



A study on wheat grass powder incorporated products and its nutritional value

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Abstract

The objective of this attempt was to formulate a nutritional food that is high in micronutrients and is consumed all over the world that incorporates wheat grass powder as a supplement for cake, biscuits, and papads. Cakes and biscuits with the following codes: C0, C1, C2 & C3 (for cakes) and B0, B1, B2 & B3 (for biscuits) were made using wheat grass powder added at 0.0, 5.0, 7.0 & 9.0% levels as a substitute of wheat flour. In order to make papads, wheat grass powder was added at amounts of 0.0, 3.0, 5.0, and 7.0%, according to P0, P1, P2, and P3, to replace the wheat gram and green gram (1:1) flour. To identify the best sample and sample differences, all product formulations performed sensory examination. The findings of the panel tasting showed that the samples of cake, biscuit, and papad that were C1, B1, and P2 had the best color, flavor, and overall acceptance. After that, the moisture, ash, fat, fiber, protein, and carbohydrate content of the chosen sample was examined. According to the current research, wheat grass powder enhances the nutritional value of baked goods by having strong antioxidant activity and useful qualities that can be used for producing functional foods.

Keywords: Wheatgrass, products development, proximate composition, sensory evaluation

Introduction

The cotyledons of the common wheat plant (*Triticum aestivum*), a member of the Gramineae family, are used to make wheatgrass, a staple food. *Triticum* is a genus of biennial and annual grasses that produces numerous varieties of wheat and is grown practically everywhere in the world. Wheat grass is a *Triticum aestivum* shoot (Mogra & Rathi, 2013) [5]. It has been stated that young grasses with high chlorophyll content may have anti-cancer properties and can treat conditions such as high blood pressure, obesity, cancer, diabetes, weariness, gastritis, ulcers, skin issues, constipation, asthma, dermatitis, and anemia (Parit *et al.*, 2018) [8]. Wheatgrass is high in proteins, total dietary fiber, carbohydrates, vitamins A, C, E, niacin, riboflavin, and folic acid, minerals like iron, calcium, magnesium, selenium, chlorophyll, and carotene, and antioxidants. It also contains 17 amino acids, of which 8 are essential and a natural source of blood building, and has an abundance of antioxidants that can be helpful in treating various diseases like diabetes and cardiovascular disease (Devi *et al.*, 2019) [2] and Eissa *et al.*, 2020) [3].

The world's population is still increasing, and with it, hunger and malnutrition are spreading throughout various regions of the globe and some staple foods' nutritional content is deteriorating as a result of soils that are no longer able to obtain their nutrients. As a result, the population will increasingly need to turn to alternate food sources or dietary supplements to get the rapidly absorbable vitamins, minerals, chlorophyll, and enzymes they require to maintain good health and increase their resistance to disease (Das *et al.*, 2012) [1]. There has been a significant increase in demand for high-fiber and low-fat goods as a result of consumers' rising interest in health and how it relates to diet. In recent decades, the demand for goods with a lower caloric value has led to an increase in the manufacture and

consumption of bakery products with reduced fat and energy content. Baked food products are enjoyed by consumers all over the world. Because of their high consumption, they could be the potential carriers of bioactive compounds like phenolic compounds and dietary fiber.

Wheatgrass is now available in powder form, which has proven to be both practical and efficient. In comparison to wheat grass juice, wheat grass powder preserves all of the plant's essential nutrients and has a higher level of dietary fiber. It is also more affordable and has a longer shelf life. Every age group may simply incorporate wheat grass powder into their daily lives to boost their intake of vitamins, minerals, and antioxidants, which will protect their bodies from degenerative diseases (Rana *et al.*, 2011) [9] and Kulkarni *et al.*, 2006) [4]. The objectives of this research were to incorporate wheat grass powder in cake, biscuit & papad and develop nutritionally enhanced products and study the nutrient composition of the developed product and conduct the acceptability studies by consumers on the developed products.

