different attributes such as color, appearance, flavor, taste, texture and overall acceptability. After the sensory evaluation most acceptable functional bread were carried out for further proximate composition and antioxidant potential analysis.

2.6 Proximate composition analysis

The determination of proximate composition (moisture content, ash content, protein content, fat content and fiber content) of different functional bread was determined (AOAC, 2015).

Total carbohydrate (% dry weight) = 100 - (Moisture % + Ash % + Protein % + fat %).

2.7 Antioxidant content analysis

Total phenolic content of the extract was estimated calorimetrically by the Folin-Ciocalteu method (Lucas et al., 2022). The absorbance of the standard (Gallic acid) and the respective extracts was measured spectrophotometrically at 765 nm. Results were expressed as gallic acid equivalents (GAE, μg/mg of weight of extract). Total flavonoids were measured by using aluminum chloride colorimetric method (Martínez et al., 2022) and expressed in terms of μg catechin equivalents (CE)/mg of dry extract. The absorbance was taken at 415 nm using a spectrophotometer.

2.7 DPPH (2, 2- Diphenyl-1-Picrylhydrazyl) Scavenging Activity

The free radical scavenging activity was tested according to (Habila et al., 2010). Various concentrations of the extracts were mixed with 80 mM of DPPH in methanol. Then, the solution was incubated for 30 min at room temperature. Quercetin was used as positive control. The optical density (OD) of the solution was measured at 517 nm by a double-beam spectrophotometer. The DPPH radical scavenging activity was calculated using the equation

- OD control – OD extract
- Inhibition (%) =
- OD control

3. RESULTS AND DISCUSSIONS

3.1 Organoleptic Evaluation Of Developed Functional Bread

The organoleptic evaluation of developed functional and control bread are presented in figure 1. The evaluation was done on a 5-point composite rating scale and 9-point hedonic scale. Sensory evaluation revealed scores revealed that the composite flour bread obtained lower scores compared to the standard bread in terms of color, appearance, flavor, taste, texture and overall acceptability. The products were prepared by the incorporation of wheat flour, germinated chickpea and pumpkin seeds in different proportion i.e., T1 (60:30:10), T2 (60:25:15) and T3 (60:20:20) which were compared with control bread. The mean score obtained for color of T1, T2 and T3 was 3.04±0.8, 4.0±0.9 and 4.1±0.8 respectively, T1 showed a significantly lower score (3.4±0.8) compared to the control bread (4.9±0.7) at $p \leq 0.05$ level. The mean score obtained for appearance was 3.2±0.83, 4.1±0.89 and 4.2±0.85 respectively, T3 showed significant score (4.2±0.85) compared to control bread (4.9±0.48) and T1

(3.2±0.83) found lower score. The mean score obtained for flavor was 2.8±1.08, 4.2±0.87 and 4.4±0.80 respectively, T3 showed a significant score (4.4±0.80) compared to the control bread (4.9±0.49) at p≤0.05 level. The mean score obtained for taste was 2.6±0.87, 3.3±0.78 and 4.5±0.90 respectively, T3 showed a significant score (4.5±0.90) compared to the control bread (5.0±0.00) at p≤0.05 level. The mean score obtained for texture was 2.8±1.37, 3.4±0.95 and 4.1±0.87 respectively, where as T1 and T2 (2.8±137 and 3.4±0.95) showed lower score as compared to T3 (4.1±0.87) compare to the control bread (5.0±0.00) at p≤0.05 level. The overall acceptability of T1, T2 and T3 was 5.8±2.60, 7.4±1.40 and 8.5±1.78 respectively. The values of overall acceptability were significantly different in T1 and T2 at p≤0.05 level whereas, T3 showed significant value when compared to the standard bread (8.9±0.24) in terms of overall acceptability (Atudorei et al., 2021) reported that the developed composite flour based bread on wheat and germinated bean in the ratio of 85:15 have 7.5 overall acceptability.

