J. Farm Sci., 37(4): (400-403) 2024

RESEARCH PAPER

Physical properties and cooking quality of buckwheat (*Fagopyrum esculentum*) ready-to-eat *chakli*

*H.THEJASWINI AND UMA N. KULKARNI

Department of Food Science and Nutrition, College of Community Science, Dharwad
University of Agricultural Science, Dharwad - 580 005, India
*E-mail: thejaswinisc10@gmail.com

(Received: August, 2024 ; Accepted: December, 2024)

DOI: 10.61475/JFS.2024.v37i4.19

Abstract: Buckwheat is pseudo cereal belonging to the Polygonaceae family, highly valued for its gluten-free protein, well-balanced amino acids and health-promoting flavonoids, making it a promising crop for the future. The main aim of the study is to evaluate physical properties and cooking quality of buckwheat *chakli.* The results showed that the width of buckwheat and rice *chakli* before and after frying varied from 52.23 to 52.77 mm and 52.29 to 52.83 mm respectively, similarly diameter of buckwheat and rice *chakli* before and after frying varied from 2.66 to 2.77 cm and 3.50 to 3.58 cm, respectively. Width of *chakli* strands in buckwheat *chakli* and rice *chakli* were varied from 5.02 to 5.09 mm and 5.52 to 5.54 mm before and after frying. The L*, a*, b* value of rice *chakli* and buckwheat *chakli* were 85.95, 32.03, 0.94 and 86.06, 31.50, 0.95, respectively. Texture was analyzed for hardness and fracture ability. Cooking parameters like water for dough preparation, dough weight, frying time, frying temperature, oil absorption and final product yield were analyzed for rice *chakli* and buckwheat *chakli*. For rice *chakli* and buckwheat *chakli* preparation70 and 80 ml water was used, frying was done for 180sec at 183^{0}C. Absorption of oil was 75 and 79 ml in rice and buckwheat *chakli,* respectively. In sensory analysis buckwheat *chakli* has acceptability index of 91.60 per cent.

Key words: Buckwheat, *Chakli*, Gluten free, Pseudocereal, Sensory profile

Introduction

Buckwheat (*Fagopyrum esculentum*) is an annual pseudo cereal belonging to the Polygonaceae family. It was first cultivated in China and is now widely produced in countries like Russia, Poland, the United States, Canada, and France. Genus Fagopyrum falls under the Caryophyllales order within the Polygonaceae family. Buckwheat goes by various names around the world, which can be essential in tracing its migration. In India, it is known as "Ogal," in Nepal as "Titephapar," in Japan for traditional noodles as "Soba," in Pakistan as "Jawas," and in Mandarin as "Tian qiaomai." In Bhutan, it's called "Bjo," and in Pakistan, it is known as "Brow." Notably, both China and Nepal refer to common buckwheat as "sweet buckwheat," while tartary buckwheat is called "bitter buckwheat" (Ahmed *et al*., 2014). In some states of India, particularly in the North and West, buckwheat flour is named "Kuttu ka atta" and is consumed by Hindus during specific fasting days, such as Navarathri, Ekadhashi, Krishna Janmashtami, and Maha Shivarathri (Pirzadah *et al*., 2019).

Buckwheat is a rich source of complex carbohydrates, fiber, protein and an array of vitamins. It also contains essential micro-minerals like zinc, copper, and manganese (Ikeda *et al*., 2005). Notably, buckwheat seeds exhibit exceptionally high antioxidant activity, surpassing that of other grains, such as oats, barley, wheat, rye and most fruits and vegetables (Pragya *et al*., 2016). Buckwheat flour (BWF) finds application in various food products like bread, cookies, pies, pancakes, and macaroni items. Convenience foods are a kind of food that impart comfort to the customer by using way of little or no need of major processing or cooking prior to consumption. Due to altering life-style, there is greater demand for ready-to-cook or ready-to-serve convenience foods from the consumer end. The ready-to-cook products ought to meet a range of features like a wider consumer base, incredibly longer shelf-life, more convenience and better eating quality. Buckwheat is of significant interest due to its gluten-free distinctiveness. Oats, buckwheat, quinoa, sorghum, soybean, maize and rice are some of the options for gluten-free grains. Incorporation of gluten-free grains in the diet no longer solely provides variety but additionally improves dietary quality, for the reason that these grains are tremendously prosperous in nutrients. The main objective of the study was to assess the physical properties of buckwheat incorporated *chakli* and to evaluate the buckwheat *chakli* acceptance by semi trained panel members.

