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## Development and evaluation of germinated buckwheat (*Fagopyrum esculentum* Moench) flour incorporated dosa

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**Abstract**

Germinated seeds or sprouts always nutritionally superior to their original seeds with higher levels of sensory properties, nutrients, lower amounts of anti-nutrients and increased protein and starch digestibility. A fermented product along with germinated grain flour makes the product more bioavailable with biochemical modification of primary food matrix brought about by microorganisms and their enzymes. Buckwheat (*Fagopyrum esculentum* Moench) belongs to polygonaceae family was germinated and fermented for dosa. Dosa was prepared with Germinated Buckwheat Flour (GBWF) at 25, 50 and 75% proportions replacing rice. 25% incorporation of germinated buckwheat flour has high sensory acceptability.

**Keywords:** Common buckwheat, germinated buckwheat, germinated buckwheat dosa, germinated

**1. Introduction**

Buckwheat (*Fagopyrum esculentum*) is a psuedocereal growing in simple conditions and can prove as an imminent and forthcoming nutritional source for the "Starving World" [1]. Buckwheat is a rich source of many health-beneficial compounds, including dietary fibers, polysaccharides, minerals, vitamins, proteins and polyphenols such as flavonoids and phenolic acids; especially rutin [2, 3]. The quantity and quality of protein in buckwheat is significantly higher than in rice, wheat, sorghum, millet, and maize. It has a well-balanced amino acid profile with a good amount of lysine, which is generally recognized as the first limiting amino acid in wheat and barley [4]. Phenolic compounds and flavones such as rutin, quercetin, orientin, vitexin, isoorientin and isovitexin were found in buckwheat hulls [5]. Buckwheat protein improves health in various ways, notably reducing serum cholesterol, suppressing gallstones and tumors and inhibiting the angiotensin I-converting enzyme [6-9]. Generally, buckwheat flour was used in different bakery products such as bread, cookies, snacks, and noodles; buckwheat enhanced non-bakery products (tea, honey, tarhana, and sprouts) [10].

**2 Materials and Methods****2.1 Procurement of raw materials**

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

**2.2 Processing of germinated buckwheat dosa (GBD)**

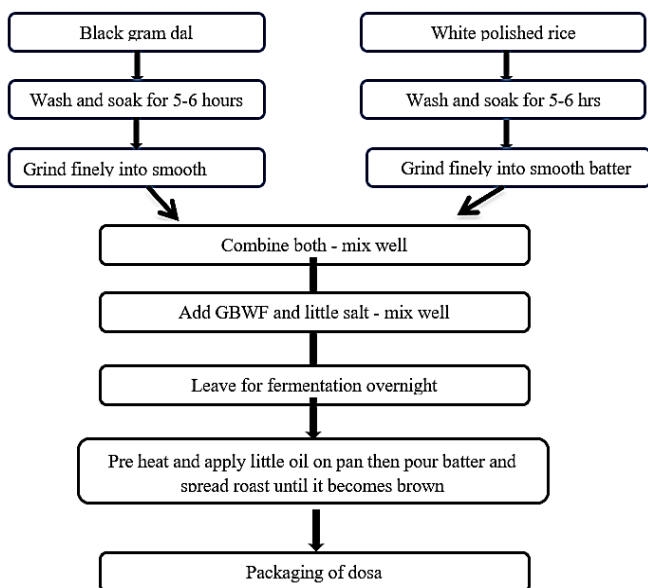
The grain was cleaned and soaked in distilled water for 12 hours and spread on Whatman filter paper in trays and covered with the filter paper to hydrate the seeds by capillarity. Water was sprinkled in between. Trays were incubated at 30°C in a BOD incubator for 48 hours. The germinated buckwheat seeds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

**2.3 Preparation of dosa**

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

**Table 1:** Proportion of the ingredients used in preparation of dosa

Combinations	Rice(g)	GBWF (g)	Black gram (g)
Control	160	-	40
GBD-1 (25%)	120	40	40
GBD-2 (50%)	80	80	40
GBD-3 (75%)	40	120	40

**Fig 1:** Flow chart of preparation of dosa.

#### 2.4 Sensory evaluation of dosa

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) [11]. 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.