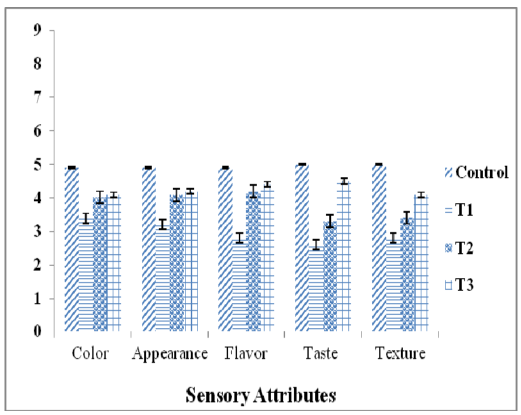

Figure 3: Sensory evaluation of developed functional bread

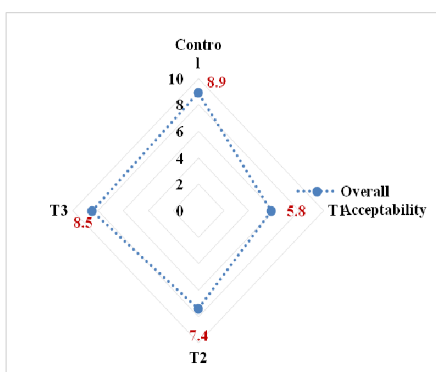

Figure 4: Overall Acceptability of Developed Functional Bread

3.2 Proximate analysis of functional bread

Proximate analysis is important for evaluating the nutritional content of the developed food products. The different proximate composition of composite flour affects the nutritional quality of the product. The total protein, fiber, moisture, fat, ash, carbohydrate in developed functional bread are shown in Table 2. Moisture content of functional bread was 16.78 g/100g is lower as compared to the control bread i.e. 16.94g/100g respectively. Similar results were observed by (Ike et al., 2020) that the moisture content of wheat and pumpkin seeds composite flour was found to be 12.13g respectively. The ash is composed of non-combustible; inorganic minerals can be attributed to the mineral content in the sample. The ash content of functional bread was 2.18g/100g significantly higher than control bread i.e. 1.58g/100g respectively. The protein content of developed functional bread was 10.56g/100g respectively, which was significantly higher than the control whole wheat flour bread i.e. 7.05g/100g. This significant increase in the protein content in the functional bread could be attributed to high protein content in chickpea and pumpkin seeds powder. Similar results were observed by (Quazib et al., 2016) that the protein content of wheat and germinated chickpea composite flour was found to be i.e.10.06±0.01g respectively. The crude fat content of developed functional bread was 10.43g/100g while the fat content of the control whole wheat bread was 9.24g/100g. Similar results were observed by (Oluwalana et al., 2012) that the fiber content of sweet potato wheat composite flour was found to be i.e.2.49g respectively. The high fat content in composite flours could have the ability to make bread without or less addition of a shortening agent. The main role of fiber is to keep the digestive system healthy. Fiber has also been shown to benefit diabetes, blood cholesterol levels, reduces constipation, coronary heart disease and obesity (Barber et al., 2020). More fiber content in the flour will take more time for dough mixing. The fiber content of functional bread was 4.23g/100g as significantly higher to control whole wheat bread 1.25g/100g. The carbohydrate content of developed functional bread was lower 57.86g/100g respectively, when compared to control i.e. 67.34g/100g

Table 2: Proximate Composition of Functional Bread on Dry Weight Basis

Nutrients (g/100g)	Control	Functional bread
Moisture	16.94 ± 0.03	16.78 ± 0.46 ns
Ash	1.58 ± 0.24	2.18 ± 0.12*
Protein	7.05 ± 0.07	10.56 ± 0.03*
Fat	9.24 ± 0.04	10.43 ± 0.02*
Fiber	1.25 ± 0.01	4.23 ± 0.01*
Carbohydrate	67.34 ± 0.01	57.86 ± 0.01*

Data are reported as mean ±SD (n=3),*denotes significant at ($p \leq 0.05$), ns denotes non-significant

3.3 Phytochemical Analysis

Phytochemical analysis showed the presence of phenols and flavonoids in functional bread. The total phenols content of functional bread is 2.73±0.05 mgGAE/100g, significantly high when compared to the control bread 1.37±0.05 mgGAE/100g. It has been observed by Xu et al., 2019 that presence of phenolic compounds in bread showed the increased antioxidant activity in bakery products. However, several authors have found that the addition of these compounds produces relevant changes in the structure and sensory characteristics of bread (Subiría-Cueto et al. 2021).