Material and methods

Procurement of raw materials

Buckwheat was procured from Main Agricultural Research Scheme, AICRP on wheat and barley, Dharwad during *kharif* 2022. Other ingredients like roasted bengal gram flour, ajwain, asafoetida, chilli powder, cumin seeds, salt, sesame and oil were procured from the local market of Dharwad.

Physical properties of buckwheat ready-to-eat *chakli*

Width, diameter, width of strands, color, texture and cooking quality were assessed.

The width of buckwheat-based *chakli* was measured by using a slide calliper. The yield parameters including in terms of mean and SD was recorded. The diameter of buckwheat-based *chakli* was measured by using a slide calliper. The mean score was recorded.The strands of buckwheat *chakli* was measured by using ruler. The mean score was recorded. Colour of buckwheat *chakli* was assessed in spectrophotometer (Konica

Table 1. Physical properties of buckwheat-based ready-to-eat *chakli*

Products		Width (mm)	Diameter (cm)	Width of *chakli* strands (mm)
Control (rice *chakli*)	Before frying	52.29±6.79	3.50±0.45	5.09±0.66
	After frying	52.83±6.86	3.58±0.46	5.54±0.71
Buckwheat *chakli*	Before frying	52.23 ± 6.78	2.66 ± 0.23	5.02 ± 0.32
	After frying	52.77 ± 6.86	2.77 ± 0.13	5.52 ± 2.45
			t-test	
Control (rice *chakli*)×Buckwheat *chakli*	Before frying	0.01^{NS}	2.55^{NS}	0.13^{NS}
Control (rice *chakli*)×Buckwheat *chakli*	After frying	0.01^{NS}	2.38^{NS}	0.03^{NS}

Parameters	Color			Texture	
	Lightness (L*)	Redness (a*)	Yellowness (b*)	Hardness (kg)	Fracturability (mm)
Control (rice *chakli*)	85.95 ± 11.17	32.03 ± 4.16	0.94 ± 0.12	20.56 ± 2.65	1657.28 ± 215.44
Buckwheat *chakli*	86.06 ± 4.55	31.50 ± 2.19	0.95 ± 0.05	23.39 ± 3.04	1885.40 ± 245.12
			t-test		
Control (rice *chakli*)×Buckwheat *chakli*	0.20^{NS}	0.15^{NS}	0.09^{NS}	1.21^{NS}	1.28^{NS}

Values are mean of three replications ± SD. NS- Non significant, *Significant at5%,**Significant at 1%.

Minolta spectrophotometer of model CM 2600/2500d). The colour was measured in chromatic components of L*, a* and b* values. L* value measures black (0) to white (100), a* represents redness (+a values) to greenness (-a values) and b* represents yellowness (+b values) to blueness (-b values). The texture is evaluated using texture analyzer machine (using exponent software). The hardness and fractur ability parameters were recorded.

Cooking quality of buckwheat ready-to-eat *chakli*

Cooking quality parameters like water for dough preparation, dough weight**,** frying time, frying temperature, oil absorption and final yield were analyzed by standard procedures

To a dry mix gradually add room temperature water using measuring cups,knead until smooth or soft dough is formed. The total water required for dough preparation was recorded and was represented in milliliter (ml).

The dough weight was measured and calculated as the total dough obtained by the total blend of ingredients used expressed as gm/100gm (Sarojani *et al.,*2021).

The frying time was measured using a stopwatch and was represented in seconds (Patel *et al*., 2019).

The *chakli* was fried at 183^{0}C temperature using thermometer (Alim *et al*., 2017). The Oil absorption of *chakli* was measured using final weight and initial weight of *chakli.*

$$\text{Oil absorption} = \frac{\text{(Final weight - Initial weight)}}{\text{Initial weight}} \times 100$$

The final yield of *chakli* was measured and calculated as the total product obtained by the total blend used expressed as gm/100 gm (Patel *et al*., 2019).

