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Original Research Article

Formulation and evaluation of mathri developed with partial replacement of wheat flour with Kodo millet (*Paspalum scrobiculatum*) flour

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ABSTRACT

Background: Kodo millet (*Paspalum scrobiculatum*) belongs to the family Poaceae. Mathri is a Rajasthani snack, a kind of flaky biscuit and also called as mathiya or mathari. A snack food refers to sweet, spicy or salty, ready to eat foods and generally include items such as chips/crisps. It is ready to eat snack generally made by wheat flour, ajwain, salt, refined oil and water.

Objective: In this study Kodo millet Mathri was prepared by using Kodo millet flour with the partial replacement of wheat flour. Six formulations K1, K2, K3, K4, K5 and K6 containing different composition of Kodo millet flour [0%, 20%, 40%, 60%, 80% and 100%] was developed.

Materials and Methods: These formulations were analyzed for sensory attributes (n=20) by semi-trained panelists. Proximate analysis was carried out using standard A.O.A.C. methods.

Results: The sensory score was highest for K3 (40%) and its overall acceptability was good. Mathri prepared with K3 (40%) Kodo millet flour was rich in fiber and minerals like, calcium, and phosphorus content on par with the control.

Conclusion: When compared to control, the selected Kodo millet Mathri was superior nutritionally and being gluten free makes it delicacy to be enjoyed by the people who are gluten intolerant.

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1. Introduction

Millets are recently recognized as “nutri cereal” due to their superiority in terms of dietary value to other cereals. Kodo millet (*Paspalum scrobiculatum*) belongs to the family Poaceae. It is an indigenous cultivated cereal of India. It is estimated to have been domesticated in southern Rajasthan and Maharashtra dating back 3000 years ago.¹ It is grown in Uttar Pradesh in the north, Kerala, Karnataka and Tamil Nadu in the south. Kodo millet is gluten free and very easy to digest. It is rich in vitamin B3, vitamin B6 and folic acid as well as minerals such as calcium, potassium, magnesium zinc and phytochemicals so it is called “nutri-cereals”. It is also rich in essential

amino acids like lysine, threonine, valine.² This millet has a variety of phytochemical constituents including derivatives of hydroxybenzoic acid and hydroxycinnamic acids, myricetin, catechin, luteolin, apigenin, daidzein, naringenin, kaempferol, and quercetin with vast health benefits and thus can be utilized as functional food.³ Millet-based food products have physiological and health-promoting impacts, notably antidiabetic, anti-obesity, and cardiovascular disease and based on the actions of phytochemicals, it plays a major role in the body’s immune system.⁴

2. Objectives

1. To develop Millet based Mathri by partially replacing wheat flour with Kodo millet flour and its organoleptic

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evaluation.

- To evaluate its sensory attributes and analysing its nutritional composition.

3. Materials and Methods

3.1. Raw materials

The present study was carried out in the department of food science and nutrition, Yuvaraja's college, (autonomous) University of Mysore, Mysuru. The raw materials such as Wheat flour, Kodo millet flour, ajwain, oil and salt were procured from local market of Mysuru.

3.2. Method of preparation

Mathri was prepared by adding different ratio of Wheat flour and Kodo millet flour. Pour the hot oil into mixture and add ajwain and salt mix it well. Add water and make hard dough and divide the dough into small balls and prepare a Mathri by rolling the dough into round shape with 5 cm diameter and 0.5 cm of thickness. Deep fry the Mathri in medium flame until golden brown and crisp.⁵

3.3. Sensory analysis of prepared mathri

Sensory evaluation was carried out to determine the acceptability of various attributes such as appearance, taste, texture, color, flavor and overall acceptability. The product was evaluated by taking average score of the 20 semi trained panelists by using 9-point hedonic scale.

3.4. Nutritional analysis of prepared mathri

Standard A.O.A.C. (1980) method was used to determine the Nutritional composition of selected variation (K3) of Kodo millet and control. The moisture content was estimated by using hot air oven at 98 to 100° C, Protein content was estimated by determining total nitrogen content using standard Micro - Kjeldhal method, ash % were estimated by high temperature incineration using muffle furnace and fat content was estimated by the Soxhlet method. The crude fibre content was estimated by crude fibre analyser. The carbohydrate content was obtained by subtracting from 100 with the sum of values of moisture, protein, fat and ash content per 100 g of the sample. Minerals like Calcium, iron and phosphorous were analysed using inductively coupled plasma mass spectrometry (ICPMS). These methods give a good precision and accuracy.^{6–14}

