Content available at: https://www.ipinnovative.com/open-access-journals

IP Journal of Nutrition, Metabolism and Health Science

Journal homepage: https://www.jnmhs.com/

Original Research Article

Formulation and evaluation of mathri developed with partial replacement of wheat flour with buckwheat flour (*Fagopyrum esculentuim*)

Deepika M[1], Manasa R[1], Shekhara Naik R[1], Mahesh Shivananjappa[1,*]

[1] *Dept. of Food Science and Nutrition, Yuvaraja's College, (Autonomous), University of Mysore, Karnataka, India*

ARTICLE INFO

Article history:
Received 15-05-2023
Accepted 28-06-2023
Available online 14-07-2023

Keywords:
Mathri
buckwheat
pseudocereal
gluten free

ABSTRACT

Fagopyrum esculentuim is commonly known as buckwheat. It is a nutraceutical important crop belongs to the family polygonaceae that can exhibit potential health benefits with low gluten content, good source of minerals and nutrients. Mathri is the famous Rajasthani snack which is traditionally prepared with wheat flour, ajwain and salt. The present study was conducted to develop Mathri by partial replacement of wheat flour with buckwheat flour in variable proportions (BW1, BW2, BW3, BW4, BW5 and BW6). The sensory evaluation of Mathri was carried out with semi- trained panellists (n=30) by hedonic rating test resulted in the maximum acceptance level for BW3 (40%) variation. Whereas BW4 (60%) had moderate scores of acceptability. In the current scenario, the development of value added products has been increased in the market. Formulation of products with partial replacement of functional foods can bring considerable change in its nutritional profile. Thus, the formulation of mathri from partial replacement of wheat flour with buckwheat flour is an attempt to develop a food product which could also be a healthy choice as a snack superior to that of normally available mathri.

1. Introduction

Mathri is a delicious and versatile snack that can be enjoyed with tea or as a travel snack. Its combination of wheat flour, ajwain, salt, and water creates a savoury and flavourful cracker. The fact that it can last for a couple of weeks at room temperature makes it convenient for storage and consumption.

Buckwheat (BW) is an annual crop belonging to the family Polygonaceae. Although it is categorized as a cereal, it is actually a pseudo-cereal.[1] In English, it is known as silver hull buckwheat, while it is called "askottu" in Hindi and "kaadugodhi" in Kannada. BW is extensively grown in hilly regions of India due to its high nutritional value and adaptability to high temperatures.[2] Buckwheat is highly nutritious, providing a rich source of energy, protein, fiber, and fat. It contains essential amino acids like lysine, threonine, and tryptophan in significant quantities.[3] This crop was initially cultivated in China and, despite its name, does not contain any wheat or gluten. It consists of 67-75% starch, 7-21% protein, 1.2-4.3% lipids, and a significant amount of dietary fiber and minerals.[4] The consumption of dietary fiber has been associated with various health benefits, including improved bowel movement and the maintenance of normal blood cholesterol and glucose levels. Therefore, it can be effective in managing Type-2 Diabetes. Furthermore, buckwheat is a valuable source of micronutrients such as iron, calcium, potassium, magnesium, zinc, phosphorus, and B-complex vitamins. It serves as an excellent plant-based, gluten-free alternative for individuals with celiac disease.[1] Hence, buckwheat was used as replacement for wheat which had considerably less similarity in its functional properties on par with wheat.

* *Corresponding author*.
E-mail address: mayavishiva@gmail.com (M. Shivananjappa).

https://doi.org/10.18231/j.ijnmhs.2023.012

2. Objective

1. To develop Mathri by partially replacing wheat flour with Buckwheat flour.
2. To evaluate the sensory attributes and analyse its nutritional composition.

