Research Article

Formulation and Organoleptic Evaluation of Germinated Buckwheat (*Fagopyrum Esculentum* Moench) Flour Incorporated Idly

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Abstract
Buckwheat is a pseudocereal has been grown for years and is used as a functional ingredient in food production. Buckwheat is a rich source of high quality proteins, trace elements, dietary fiber and antioxidant substances such as flavones, phytosterols, and fagopyrins; government of India named buckwheat as "Nutri-cereal". Germination and fermentation, both biological processes involving biochemical and physiological reactions of buckwheat can increase the organoleptic properties and nutrient bio-availability, also decreases anti-nutrients. The aim of the present work was to evaluate the suitability of germinated buckwheat flour for development of idly. Three formulations were prepared with germinated buckwheat flour ranged from 25, 50 and 75% replacing idly rava. These products were evaluated for sensory attributes. Evaluation resulted that addition of 25% of germinated buckwheat flour was more acceptable. Idly prepared with 100% idly rava was served as control.

Keywords: Germinated buckwheat, Germinated buckwheat idly, Common buckwheat, Germinated-fermented product, Germinated Idly

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Introduction

Buckwheat (*Fagopyrum Esculentum* Moench) is an alternative crop belonging to the Polygonaceae family and is referred to as a "pseudocereal." Common buckwheat (*Fagopyrum esculentum* Moench) and tartary buckwheat (*Fagopyrum Tataricum* Gaertn) are the most widely grown species of buckwheat. The major producers of buckwheat are Russia, China, Ukraine and Kazakhstan [1, 2]. Buckwheat is also cultivated in Slovenia, Brazil, Hungary, Austria, Nepal and Poland [3]. In India, it is cultivated in the high altitude areas of North East hilly region on a large scale. Buckwheat is considered of high nutritional value because of its high content of vitamin B1 and B2, protein with balanced amino acid composition and soluble carbohydrates. It is also a good source of antioxidant compounds such as phenolic acids, flavonoids, tocopherols, reduced glutathione, inositol phosphates and melatonin [4]. These components might be beneficial for treating some chronic human diseases such as diabetes and hypertension as well as other cardiovascular ailments.

There have been a variety of buckwheat foods such as griddle cakes, buckwheat wine, buckwheat sauce, buckwheat cakes, buckwheat-lotus confectionery around the world. Dumplings, honey, beer, tea, zlovenka are famous in Europe, France, Japan and Slovenia. Noodles made from buckwheat flour-water dough have been popular in some countries, such as China, Japan, and Italy [5]. Absence of gliadin and glutenin composites is the important basis for significant increase of buckwheat products, so that it can be consumed by celiac disease persons. Germination and fermentation are the traditional processing techniques to improve vitamins, minerals and phytochemicals. These are the effective ways for reducing the mineral and vitamin deficiencies.

Materials and Methods

Procurement of raw materials

Buckwheat was procured from Assam Agricultural University, Jorhat. All the other ingredients used for the study black gram and idly rava were obtained from local market.

Processing of germinated buckwheat idly (GBI)

The grain was cleaned and soaked in distilled water for 12 hours and spread on Whattman filter paper in trays and covered with the filter paper to hydrate the seeds by capillarity. Trays were incubated at 30°C in a dark chamber for 48 hours. The germinated buckwheat seeds were taken and dried at 65°C in a tray drier for 5-6 hours. Dried sprouts were then milled using a grinder; obtained flour was sieved and stored in plastic bags for the formulations.

Preparation of idly

Present study was carried out to develop a product with different combinations of idly rava and germinated buckwheat flour (GBWF). Three different compositions of idly was prepared **Table 1**.

Table 1 Proportion of the ingredients used in preparation of idly

Combinations	Idly rava (g)	GBWF (g)	Black gram (g)
Control	150	-	50
GBI-1 (25%)	112.5	37.5	50
GBI-2 (50%)	75	75	50
GBI-3 (75%)	37.5	112.5	50

Black gram dal was washed, soaked and grinded finely into smooth batter. Idly rava and GBWF was soaked for 2 minutes and mixed well with black gram dal batter by adding little salt to it. Left overnight for fermentation and idly was prepared by wet steaming method using idly cooker for 10-15 minutes.

