The Pharma Innovation

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Development of thalipeeth by partial replacement of wheat flour with kodo millet (*Paspalum scrobiculatum*) flour

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Abstract
Thalipeeth, a savory flatbread from Maharashtra, combines cereals and pulses, often enjoyed with breakfast or as a teatime snack. Kodo millet emerges as a nutritious substitute for rice and wheat with rich in B-vitamins, calcium, protein and is gluten-free and beneficial for heart health and diabetes management. This study aimed to develop a value-based product with lower gluten and carbohydrate levels compared to standard thalipeeth. The product, formulated by partially replacing whole wheat flour with Kodo Millet flour in six variants, including a control group, underwent standardized evaluation based on sensory attributes. Proximate analysis revealed reduced carbohydrates and fat, while fiber, phosphorus, and calcium increased due to the incorporation of Kodo millet flour. This resulted in a health promoting product with a superior nutritional profile compared to traditionally prepared thalipeeth.

Keywords: thalipeeth, partial, replacement, wheat, *Paspalum scrobiculatum*

1. Introduction
Thalipeeth, a traditional pancake from Maharashtra, is made from a blend of flour dough comprising cereals, pulses, and legumes. The growing popularity of such traditional foods is a result of urbanization and industrialization. Nevertheless, this surge in demand has prompted the requirement for mechanized production and standardized procedures [1].

Kodo millet is cultivated in India, Pakistan, and regions like Karnataka, Tamil Nadu, Maharashtra, Odisha, West Bengal, Rajasthan, Uttar Pradesh, and the Himalayas. It is regionally called as Kodo, Kodra, Harka, or Varagu. Kodo millet, a nutritious grain, offers a compelling alternative to rice and wheat with its higher protein, fiber, and mineral content. Rich in vitamin B3, B6, and folic acid, as well as calcium, potassium, magnesium, and zinc, it contains 8.3% protein, notably glutelin. With 9% crude fiber, it provides 353 Kcal per 100g, making it a popular gluten-free choice for diverse multigrain products [2].

Kodo millet is gluten-free, making them suitable for those with gluten intolerance. They are easily digestible due to higher lecithin content, promoting a healthy nervous system. Research on millet-based products is growing, recognizing their potential benefits for the increasing population in developing countries [3].

1.1 Objectives
- To develop Thalipeeth by partially replacing wheat flour with Kodo Millet flour
- To Analyze the Sensory quality of the developed product
- To Estimate its Proximate composition

2. Materials and Methods
2.1 Raw materials
The study was conducted at the Department of Food Science and Nutrition, Yuvaraja's College, (Autonomous) University of Mysore, Mysuru. Raw materials, including rice flour, Kodo Millet flour, onions, chillies, cumin seeds, turmeric powder, and oil, were obtained from the local market of Mysuru.

2.2 Methods of preparation
Kodo Millet based Thalipeeth was prepared by combining all the raw ingredients, namely wheat flour, Kodo Millet flour, rice flour, finely chopped onion, chili, coriander leaves, ginger-garlic paste, cumin seeds, turmeric powder, and salt, excluding water. Semi-hard dough was formed and allowed to rest for 30 minutes. Subsequently, the dough was divided into equally sized balls, flattened to a thickness of 2-3mm, and shaped into round discs. These were then placed on a preheated iron pan greased with oil. Small holes were made to facilitate steam release, and both sides were evenly cooked over high flame [4].

2.3 Sensory analysis of kodo millet Thalipeeth
A sensory evaluation of the developed product was carried out to determine its acceptability across various attributes. Thirty semi-trained panelists participated in the assessment, rating the product on a 9-point hedonic scale. The overall score was determined based on average scores [5].

2.4 Nutritional analysis of Kodo Millet Thalipeeth
The nutritional composition was analyzed in triplicates using established A.O.A.C. (1980) methods [6]. Moisture content was determined through a hot air oven at 98 to 100 °C, protein content using the Micro-Kjeldhal method for total nitrogen, ash percentage through high-temperature incineration in a muffle furnace, and fat content estimated with the Soxhlet apparatus [7-8]. Crude fiber content was assessed using a crude fiber analyzer. Carbohydrate content was calculated by subtracting the sum of moisture, protein, fat, and ash content from 100 for every 100g of the sample. Additionally, minerals such as calcium, iron, and phosphorus were analyzed using Atomic Absorption Spectrometry (AAS), renowned for its precision and accuracy [9-12].