3. Materials and Methods

1. *Raw materials:* The present study was carried out in the department of Food Science and Nutrition, Yuvaraja's College, (Autonomous) University of Mysore, Mysuru, Karnataka, India. The raw materials viz., Wheat flour, Buckwheat flour, ajwain, oil and salt were procured from local grocery shop of Mysuru, Karnataka, India.
2. *Methods:* Mathri which was kept as standard (SBM) was entirely prepared from wheat flour and other ingredients. Wheat flour, Buckwheat flour, ajwain and salt were mixed in appropriate proportions. Hot oil was poured into the mixture; known quantity of water was Added to make semi-hard dough. The dough was divided into equal sized balls and flattened into round shape which was 5cm diameter and 0.5 cm in thickness. Mathri was deep-fried on medium flame till it turns golden brown and crisp. All the factors except flours ratio were kept constant.[5]
3. *Sensory evaluation:* Mathri was developed and evaluated for its organoleptic properties keeping standard Mathri as reference. It was carried out by 30 semi-trained panellists. Hedonic scale (1- 9 Ratings) was used for rating the sensory quality of the Buckwheat flour Mathri. The mean value of 30 score cards were considered for evaluating the sensory attributes.[5]
4. *Proximate analysis:* Sample of Mathri was analysed in triplicates. Mathri prepared from BW3 (40%) were used for proximate analysis to determine its nutritional composition using standard AOAC (1990) methods for individual nutrients.[6] The moisture content was estimated by subjecting the samples to a hot air oven at 98-100°C.[7] The protein content was determined using the standard Micro-Kjeldhal method.[8] The fat content was estimated using the Soxhlet extraction method. The ash content was determined through high-temperature incineration using a muffle furnace. The crude fibre content was estimated using a crude fibre analyser.[9] To obtain the carbohydrate value of Mathri, the sum of the moisture, protein, fat, and ash content per 100 g of the sample was subtracted from 100.[10] Furthermore, the mineral content, including calcium, iron, and phosphorus, were analysed using Inductively Coupled Plasma Mass Spectrometry (ICPMS).[11–13] The results obtained from the standard AOAC methods for nutrient analysis were accurate and precise.
5. *Statistical analysis:* The statistical analysis was done using Snedecor and Cochran[14] and by Duncan's multiple range test with the *p < (0.05) considered to be significant.[15]

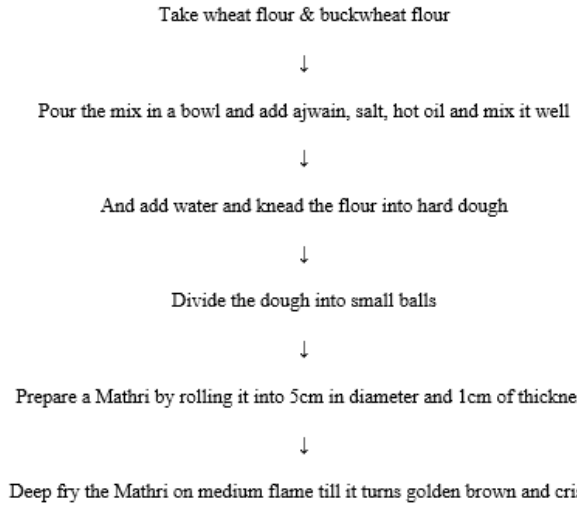

Fig. 1: Flow chart for preparation of buck wheat mathri

3.1. Formulation of buckwheat flour mathri

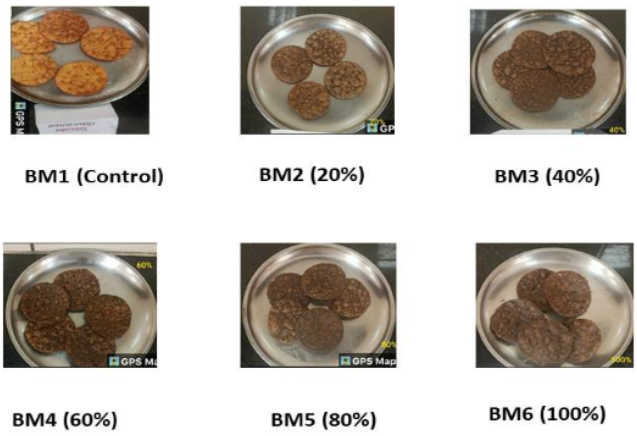

Fig. 2: Different variations of mathri developed from Buckwheat flour in comparison of wheat flour Mathri.