Sensory evaluation of idly

A semi-trained panel of 15 members from PG&RC, PJTSAU using 9 point hedonic scale evaluated the products for colour, texture, flavour, taste and overall acceptability. Scores were based on a hedonic scale of 1 to 9 where: 1=I dislike extremely (very bad) and 9 = I like extremely (excellent) [6]. The samples were presented in plates coded with three digit numbers in individual cabins in sensory evaluation lab. Panelists rinsed their mouth with water after testing each sample.

Statistical analysis

All the analysis was performed in replications and the results were presented as mean ± standard deviation. Difference between the variables was tested for significance by (ANOVA) using SAS version 9.1.

Results and Discussion

The mean sensory scores of idly prepared with germinated buckwheat flour were presented in **Table 2**. Wojtowicz *et al.* (2013) studied the influence of buckwheat addition on physical properties, texture, color and sensory characteristics of extruded corn snacks. Buckwheat flour was added in the amount from 10 to 50%, addition of buckwheat flour to extruded corn had increased durability, lowered hardness and tractability [7].

Table 2 Mean sensory scores of idly incorporated with germinated buckwheat flour

Idly	Colour	Texture	Taste	Flavor	Overall acceptability
Control	8.53^{a}±0.51	8.46^{a}±0.51	8.33^{a}±0.48	8.46^{a}±0.51	8.53^{a}±0.51
GBI-1	8.00^{b}±0.65	8.00^{a}±0.65	7.93^{a}±0.88	7.93^{b}±0.70	8.20^{a}±0.56
GBI-2	7.00^{c}±0.84	6.93^{b}±1.10	6.80^{b}±1.08	7.06^{c}±0.79	7.00^{b}±0.84
GBI-3	6.26^{d}±0.88	5.93^{c}±1.03	6.40^{b}±1.12	6.7^{d}±0.96	6.53^{c}±0.99
Mean	7.45	7.33	7.36	7.55	7.56
CD	0.45	0.59	0.58	0.48	0.50
SE of mean	0.22	0.29	0.28	0.23	0.24
CV (%)	8.30	10.98	10.74	0.65	9.03

Values are expressed as mean ± standard deviation of fifteen determinations

The sensory attributes of idly were plotted in **Figure 1**. The mean sensory scores of colour for germinated buckwheat idly ranged from 8.53±0.51 to 6.26±0.88 (Table 2). The highest mean scores of colour were given to control (8.53±0.51) followed by GBI-1 (8.00±0.65), GBI-2 (7.00±0.84) whiles the lowest scores for colour of GBI-3

(6.26±0.88). The mean scores of texture were from 8.46±0.51 to 5.93±1.03 (Table 2). The control sample had the highest mean score (8.46±0.51) followed by GBI-1 (8.00±0.65), GBI-2 (6.93±1.10) while GBI-3 (5.93±1.03) had least score with 75% incorporation. The mean scores for texture of control (8.46) were significantly on par with GBI-1 (8.00).

The mean sensory scores for taste ranged from 8.33±0.48 to 6.40±1.12 (Table 2). The control (8.33±0.48) sample had the highest score followed by GBI-1 (7.93±0.88), GBI-2 (6.80±1.08) while GBI-3 (6.40±1.12) had least mean score for taste. The mean scores for taste of control (8.33) were significantly on par with GBI-1 (7.93). The mean scores of flavor for idly varied from 8.46±0.51 to 6.73±0.96 (Table 2). Control (8.46±0.51) scored highest mean scores followed by GBI-1 (7.93±0.70), GBI-2 (7.06±0.79), while GBI-3 (6.73±0.96) had least mean score for flavor of idly.

The mean scores of overall acceptability for idly increased from 8.53±0.51 to 6.53±0.99 (Table 2). The control had highest mean score for overall acceptability (8.53±0.51) followed by GBI-1 (8.20±0.56), GBI-2 (7.00±0.84) whereas GBI-3 (6.53±0.99) had lowest mean score for overall acceptability. The mean scores for overall acceptability of control (8.53) were significantly on par with GBI-1 (8.20).