2.5 Statistical analysis
The data generated from this work was statistically analysed by the application of Holm Sidak method to determine significance, with a level set at $p \leq 0.05$ (13).

2.6 Formulation of the product

Table 1: Formulation of product (ingredients g/100gm) for preparation of Kodo Millet Thalipeeth

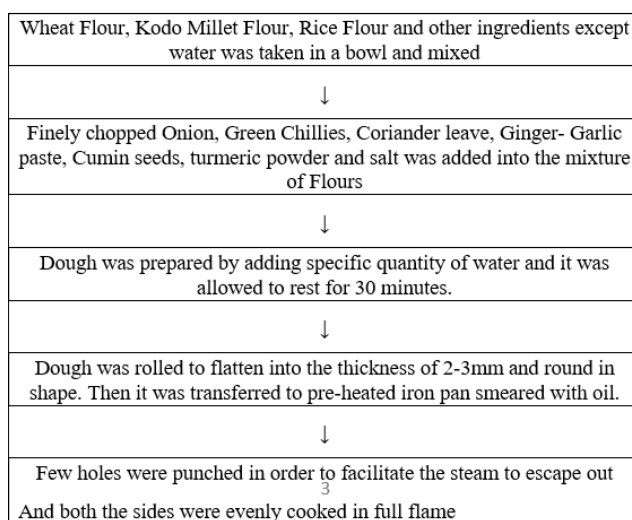| Ingredients	Control	KMT1	KMT2	KMT3	KMT4	KMT5
Wheat Flour (g)	75	60	45	30	15	-
Rice Flour (g)	25	25	25	25	25	25
Kodo Millet (g)	-	15	30	45	60	75

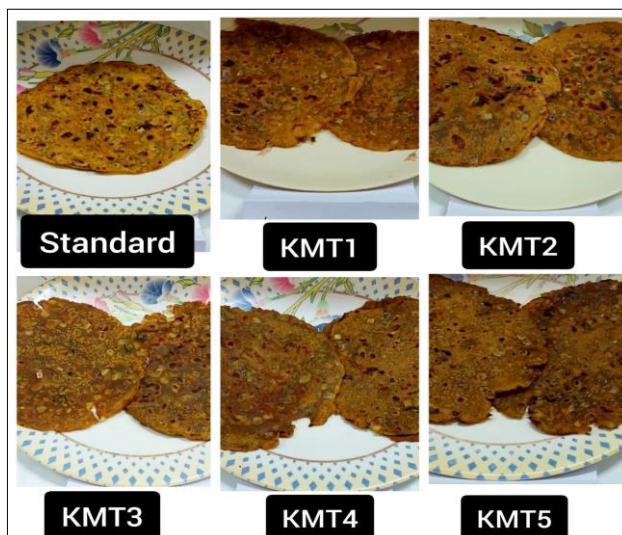**Fig 1:** Flow chart for the preparation of Kodo Millet Thalipeeth

Fig 2: Thalipeeth prepared from partial replacement of wheat flour with Kodo Millet flour in different proportions

3. Results and Discussion
3.1 Sensory evaluation of Kodo Millet Thalipeeth
The impact of incorporating different levels of KMT1 to KMT5 on the sensory attributes of Thalipeeth is detailed in Table 2. The standard Thalipeeth achieved the highest score for its excellent organoleptic properties. KMT2, KMT3, and KMT4 scored similarly to the control among all sensory attributes. However, KMT5 and KMT6 exhibited lower scores and were less preferred compared to other variations. Notably, among all variations, KMT4 was more acceptable on par with control in terms of sensory attributes.

Table 2: Sensory scores of different variations of Thalipeeth developed from Kodo Millet Values are mean ± SD (n=30) *p value < 0.05 (Holm Sidak method)

Parameter	Standard Thalipeeth	KMT1	KMT2	KMT3	KMT4	KMT5
Appearance	8.82±0.39	8.29±0.58	8.19±0.58	8.47±0.21	7.32±0.93	6.88±0.80
Colour	8.82±0.35	8.17±0.72	8.17±0.72	8.41±0.79	7.29±0.91	6.54±0.87
Texture	8.70±0.58	8.05±0.74	8.14±0.74	8.29±0.77	7.17±0.95	6.52±0.79
Flavour	8.58±0.61	7.5±0.79	8.01±0.79	8.17±0.88	7.31±0.86	6.35±0.31
Taste	8.70±0.58	7.8±0.69	7.98±0.69	8.15±0.80	7.29±0.98	6.47±0.71
Overall acceptability	8.75±0.55	8.05±0.65	8.12±0.31	8.23±0.75	7.29±0.92	6.43±0.23

3.2 Proximate Composition of Kodo millet Thalipeeth
An in-depth examination of the proximate composition of the chosen KM Thalipeeth (KMT4) and the control were undertaken, and the findings are outlined in Table 3. Notably, the moisture content remained constant across all variations of KMT. Intriguingly, KMT4 demonstrated elevated protein content in comparison to the control, accompanied by a reduction in carbohydrate content. Additionally, KMT4 exhibited increased levels of essential nutrients, including fiber, iron, and phosphorus.