4. Results and Discussion

The formulation of mathri involved partially replacing wheat flour with buckwheat flour at different concentrations. The replacement of buckwheat flour was set as 20%, 40%, 60%, 80%, and 100% respectively. Buckwheat flour has a lower gluten level compared to wheat flour. As the percentage of buckwheat flour increased in the dough preparation, the dough consistency of mathri resulted in

Table 1: Formulation of the product (g/100gm) for preparation of mathri from BW flour.

Ingredients	BM1 0%	BM2 20%	BM3 40%	BM4 60%	BM5 80%	BM6 100%
Wheat flour (g)	100	80	60	40	20	-
Buckwheat flour (g)	-	20	40	60	80	100
Ajwain (g)	0.5	0.5	0.5	0.5	0.5	0.5
Salt (g)	2	2	2	2	2	2
Oil (ml)	15	15	15	15	15	15
Water (ml)	60	60	60	60	60	60

Table 2: Sensory evaluation of Mathri of different variations compared with standard as control.

Variation	Appearance	Colour	Texture	Taste	Flavour	Overall acceptability
BM1(control)	8.85±0.12	8.91±0.11	8.79±0.27	8.65±0.21	8.59±0.20	8.79±0.11
BM 2 (20%)	8.36±0.11	8.10±0.12	8.12±0.34	8.25±0.27	8.31±0.17	8.31±0.18
BM 3 (40%)*	8.21±0.10	8.12±0.13	8.43±0.19	8.63±0.11	8.25±0.14	8.25±0.13
BM 4 (60%)	7.75±0.13	7.68±0.11	7.87±0.11	7.68±0.29	7.62±0.21	7.93±0.18
BM 5 (80%)	7.06±0.11	6.75±0.12	7.0±0.16	6.43±0.12	6.15±0.14	6.73±0.12
BM6 (100%)*	6.03±0.14	6.10±0.11	6.06±0.19	5.87±0.17	5.81±0.28	5.94±0.16

Values are mean ± SD (n=30) *p value < 0.05 (Holm sidak method)

Table 3: Nutritional composition of Mathri from buckwheat flour SB3 (40%) compared with standard.

Nutrients	Mathri (Standard)	BM3 (40%)
Moisture (%)	11.14±0.19	11.17±0.18
Carbohydrate (g)	50.92±0.15	46.91±0.13
Protein (g)	10.57±0.23	12.52±0.41*
Fat (g)	16.63±1.06	16.52±0.94
Crude fiber (g)	9.46±1.14	12.49±1.11*
Energy (kcal)	401.11±0.36	387.88±0.58
Total ash (g)	1.28±1.25	1.39±1.30
Iron (mg)	4.61±0.03	4.25±0.01
Calcium (mg)	36.11±0.58	41.54±0.46*

*Values are mean (SD, p ≤0.05 (Holm Sidak) n=3

variable textural property. The unique flavor profile, mild bitter taste and a dark colour with volatile compounds dominated the rest of ingredients. Consequently, as the percentage of buckwheat increased the flavor, taste and colour of mathri also varied significantly. According to sensory evaluation, 40 % buckwheat mathri was most acceptable in terms of texture, colour, flavor and taste. While, 80% and 100% were slightly disliked with the lowest scores and not well-received by sensory panellists.

The proximate estimation of nutrients present in selected variation (40%) was resulted in significantly increased levels of Crude fiber, Iron, calcium content and low carbohydrate level than standard Mathri. Thus, the developed mathri was found to be superior in terms of nutritional value with low gluten and low glycemic content.