Whereas, the flavonoids content of functional bread is 1.10±0.04 mg QE/100g found significantly higher as compared to control bread 0.118±0.01 mg QE/100g respectively. According to Bhatt and Gupta, 2015 growing consensus for the hypothesis that the specific intake of food and drink containing relatively high concentrations of flavonoids may play a meaningful role in reducing the risk of cardiovascular disease and also Phenolics have many health benefits like antioxidative, anti-inflammatory, antimutagenic and anticarcinogenic properties, also maintains flavor, taste, color and prevention of their oxidation deterioration. (Singh and Yadav 2022)

Table 3: Antioxidant content and antioxidant activity of Best Acceptable Functional Bread

Parameters	Control bread	Functional bread
Total phenols content (mgGAE/100g)	1.37±0.05	2.73±0.05*
Total flavonoids content (mg QE/100g)	0.118±0.01	1.10±0.04*

Data are reported as mean ±SD (n=3),*denotes significant at ($p \leq 0.05$), ns denotes non-significant

3.4 Antioxidant Activity of Functional Bread

Phenol compounds can also act as antioxidants by reacting with and capturing dangerously reactive compounds called free radicals before the radicals can react with other bimolecular and cause serious damage. Antioxidant activities of bread enriched with pumpkin flour are shown in Figure 2. Antioxidant activity of bread measured by the ability of the test sample to scavenge DPPH radical Addition of pumpkin seed powder and chickpea flour significantly affected ($P<0.05$) antioxidant activity (DPPH) of enriched bread. Addition of composite flour significantly increased antioxidant activity of bread compared to that of control bread as measured by DPPH scavenging activity.

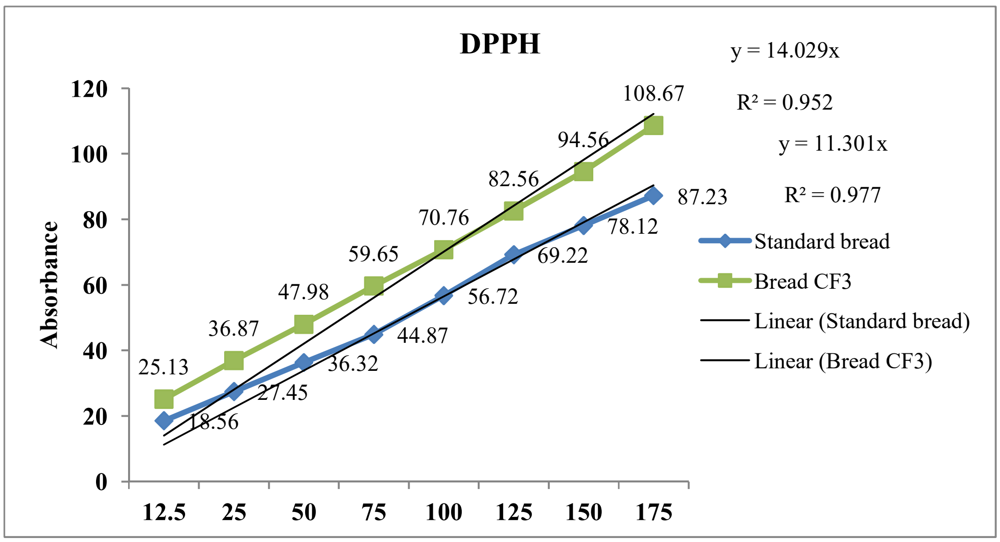

Figure 5: The DPPH free radical scavenging activity of control and functional bread in methanol extract

The given result of free radical (DPPH) scavenging activity (IC_{50}) of Standard Bread and functional bread (T3) was 4.42±0.05 and 3.56±0.01 respectively. This observation concludes the antioxidant activity of T3 was higher after incorporation of germinated chickpea flour and pumpkin seeds to wheat bread when compared to whole wheat flour based at $p \leq 0.05$ level. Similar results were observed by (Ozcan, 2022) that the developed chufa-tuber bread exhibits IC_{50} value of 3.24 and 0.20 in standard wheat bread.

CONCLUSIONS

Functional breads are highly nutritious and provide a sufficient amount of nutrients needed for normal body function and sustaining daily activities. The results of the study endorsed that the developed functional bread with germinated chickpea flour and pumpkin seeds powder is a nutritional dense food option having nutritional and antioxidant properties since it offers a combination of vital nutrients as protein, fat, fiber and antioxidants that might be endowed to overall health and wellbeing. The organoleptic evaluation, phytochemical analysis and antioxidant activity of developed functional bread from wheat, germinated chickpea, and pumpkin seeds powder T3- 60:20:20 showed high acceptability by semi-trained a panel which concludes that preparation of such functional food products will not only enhance the sensory attributes but play a major role in nutrition and provide basic nutrients and may improve health prospects. However, functional bread fortified with pumpkin seeds and germinated chickpea had the nutritious and greatest acceptability ratings by the panelists.

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