4. Statistical Analysis

Each sample was analysed in triplicates. The data obtained was analysed statistically using standard methods given by Snedecor and Cochran¹⁵ and by Duncan's multiple range test with the $p \leq 0.05$ consider to be significant.¹⁶

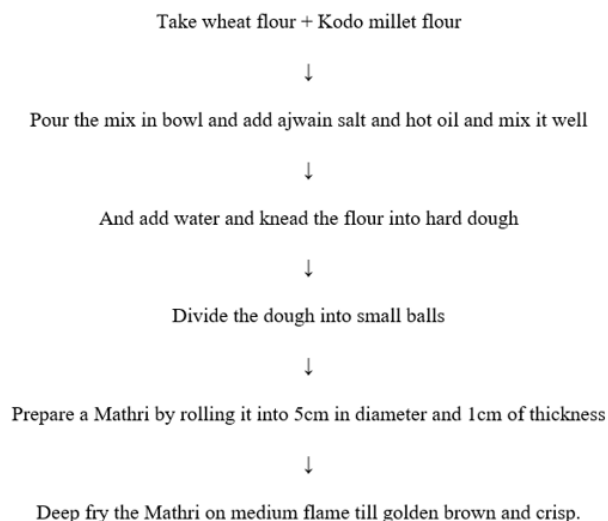


Fig. 1: Flow chart for preparation of kodo millet mathri

5. Formulation of the product

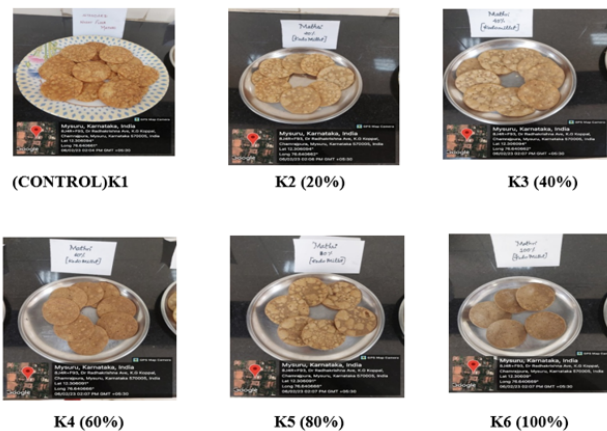


Fig. 2: Different variations of Mathri developed from Kodo millet flour in comparison of wheat flour Mathri.

6. Results and Discussion

The study was undertaken to prepare millet-based Mathri by partially replacing wheat flour with Kodo millet flour. The data pertaining to the effect of incorporation of various levels of Kodo millet flour (20, 40, 60, 80 and 100%) on sensory attributes of Mathri are shown in Table 2. The scores obtained for all sensory attributes for K1, K2 and K3 were almost similar on par with the control. K5 and K6 showed decreased score and were less acceptable compared to other variations.

The proximate composition of accepted Kodo millet Mathri (K3) and that of control were analysed and the

Table 1: Formulation of the product (ingredients g/100 gm) for preparation of Kodo millet flour Mathri

Ingredients	K1	K2	K3	K4	K5	K6
Wheat flour (g)	100	80	60	40	20	-
Kodo millet 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 scores of different variation of Mathri developed from partial replacement of wheat flour with Kodo millet flour. Values are mean \pm SD, $p \leq 0.05$ (Holm Sidak method), $n=20$

Variation	Appearance	Colour	Texture	Taste	Flavour	Overall acceptability
K1 (control)	8.1 \pm 0.12	8.2 \pm 0.14	7.9 \pm 0.21	7.85 \pm 0.32	7.8 \pm 0.32	8.2 \pm 0.45
K2 (20%)	7.54 \pm 0.11	7.65 \pm 0.71	7.35 \pm 0.71	7.27 \pm 0.61	7.58 \pm 0.61	7.83 \pm 0.53
K3 (40%)	7.57 \pm 0.61	7.35 \pm 0.61	7.55 \pm 0.51	7.54 \pm 0.51	7.65 \pm 0.71	7.65 \pm 0.73
K4 (60%)	7.45 \pm 0.64	7.31 \pm 0.63	7.51 \pm 0.61	7.48 \pm 0.51	7.51 \pm 0.51	7.54 \pm 0.68
K5 (80%)	6.23 \pm 0.25	6.25 \pm 0.44	6.84 \pm 0.51	6.83 \pm 0.92	6.75 \pm 0.44	6.83 \pm 0.74
K6 (100%)	6.0 \pm 0.51	6.0 \pm 0.51	6.06 \pm 0.77	5.87 \pm 0.5	5.81 \pm 0.54	5.85 \pm 0.44

results of the same are shown in Table 3. The moisture content of all variations of Mathri's was similar. The values of protein and fat content were higher in K3 than that of control, whereas carbohydrate was less. However, fibre, ash, iron, calcium and phosphorus content were increased in Kodo millet Mathri.