Materials and method

Preparation of wheat grass powder

Wheat seeds were purchased from the local market in Bahadur bazar, Dinajpur, Bangladesh. The seeds were soaked in tap water for 24 hours before being covered with a damp cotton cloth and left to grow for 48 hours. On perforated soil bed trays within, the sprouted wheat seeds were next set. The trays were positioned so that the young plants could get regular airflow and sunlight, and the sprouts were watered twice daily. Wheatgrass is the result of the sprouted seeds transforming into young leaf blades. The wheat grasses were harvested on the 10th day after the sprouting period. Harvested wheatgrass was chopped into

small, equally sized pieces used for the drying experiment. Wheatgrass samples were placed in a hot air oven at 30-35°C for 24 hours. The dried leaves were coarsely powdered in a blender and powder was stored in polythene bags.

Standardization of formula (ingredients in g/100 gm) for preparation of wheat grass powder (WGP) incorporated products

For standardization of formula various combinations were used and the best one selected for further utilization. WGP, wheat flour was blended with ingredients sugar, baking powder, baking soda, salt, dalda, cardamom, oil, sugar, egg, testing salt, papad khar, black pepper, water and made dough. This dough was utilized in the preparation of biscuits, cake and papad. All the standardized ingredients were kept constant throughout all treatments.

Preparation of wheat grass powder incorporated Biscuits

The basic formulations used for preparation of biscuits from different treated samples are outlined in Table 2.2. All the ingredients were weighed accurately. The pre-weighed flour, sugar, salt and baking powder were mixed thoroughly. Then shortening and egg were added and mixed properly to make adequate dough and kept rest for a while then the dough was rolled to a uniform sheet of thickness. The sheet was cut according to the desired shape and size of biscuits with a cutter and baked in the oven at 180°C C for 23 minutes, cooled to ambient temperature and packed in plastic bags.

Preparation of wheat grass powder incorporated Cake

First of all, sugar and egg were blended for 2 minutes then baking-powder, flour, and sugar were added and mixed thoroughly. The dough was prepared manually by whipping the composite mix flour in a pan for about 10 min. Milk was added to the batter. Aluminum metal molds with a standard were used throughout the experiments for development of cake. The batter (100 g) was poured into the cake molds. The trays of cake molds were placed in the baking oven. Eight cake molds were arranged in four rows of two on a baking tray and baked for 25 min at 170°C in a preheated oven. The oven, the tray, and the tray position in the oven were identical in each case. The cakes were left to cool at room temperature for 1 h on a rack in order to avoid moisture condensing on their undersurface. The 8 cakes baked on the two baking trays were packed in polypropylene bags and stored in a dry environment prior to analysis.

Preparation of wheat grass powder incorporated papads

Wheat grass powder, green gram and black gram cleaned and ground in to flour then sieved to 60 mesh sieve and add ingredients (papadkhar +testing salt + black pepper). Then mixed flour in boiling water, stirred well, mixed into smooth dough, divided dough into small portion (10g each ball). Then papads were made and allowed to sun drying for 6-8 hrs. After that papads dried at room temperature, packed in plastic bags and stored at room temperature for further study.