Table 3: Proximate composition of Thalipeeth (control and KMT4) developed from Foxtail. Values are mean ± SD (n=3) *p value < 0.05 (Holm Sidak method)

Nutrients	Standard	KMT4
Energy (kcal)	335.21±3.11	319.88±1.81
Protein (g)	9.03±0.71	8.41±0.04
Fat (g)	2.01±0.15	1.98± 0.83
Fibre (g)	6.17±0.13	7.65 ± 0.28*
Moisture (%)	11.04±1.12	12.85± 0.34
Ash (g)	1.50±0.20	1.98 ± 0.19
Carbohydrate (g)	70.25±1.05	67.87±1.32*
Phosphorus (mg)	59.37±1.3	144.27±1.01*
Calcium (mg)	5.57±0.11	19.31±0.24*

4. Conclusion
The above findings indicate that standardized Kodo Millet-based thalipeeth is nutritionally superior. Significant variations in ingredients and process parameters support this conclusion. Sample KMT4 stands out as the most acceptable, scoring 7.29 in overall acceptability based on sensory parameters. In general, the chosen ingredients for thalipeeth preparation demonstrated a commendable nutritional profile. To specify, carbohydrate was significantly lower than that of the standard Thalipeeth. Kodo millet based thalipeeth had enhanced amount of fiber, Calcium and phosphorus. This study revealed the positive impact of plant-based sources, highlighting their nutritional and health benefits for people of all age groups.

5. References
1. Gupta S, Prakash J. Nutritional and sensory quality of micronutrient-rich traditional products incorporated with green leafy vegetables. International Food Research Journal. 2011;8(1):667-675.
2. Deshpande SS, Mohapatra D, Tripathi MK, Sadvatha RH. Kodo Millet-Nutritional Value and Utilization in Indian Foods. *ICAR-Central Institute of Agricultural Engineering*, Nabibagh, Berasia Road, Bhopal (M.P.), India. Sumedha Deshpande, Corresponding Author; c2015. Email: Sumedha.Despande@icar.gov.in.
3. Gangakhedkar PS, Pawar SA, Wandhekar SS, Machewad GM. Formulation and quality evaluation of plant protein-rich Thalipeeth. The Pharma Innovation. 2021;10(12):2234-2237. ISSN (Electronic): 2277-7695, ISSN (Print): 2349-8242.
4. Chandel U, Mankotia BS. Combining Ability in Local and Cimmyt In Bred Lines of Maize (*Zea mays* L.) for Grain Yield and Yield Components Using Line x Tester Analysis. *SABRAO Journal of Breeding and Genetics. 2014;46(2).
5. Srilakshmi B. Food Science, Evaluation of Food Quality, 5th Ed., New Age International (P) Limited; c2009. p. 297-298.
6. AOAC. Solids (Total) and Moisture in Flour, Method 925.10. In: Official Methods of Analysis, 18th Edition, AOAC International, Gaithersburg; c2005.
7. AOAC. Determination of Protein Content in Food, Method 945.18-B. In: Official Methods of Analysis, AOAC International Publisher, Gaithersburg; c2005.
8. AOAC Official Method 996.06. Fat (Total, Saturated, and Unsaturated) in Foods - Hydrolytic Extraction Gas Chromatographic Method. Official Methods of Analysis of AOAC International, 18th ed. 2005. Gaithersburg, Maryland, USA.
9. AOAC. Ash of Flour (Direct Method), Method 923.03. In: Official Methods of Analysis, 18th Edition, AOAC International Publisher, Gaithersburg; c2005.
10. Official Methods of Analysis. 16th Ed., AOAC IN-Ternational, Gaithersburg, MD, sec. 33.8.04, Method 930.33; c1995.
11. Duncan BO. Multiple Range and Multiple F Test, Biometrics. 1955;11(1):1-42. DOI: 10.2307/3001478.