Acceptability of buckwheat ready-to-eat *chakli*

The developed buckwheat *chakli* was subjected to sensory evaluation by a group of 15 semi trained panel members in the Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad. The developed products were evaluated for appearance, color, flavour, taste, texture and overall acceptability using nine point hedonic scale (Amerine *et al*., 1965). Acceptability index was calculated by summing up of all the sensory scores of appearance, texture, flavor, taste and overall acceptability and it was divided by maximum score (54) and multiplied by 100 (Bustos *et al*., 2011).

$$\text{Acceptability Index (AI)} = \frac{\text{Total Score}}{\text{Maximum Score}} \text{x100}$$

Statistical analysis

Mean, standard deviation was used to interpret the data. Data obtained for physical parameters and cooking quality parameters of developed buckwheat *chakli* were subjected to one way ANOVA (Analysis of variance) using SPSS (version 23) and 't' test was used to know the significant difference.

Results and discussion

Physical properties of buckwheat ready-to-eat *chakli*

The comparison between the physical parameters of rice *chakli* (control) and buckwheat *chakli* before and after frying

Table 2. Cooking quality parameters of buckwheat-based ready-to-eat *chakli*

Products	Water for dough preparation (ml)	Dough weight (g)	Frying time (sec)	Frying temperature (°C)	Oil absorption (ml)	Final product (g)
Chakli						
Control (rice *chakli*)	70	189	150	183$^0_0$C	75	159
Buckwheat *chakli*	80	191	150	183 C	79	160
t-test						
Control(rice *chakli*)× Buckwheat *chakli*	1.25^{NS}	0.09^{NS}	0.00^{NS}	0.00^{NS}	0.48^{NS}	0.05^{NS}

Values are mean of three replications. NS- Non significant, *Significant at 5%, **Significant at 1%.

Table 3. Sensory evaluation of buckwheat-based *chakli*

Parameters	Buckwheat *chakli*
Appearance	8.40±0.50
Colour	8.27±0.25
Flavour	8.13±0.35
Taste	8.27±0.45
Texture	8.20±0.56
Overall acceptability	8.20±0.41
Acceptability Index (%)	91.60±2.60

Values are expressed as Mean ± S.D.

revealed significant difference (Table 1). Before frying, both types of *chakli* had similar widths, with the control rice *chakli* being slightly wider (52.29 cm) than buckwheat *chakli* (52.23 cm). However, the diameter of rice *chakli* was notably larger compared to buckwheat *chakli* (3.50 cm and 2.66 cm, respectively). Additionally, the thickness (5.09 cm) of rice *chakli* was higher than that of buckwheat *chakli* (5.02 cm). Non-significant differences were found in width, diameter and width of *chakli* strands in both before and after frying. In terms of color, both rice *chakli* and buckwheat *chakli* did not differ significantly and the L*, a*, b* values were 85.95 and 86.06, 32.03 and 31.50, 0.94 and 0.95, respectively. However, there was a slight distinction in redness (a*), with rice *chakli* (32.03) exhibiting a slightly higher value compared to buckwheat *chakli* (31.50). The variation in thecolour is due to type of ingredients used (Tanna *et al,* 2020). Buckwheat *chakli* demonstrated higher values for both hardness (23.39 kg) and fracturability (1885.4 mm) compared to rice *chakli* (20.56 kg and 1657.28 mm). It means that to compress small piece of buckwheat sample treatment takes more force and to break large quantity of same sample control required less force.

Cooking quality of buckwheat ready-to-eat *chakli*

The quality parameters of buckwheat *chakli* are depicted in Table 2. Buckwheat *chakli* requires 80 ml of water for dough preparation compared to rice *chakli* (70 ml). Dough weight was higher in buckwheat *chakli* (191 g) than rice *chakli* (189 g). Frying time (2:30 min) and frying temperature (183^0C) was same for both rice *chakli* and buckwheat *chakli*. Oil absorption was found to be higher in buckwheat *chakli* (79 ml) than rice *chakli* (75 ml). Buckwheat *chakli* has yield of 160 g while rice *chakli* has 159 g. There was no significant difference observed in water required for dough preparation, dough weight, frying temperature and oil absorption. More water (80 ml) was required for dough preparation of buckwheat *chakli* compared to proso millet *chakli* reported by Sarojani *et al,*(2021). More water absorption in buckwheat is attributed to higher fibre content facilitating in binding and entrapment of water. The differences in water absorption capacity were driven by variation in granular structure and the formation of hydrogen and covalent bonds between the starch chains (Abdalla *et al.,* 2009).