Fig 1: Prepared biscuit samples

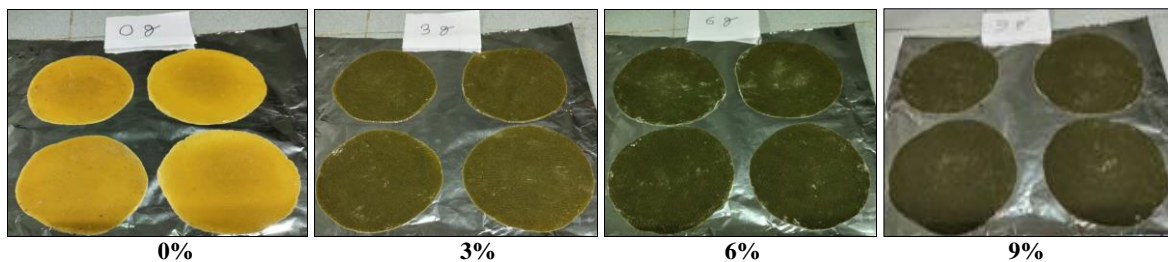


Fig 2: Prepared papad samples



Fig 3: Prepared cake samples

Table 1: Sample numbering for identification

| Sample Name | Observation Name | Identification Name |
|---------------|-----------------------------|---------------------|
| Cake | Plain Cake | C ₀ |
| | 3% WGP Supplemented Cake | C ₁ |
| | 6% WGP Supplemented Cake | C ₂ |
| | 9% WGP Supplemented Cake | C ₃ |
| Sweet Biscuit | Plain Biscuit | B ₀ |
| | 3% WGP Supplemented Biscuit | B ₁ |
| | 6% WGP Supplemented Biscuit | B ₂ |
| | 9% WGP Supplemented Biscuit | B ₃ |
| Papad | Plain Papad | P ₀ |
| | 3% WGP Supplemented Papad | P ₁ |
| | 6% WGP Supplemented Papad | P ₂ |
| | 9% WGP Supplemented Papad | P ₃ |

Table 2: Standardization of Formula (ingredients g/100 gm) for preparation of WGP incorporated biscuit

| Ingredients | Treatments | | | |
|--------------------|------------|--------|--------|--------|
| | B0 | B1 | B2 | B3 |
| Wheat flour | 50 g | 45 g | 43 g | 41 g |
| Wheat grass powder | 0.0 g | 5 g | 7 g | 9 g |
| Icing sugar | 22.5 g | 22.5 g | 22.5 g | 22.5 g |
| Edible oil | 12ml | 12ml | 12ml | 12ml |
| Cardamom | 0.8 g | 0.8 g | 0.8 g | 0.8 g |
| Baking soda | 1.4 g | 1.4 g | 1.4 g | 1.4 g |
| Salt | 0.8 g | 0.8 g | 0.8 g | 0.8 g |
| Dalda | 12.5 g | 12.5 g | 12.5 g | 12.5 g |

Table 3: Standardization of Formula (ingredients g/100 gm) for preparation of WGP incorporated cake

| Ingredients | Treatments | | | |
|--------------------|------------|--------|--------|--------|
| | C0 | C1 | C2 | C3 |
| Wheat flour | 36.5 g | 31.5 g | 29.5 g | 27.5 g |
| Wheat grass powder | 0.0 g | 5 g | 7 g | 9 g |
| Icing sugar | 27.3 g | 27.3 g | 27.3 g | 27.3 g |
| Edible oil | 12.6ml | 12.6ml | 12.6ml | 12.6ml |
| Baking soda | 0.6 g | 0.6 g | 0.6 g | 0.6 g |
| Baking powder | 1.0 g | 1.0 g | 1.0 g | 1.0 g |
| Egg | 22 g | 22 g | 22 g | 22 g |

Table 4: Standardization of Formula (ingredients g/100 gm) for preparation of WGP incorporated papad

| Ingredients | Treatments | | | |
|---------------------------------------|------------|--------|--------|-------|
| | P0 | P1 | P2 | P3 |
| Black gram & Green gram (1:1 mixture) | 58.5 g | 55.5 g | 52.5 g | 49.5g |
| Black pepper powder | 0.7 g | 0.7 g | 0.7 g | 0.7 g |
| Edible common salt | 0.4 g | 0.4 g | 0.4 g | 0.4 g |
| Edible oil | 8.8 g | 8.8 g | 8.8 g | 8.8 g |
| Papad khar | 2.6 g | 2.6 g | 2.6 g | 2.6 g |
| Water | 29 ml | 29 ml | 29 ml | 29 ml |
| Wheat grass powder | 0.0 g | 3.0 g | 6.0 g | 9.0 g |