5. Conclusion

In this study, Mathri prepared from 40% replacement with Buckwheat flour was the most acceptable variation and is healthy as it had increased levels of protein, crude fiber and calcium. Low carbohydrate with high fiber makes this product low-glycemic as well as low- gluten. As buckwheat is the abundant source of macro, micronutrients as well as phytonutrients, this attempt made an ordinary snack into a nutritionally superior food product which would be a better option to in corporate this in daily healthy diet.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Latharani R, Kulkarni S. Essential mineral composition of buckwheat (Fagopyrumesculentuim) Varieties for nutrition security. *Pharma Innov J*. 2022;11(10):1895–8.
2. Rosentrater KA, Evers AD. Introduction to cereals and pseudocereals and their production. *Kent's Technol Cereals*. 2018;p. 1–76. doi:10.1016/B978-0-08-100529-3.00001-3.

3. Li S, Zhang QH. Advances in the development of functional foods from buckwheat. *Crit Rev Food Sci Nutr*. 2001;41(6):451–64.
4. Rani RL, Kulkarni UN, Biradar S. Essential mineral composition of buckwheat (Fagopyrum esculentum) varie. *Pharma Innov J*. 2022;11(10):1895–8.
5. Ritu M, Bharti J, Sharma A. Nutritive value and sensory evaluation of value added products developed by incorporating dried Harshingar (Nyctanthesarbor- tristis) leaf powder. *J Phytol Res*. 2022;33(2):149–56.
6. Thiex N, Novotny L, Crawford A. Determination of Ash in Animal Feed: AOAC Official Method 942.05 Revisited. *J AOAC Int*. 1990;95(1):1392–7.
7. Gouveia SS, Freitas G, de Brito J, Slaski JJ. Nutritional and Mineral Variability in 52 Accessions of Common Bean Varieties (Phaseolus vulgaris L.) from Madeira Island. *Agricul Sci*. 2005;5(4). Available from: https://scirp.org/reference/referencespapers.aspx?referenceid=1123242.
8. Determination of Protein Content in Food, Method 945.18-B. In: Official Methods of Analysis. *AOAC*. 2005;.
9. W Horwitz Eit. AOAC (2005) Ash of Flour (Direct Method), Method 923.03. In: Official Methods of Analysis; 2005. Available from: https://www.researchgate.net/publication/292783651_AOAC_2005.
10. Ojeka EO, Ayodele JT. Determination of chromium, copper, lead and nickel in some Nigerian vegetable's oils. *Spectrum*. 1995;16(3):75–8.
11. 12.Official Methods of Analysis (1995) 16th Ed., AOAC In-Ternational, Gaithersburg, MD, sec. 33.8.04, Method ; 1995. p. 930–3.
12. AOAC IN-TERNATIONAL; 1995.
13. Official Methods of Analysis (1995) 16th Ed., AOAC In-Ternational, Gaithersburg, MD, sec. 33.5.03, Method . vol. 930; 1995. p. 29. Available from: https://www.aoac.org/.
14. Snedecor GW, Cochran WG. Statistical Methods. 17th ed. Ames: The Iowa State University Press; 1987. p. 221–2.
15. Duncan BO. Multiple Range and Multiple F Test. *Bio-metrics*. 1955;11(1):1–42.

Author biography

Deepika M, PG Student https://orcid.org/0009-0000-3202-2712

Manasa R, Research Scholar https://orcid.org/0000-0003-0082-7975

Shekhara Naik R, Professor and Head https://orcid.org/0000-0003-1527-5296

Mahesh Shivananjappa, Assistant Professor https://orcid.org/0000-0003-4013-1999

Cite this article: Deepika M, Manasa R, Shekhara Naik R, Shivananjappa M. Formulation and evaluation of mathri developed with partial replacement of wheat flour with buckwheat flour (*Fagopyrum esculentuim*). *IP J Nutr Metab Health Sci* 2023;6(2):76-79.