Table 3 shows the sensory scores of buckwheat ready-to-eat *chakli* and found that it had acceptable range from liked very much to liked extremely with a mean score for appearance (8.40), color (8.27), flavour (8.13), taste (8.27), texture (8.20) and acceptability index (91.60%). The variations in sensory scores of buckwheat *chakli* may be due to varietal difference, composition, structural difference, soil condition and genetic constitution of buckwheat (Paul and Palmer, 1997). This also depends on individual perception about the product.

Conclusion

The comparison between rice and buckwheat *chakli* revealed notable differences in physical parameters, such as width, diameter, and thickness, with buckwheat *chakli* generally exhibiting smaller dimensions. *Chakli*, a beloved Indian snack, enjoys widespread popularity due to its crispy texture and savory taste, cherished by all age groups. Replacing rice flour with buckwheat flour brings significant nutritional benefits, as buckwheat is gluten-free, fiber-rich, and packed with essential nutrients. This makes buckwheat *chakli* an ideal choice for health-conscious individuals and those with gluten sensitivities. Additionally, buckwheat flour imparts a delightful nutty flavor and denser texture to *chakli,* elevating its taste profile. Overall, buckwheat *chakli* offers a wholesome snacking alternative, catering to diverse preferences and contributing to a balanced diet.

Acknowledgment

I would like to acknowledge RKVY Project, University of Agricultural Sciences, Dharwad for financial assistance throughout the course of this research project. Their funding played a crucial role to conduct this study.

References

Abdalla A A, Ahmed M U, Ahmed R A, Tinay H A and Ibrahim A K, 2009, Physico chemical characterization of traditionally extracted pearl millet starch (Jir). *Journal of Applied Science Research*, 5(11): 2016-2027.

Ahmed A, Khalid N, Ahmad A, Abbasi N A, Latif M S and Randhawa M A, 2014, Phytochemicals and biofunctional properties of buckwheat: a review. *The Journal of Agricultural Sciences*, 152(3): 349-69.

Alim H, Xavier K M, Gangan S S and Balange A K, 2017, Development of Fish Chakli from Pangasius Mince and Its Storage Study. *Journal of Indian Fisheries Association*, 44(1): 23-31.

Amerine M A, Pangborn R M and Roessler E B, 1965, Principles of Sensory Evaluation of Food, Academic Press, New York, 602.

Bustos M C, Perez G T and Leon A E, 2011, Sensory and nutritional attributes of fibre-enriched pasta. *LWT-Food Science and Technology*, 44(14): 29-34.

Ikeda S, Yamashita Y, Kusumoto K and Kreft I, 2005, Nutritional characteristics of minerals in various buckwheat groats. *Fagopyrum*, 22: 71-75.

Patel S K, Khan M A, Rana G K and Mehra M, 2019, Formulation, Development and Quality Assessment of Nutri-Rich Snack Food (Sev). *Asian Journal of Dairy and Food Research*, 38(3): 257-260.

Paul P C and Palmer H H, 1977, *Food Theory and Application*. John Wiley and Sons Publication, London, 214-216.

Pirzadah T B, Malik B, Tahir Y and Rehman U R, 2019, Buckwheat journey to functional food sector. *Current Nutrition and Food Science*, 16(2): 134-141.

Pragya S and Raghuvanshi R S, 2016, Nutritional and health aspects of buckwheat. *World Journal of Pharmaceutical Research,* 5(9): 453-468.

Sarojani J K, Hegde S C, Desai S R and Naik B K, 2021, Standardization and nutrient composition of the proso millet chakli. *In Biological Forum–An International Journal* (SI-AAEBSSD-2021) (Vol. 13, No. 3b, pp. 44-50).

Tanna P D, Bhola D V and Fofandi B C D, 2020, Preparation of fish chakli by using edible fish powder (*Scomberomorus guttatus*) incorporated with different flours. *Journal of Entomology and Zoology Studies*, 8(5): 2438-2444.