Analysis of proximate composition

All proximate composition was determined by following the methods of AOAC (2005). Moisture content of prepared samples was determined by drying the samples at 105°C in a drying oven till a constant weight was attained. Ash content was determined in triplicate using a muffle furnace at 600°C for 8 hours. Protein content was determined by the Micro-Kjeldahl method as described by AOAC (2005) first determining the percent nitrogen content and then converted to % crude protein by multiplying with the factor 6.25. Crude fiber was determined by Acid-Alkali Hydrolysis. Fat content was determined by extracting 3g of sample with hexane using Soxhlet apparatus for 6 hours at 80°C. When the hexane was reached to a small volume, it was poured into a dry (previously weighed) petri dish. All of the hexane was evaporated in a drier at 100°C for 1 hour, cooled and

weighed. Difference in the weights was the hexane soluble material present in the sample. Available carbohydrate content was determined by difference, *ie.* by subtracting the sum of the values of moisture, ash, protein, fat and crude fiber from 100.

Sensory Evaluation

Twenty semi-trained members of the Engineering Faculty, Department of Food Science and Nutrition at the Hajee Mohammad Danesh Science and Technology University, Bangladesh, evaluated the food's appearance, color, aroma, taste, texture, and overall acceptability using a 9-point hedonic scale (9 = extremely like, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike extremely, and 1 = dislike extremely).

Statistical analysis

The experiment was conducted in triplicate for each sample. The data were subjected to analysis of variance (ANOVA) using SPSS software (Version 22.0.0.0). Duncan test was used to compare between treatments by one-way ANOVA at $P \leq 0.05$ significant level of each variable.

Results and discussions

Proximate composition of wheat grass powder (%)

Proximate analysis shows the core nutritional make-up of every product, and it is what gives customers their first impression of that product. The approximate makeup of wheatgrass powder is shown in Figure A. It was discovered to have great fiber and protein content, demonstrating its potential for the creation of different compositions that are high in protein. Additionally, the wheat grass powder's relatively substantial amount of ash demonstrates that it contains essential elements for the body's healthy operation. Additionally, the wheat grass powder's low-fat level makes it a great choice for those with disorders like atherosclerosis and cardiovascular disease (Mujoriya & Babu Bodla KIET, 2011) [6]