6.1. Proximate composition of prepared mathri Table 3

Table 3: Proximate composition of Mathri's (control and K3) developed from Kodo millet flour with partial replacement of wheat flour.

Nutrients/100 g	Control(C0)	K3 (40%)
Moisture (%)	13.03 \pm 2.12	12.01 \pm 1.81
Carbohydrates (g)	57.12 \pm 1.10	53.56 \pm 1.6*
Protein (g)	10.57 \pm 0.71	11.08 \pm 0.83
Fat (g)	15.93 \pm 0.15	17.14 \pm 0.28
Fibre (g)	2.26 \pm 0.13	5.09 \pm 0.3*
Ash (g)	0.61 \pm 0.11	1.12 \pm 0.1*
Energy (Kcal)	422.63 \pm 3.11	417.16 \pm 3.05
Iron (mg)	2.06 \pm 0.11	2.38 \pm 0.32
Calcium (mg)	23.2 \pm 1.09	37.97 \pm 1.01*
Phosphorus (mg)	121.24 \pm 1.19	184.2 \pm 2.02*

Values are mean \pm SD, $p \leq 0.05$ (Holm Sidak), $n=3$

7. Conclusion

Mathri is a Rajasthani snack. It's a kind of flaky biscuit and also called as mathiya or mathari. It is served best with hot beverages and is popular Indian snack. Here we attempted to develop Mathri from Kodo millet flour. Wheat is rich in gluten, Kodo millet is gluten free and rich in antioxidants, fibre and minerals. In our study partial replacement of wheat flour with of Kodo millet flour up to 40% was acceptable.

When compared to control, the selected Kodo millet Mathri was superior nutritionally and being gluten free makes it delicacy to be enjoyed by the people who are gluten intolerant.

8. Source of Funding

None.


9. Conflict of Interest


None.

References

- House LR, Osmanzai M, Gomez MI, Monyo ES, Gupta SC. Agronomic Principles. and others, editor; 1995. p. 27–67. Available from: <http://oar.icrisat.org/5675/>.
- Ravindran G. Seed proteins of millets: amino acid composition, proteinase inhibitors and in vitro digestibility. *Food Chem.* 1992;44(1):13–7.
- Deshpande SS, Mohapatra D, Tripathi MK, Sadvatha RH. Kodo millet-Nutritional Value and Utilization in Indian Foods. *J Grain Processing Storage.* 2015;2(2):16–23.
- Chetan S, Malleshi N. Finger Millet Polyphenols: Characterization and Their Nutraceutical Potential. *Am J Food Technol.* 2007;2(7):282–92.
- Stupner H, Muller EP, Mathuram V, Kundu AB. Iridoid glucosides from *Nyctanthes arbor tristis*. *Phytochemistry.* 1993;32:375–8.
- AOAC omoa. Association of official analytical chemical. 15th ed. Washington, DC, USA; 1990.
- Stupner H, Muller EP, Mathuram V, Kundu AB. Iridoid glucosides from *Nyctanthes arbor tristis*. *Phytochemistry.* 1993;32(2):375–8.
- Solids (Total) and Moisture in Flour. In: Official Methods of Analysis. AOAC International, Gaithersburg.; 2005.
- AOAC International Publisher G. Determination of Protein Content in Food, Method 945.18-B. In: Official Methods of Analysis; 2005.
- Official Methods of Analysis. AOAC International Publisher; 2005.
- AOAC Official Method 996.06. Fat (Total, Saturated, and Unsaturated) in Foods - Hydrolytic Extraction Gas Chromatographic Method. 18th ed. Gaithersburg, Maryland, USA.; 2005.

12. Patricia Cunniff AoOAC. Official methods of analysis of AOAC international; 1995. Available from: <https://www.worldcat.org/title/official-methods-of-analysis-of-aoac-international/oclc/421897987>.
13. Official Methods of Analysis (1995) 16th Ed., AOAC International, Gaithersburg, MD, sec. 33.4.01, Method 945.48H.
14. Official Methods of Analysis (1995) 16th Ed., AOAC International, Gaithersburg, MD, sec. 33.5.03, Method 930.29.
15. Snedecor GW, Cochran WG. Statistical Methods. 17th ed. The Iowa State University Press; 1987. p. 221–2.
16. Duncan BO. Multiple Range and Multiple F Test. *Bio-metrics*. 1955;11(1):1–42.

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