The mean scores of the control were significantly differed with GBI-2 and GBI-3 for colour, texture, taste, flavor and overall acceptability $p \leq 0.05$. The highest rating for colour, texture, taste, flavor and overall acceptability was for 25% incorporated idly among the germinated buckwheat flour substituted idly, thus 25% of incorporation of germinated buckwheat flour to the idly was suitable. Hemlata and Pratima (2015) formulated idly with germinated fenugreek seeds. Sensory evaluation showed that 30% incorporation was best acceptable [8].

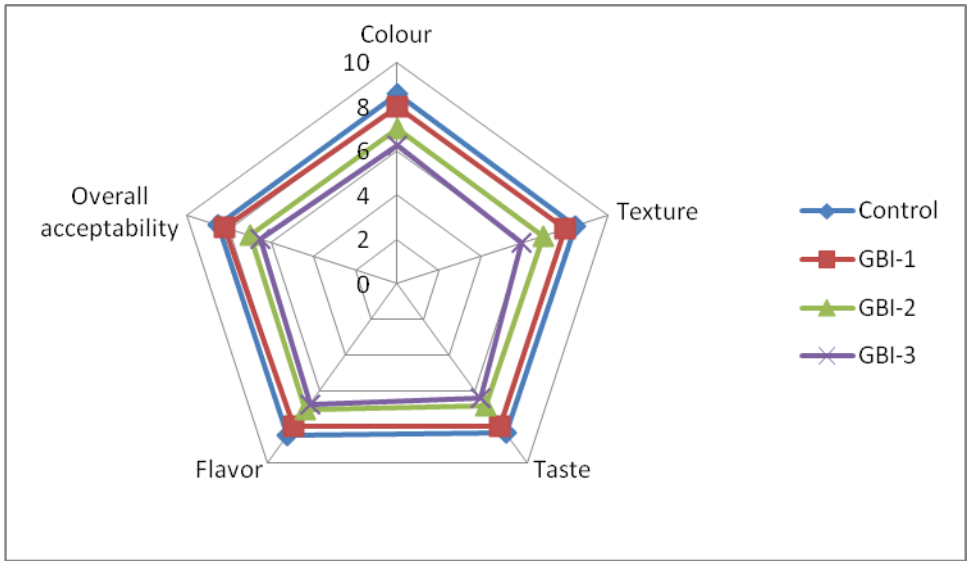

Figure 1 Sensory attributes of developed idly

Gluten free cookies formulated with rice and buckwheat flour in three different ratios. Elevation of buckwheat flour from 10 to 20% resulted in an increase in sensory scores for flavor, chewiness and rupture [9]. Tarhana, a traditional fermented food majorly prepared with wheat flour and yogurt. 40% buckwheat flour enhanced tarhana has received the highest taste and overall acceptability scores [10]. Nakamura *et al*. (2013) prepared an antihypertensive food, neo-fermented sprouts (neoFBS) from lactic fermentation of buckwheat sprouts. Administration of lactic-fermented buckwheat sprouts at 0.010 mg/kg has decreased the both systolic and diastolic blood pressure in the spontaneously hypertensive rats (SHR). Orally administered neo-FBS (10 mg/kg) significantly decreased angiotensin I-converting enzyme (ACE) activity in the lung, thoracic aorta, heart, kidney, and liver of SHRs. Neo-FBS had a detectable relaxing effect on a phenylephrine-precontracted thoracic aorta in SHRs at 0.5 μg/mL and the EC50 value was 8.3 ± 1.4 μg/mL [11]. Results showed that 25% incorporation of germinated buckwheat flour was most suitable than 50% and 75% addition.

Conclusion

Hence, it concluded as an attempt was made to improve the sensory and nutritional quality characteristics like minerals and antioxidant activity by substituting germinated buckwheat flour with regular idly rava. The germinated buckwheat idly at 25% was found to be the most acceptable among all the formulations from sensory evaluation scores.

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