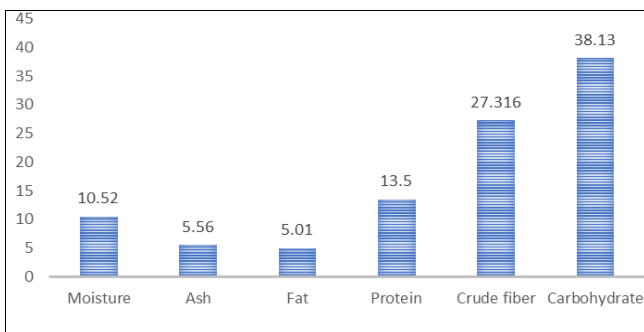


Fig A

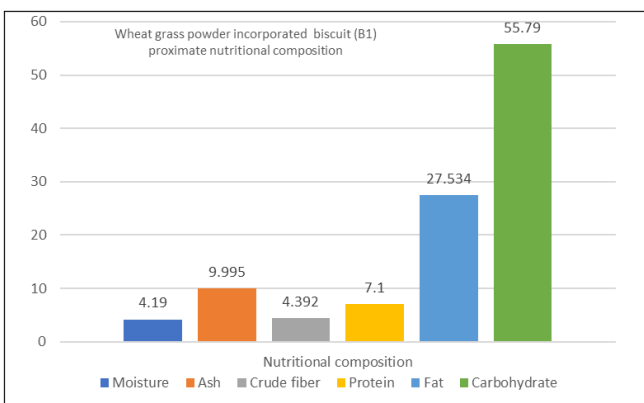


Fig B

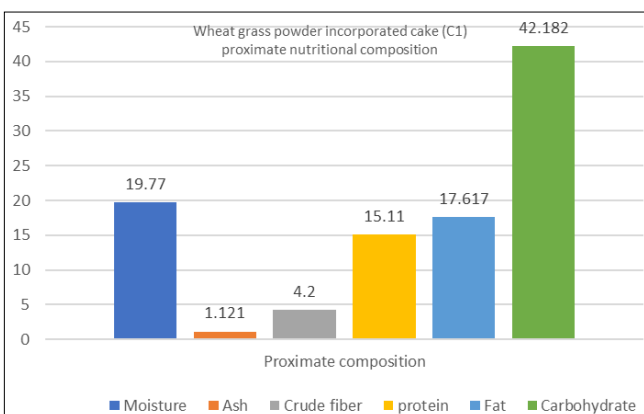


Fig C

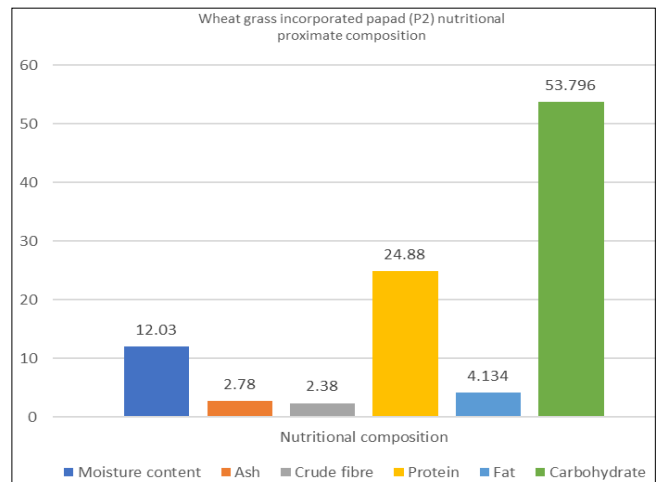


Fig D

Fig 4: Proximate composition of wheat grass powder (Fig: A) and prepared products (Fig: B, C, D)

Nutritional composition of prepared products

In Figure 3.1 findings about the approximate composition of wheat grass (WGP) incorporated products were presented. A small amount of the proximate composition of the biscuit, cake and papad was affected by the addition of WGP. Results showed that adding WPG to the biscuit sample significantly increased the amount of fiber and carbohydrates, increasing from 27.316% to 27.534% and 38.13 to 55.79%, respectively (Figure: A and B). By adding wheat grass powder, the following values have been obtained: 12.77%, 65.69%, 18.09%, 0.26%, and 3.176% for protein, carbohydrate, fat, ash, and moisture, respectively (Shashank *et al.*, 2021) [12]. However, compared to the biscuit sample, the cake (Figure: C) and papad (Figure: D) samples had a substantial level of carbohydrate content. According to studies (Rahman *et al.*, 2015) [11], wheatgrass-infused muffins (which are nearly identical to cakes) have a moisture content of 22.13%, ash 1.121%, fat 17.22%, protein 14.67%, carbohydrate 41.24%, and fiber 3.31%. In a previous study, Venna *et al.* (2012) and (ND Kalange, UD Chavan, PM Kotecha, 2020) [7] reported that papad made from seed powder had moisture content of 12.9%, ash of 3.6%, fat 4%, protein 24.86%, carbohydrate 57.7%, and fiber of 2.27%. Above all this contradiction of results with our research work might be due to several factors including variety of wheat, drying temperature, climatic and cultivation conditions of wheatgrass, postharvest storage of wheatgrass and different percentage of wheatgrass powder incorporated in the products.

Sensory evaluation

Twenty semi-trained panelists rated the sensory qualities of prepared items, such as their look, color, texture, flavor, and acceptability overall. According to the hedonic rating test, they had given a score. Table 5. provides the mean score for the sensory assessment for products containing wheat grass. In comparison to other products (cakes and papads), the results showed that sample B1 was best liked by potential customers when it came to biscuits. The overall acceptance rating is 8.05 ± 0.88 . According to Runjala & Murthy, (2013) [10] who made sweet biscuit using wheat grass powder, the overall acceptance of the wheat grass powder incorporated biscuit received a score of 5 (out of 9). The cakes and papads were evaluated based on their organoleptic features,

and the results showed substantial variations between the treatments. The results showed that the sample C1 and P2 was most appreciated by the potential consumers. It has overall acceptability score 7.60 ± 0.87 and 7.5 ± 0.88

respectively. The findings of the sensory characteristics liking test indicated that a partial replacement of wheat flour in prepared products with up to 6% wheat grass powder is acceptable.