#### 2.5 Statistical analysis

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

#### 3. Results and Discussion

Mean sensory scores of dosa were presented in Table 2. Sensory rating of dosa for colour showed that control sample (8.60) scored highest due to excellent appearance followed by GBD-1 (8.06), GBD-2 (7.40), and while minimum mean score of colour was observed for GBD-3 (6.13). The mean scores of the colour for control were significantly differed with germinated buckwheat incorporated dosa. Sensory evaluation of biscuits incorporated with buckwheat flour has demonstrated high sensorial acceptability [12].

Mean sensory scores of dosa texture varied from 6.33 to 8.53 (Table 2). The best texture rating was for control (8.53) followed by GBD-1 (7.80), GBD-2 (7.40) while the minimum rating was for GBD-3 (6.33) with 75% incorporation. Mean scores for texture of GBD-1 (7.80) and GBD-2 (7.40) were not significantly differed at  $P=0.05$ .

Mean sensory scores for taste of dosa differed from 6.66 to 8.80 (Table 2). Sensory acceptability of dosa revealed that the control sample had highest mean score for taste (8.80) followed by GBD-1 (8.20), GBD-2 (7.26), while GBD-3 (6.33) had least mean score for taste of dosa.

Mean sensory scores of dosa flavor differed from 8.20 to 6.66 (Table 2). Sensory acceptability of dosa revealed that the control sample had highest mean score for flavor (8.20) followed by GBD-1 (7.93), GBD-2 (7.33), while GBD-3 (6.66) had least mean score for flavor of dosa. The mean scores of flavor for control (8.20) and GBD-1 (7.93) were not significantly differed at  $P=0.05$ .

**Table 2:** Mean sensory scores of dosa incorporated with germinated buckwheat flour

Dosa	Colour	Texture	Taste	Flavor	Overall acceptability
Control	8.60 <sup>a</sup> $\pm$ 0.50	8.53 <sup>a</sup> $\pm$ 0.51	8.80 <sup>a</sup> $\pm$ 0.41	8.20 <sup>a</sup> $\pm$ 0.41	8.60 <sup>a</sup> $\pm$ 0.50
GBD-1	8.06 <sup>b</sup> $\pm$ 0.79	7.80 <sup>b</sup> $\pm$ 0.86	8.20 <sup>b</sup> $\pm$ 0.67	7.93 <sup>a</sup> $\pm$ 0.79	8.13 <sup>a</sup> $\pm$ 0.74
GBD-2	7.40 <sup>c</sup> $\pm$ 0.82	7.46 <sup>b</sup> $\pm$ 0.83	7.26 <sup>c</sup> $\pm$ 0.88	7.33 <sup>b</sup> $\pm$ 0.2	7.33 <sup>b</sup> $\pm$ 0.72
GBD-3	6.13 <sup>d</sup> $\pm$ 0.83	6.33 <sup>d</sup> $\pm$ 0.81	6.33 <sup>d</sup> $\pm$ 0.72	6.66 <sup>c</sup> $\pm$ 1.04	6.06 <sup>c</sup> $\pm$ 0.99
Mean	7.55	7.53	7.65	7.53	7.53
CD	0.50	0.57	0.48	0.58	0.49
SE of mean	0.25	0.28	0.24	0.28	0.24
CV (%)	9.08	10.29	8.59	10.45	8.96

**Note:** Values are expressed as mean  $\pm$  standard deviation of fifteen determinations.

Mean sensory scores for overall acceptability of dosa varied from 8.60 to 6.06 (Table 2). It revealed that the control sample had highest mean score for overall acceptability (8.60) followed by GBD-1 (8.13), GBD-2 (7.33), while GBD-3 (6.06) had least mean score for overall acceptability. In all sensory attributes control has the highest rating followed by GBD-1 with 25% incorporation. Among the incorporated dosa 25% of supplemented dosa had the best mean score, thus 25% of incorporation was suitable for germinated buckwheat dosa. Torbica *et al.* (2012) reported that elevation of buckwheat flour from 10 to 20% in gluten free cookies resulted in an increase in sensory scores for flavor, chewiness and rupture [13]. Shreeja *et al.* (2019) reported that 25% incorporation of germinated buckwheat milk in payasam was most acceptable

and there is no significant difference between control and the sample in terms of organoleptic properties [10].

#### 4. Conclusion

It can be concluded that 25% addition of germinated buckwheat flour for fermented products gives good sensorial properties; hence it has no significant difference with control and can also increase the nutritional bio-accessibility and bioavailability.

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