Table 5: Mean sensory score of the prepared samples

| samples | | appearance | Color | flavor | texture | taste | overall |
|---------|----|-------------------|----------------------|-------------------|----------------------|----------------------|-------------------|
| | B1 | 7.90 ± 0.71^a | 7.90 ± 0.85^a | 7.90 ± 0.85^a | 7.95 ± 0.85^a | 8.10 ± 0.78^a | 8.05 ± 0.88^a |
| biscuit | B2 | 7.60 ± 0.76^a | 7.65 ± 0.82^a | 7.85 ± 0.87^a | 7.70 ± 0.87^{ab} | 7.80 ± 1.12^a | 7.55 ± 1.02^a |
| | B3 | 6.60 ± 1.50^b | 6.85 ± 1.09^b | 7.10 ± 1.12^b | 7.25 ± 0.97^b | 6.60 ± 1.43^b | 6.8 ± 1.32^a |
| | C1 | 7.80 ± 0.74^a | 7.65 ± 0.87^a | 7.40 ± 0.99^a | 7.75 ± 0.82^a | 7.40 ± 0.99^a | 7.60 ± 0.87^a |
| cake | C2 | 7.20 ± 0.95^b | 7.15 ± 0.85^{ab} | 7.15 ± 0.98^a | 7.50 ± 0.81^a | 6.95 ± 1.05^{ab} | 7.25 ± 1.10^a |
| | C3 | 6.85 ± 1.04^b | 6.80 ± 1.18^b | 6.40 ± 1.27^b | 6.70 ± 0.85^b | 6.45 ± 1.27^b | 6.40 ± 1.14^b |
| | P1 | 7.80 ± 0.68^a | 7.80 ± 0.97^a | 7.80 ± 0.78^a | 7.85 ± 0.75^a | 8.00 ± 0.71^a | 7.45 ± 0.69^a |
| papad | P2 | 7.55 ± 0.68^a | 7.60 ± 0.60^a | 7.80 ± 0.60^a | 7.65 ± 0.97^a | 7.75 ± 0.97^a | 7.50 ± 0.88^a |
| | P3 | 6.60 ± 0.82^b | 6.85 ± 0.91^b | 7.10 ± 0.75^b | 7.25 ± 0.83^a | 6.60 ± 0.85^b | 6.80 ± 0.97^b |

^{a-b} Different superscript alphabets in each column indicate significance difference among the formulations ($p < 0.05$)

Conclusion

The effects of adding wheat grass powder to cake, papad, and biscuits were analyzed. Protein, fiber, carbohydrates, and other nutrients were adequately maintained in the food that was prepared. In terms of texture, flavor, and taste, cake (sample C1), biscuits (sample B1), and papad (sample P3) have better consumer approval than the other prepared foodstuffs. These samples also scored highly in overall acceptability when compared to the other samples in a sensory evaluation. Additionally, because the quality of the powder has been improved for a wider range of acceptance, it may be regarded as a significant functional food that can be used to improve therapeutic benefits while developing a food product rich in irreplaceable nutrients.

Author Contributions

The study's concept and design were developed equally by Anwara Akter Khatun, Md. Abdul Halim, Razib Kumer Saha, Tahmina Mony, Humyra constructed the materials and assembled and interpreted the data. A preliminary outline of the article was written by Md. Abdul Halim, Razib Kumer Saha, Tahmina Mony, Humyra. Anwara Akter Khatun has contributed as a corresponding author in this paper.

Conflicts of Interest

There is no-conflict of interest in the paper and all the authors are agreed to publish the paper in this journal.

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