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# Development and quality evaluation of pancake premix prepared using kodo millet

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**Abstract**
This study explores the development and quality evaluation of a pancake premix formulated using Kodo millet (*Paspalum Scrobiculatum*) and finger millet (*Eleusine Coracana*). The premix substitutes jaggery for refined sugar and significantly reduces the use of all-purpose flour (maida). Three sample formulations (TF1, TF2, TF3) were prepared by varying millet compositions and tested for nutritional content and sensory characteristics. The formulation TF3 (180g Kodo millet, 120g finger millet) emerged as superior in both nutritional and sensory attributes. This research highlights the potential of incorporating indigenous millets and natural sweeteners in ready-to-use convenience foods to enhance nutritional intake.

**Keywords:** Kodo millet, finger millet, pancake premix, jaggery, nutritional enhancement, functional foods

## Introduction
Convenience foods, particularly premixes, are gaining prominence due to the fast-paced lifestyle of consumers seeking quick and nutritious meal options. Pancakes, being a widely accepted breakfast food, are commonly made with refined flour and sugar—ingredients often criticized for their limited nutritional value and contribution to metabolic disorders (Santos & Vasconcelos, 2023) [10]. This study aims to improve the nutritional profile of pancakes by incorporating millets and natural sweeteners.
Millets are known for their high fiber, mineral, and antioxidant content. Kodo millet is gluten-free and rich in lecithin, making it ideal for nerve health and cardiovascular support (Ravindran *et al*., 1992) [8]. Finger millet is exceptionally high in calcium and polyphenols, providing both nutritional and therapeutic benefits (Chethan & Malleshi, 2007) [3]. These grains are resilient to climate change and can support sustainable agricultural practices (Ragaee *et al*., 2006) [7].
Jaggery, a traditional sweetener made by concentrating sugarcane juice, retains essential micronutrients like iron, magnesium, and calcium, which are lost in refined sugar (FAO, 2007) [4]. It is widely used in Indian cuisine and recommended in Ayurveda for its therapeutic benefits (FSSAI, 2016) [5].
This study aims to formulate and evaluate a pancake premix enriched with Kodo and finger millet and sweetened with jaggery, thereby offering a more healthful alternative to conventional mixes.

## Materials and Methods
### Procurement of Raw Materials
Kodo millet, finger millet, milk powder, jaggery, baking powder, cardamom powder, emulsifier, and salt were procured from Agrozee Organics and local markets in Pune. All materials were manually cleaned to remove dust, stones, and other impurities. Analytical-grade chemicals were used for all testing procedures.

### Formulation Design
Three premix formulations—TF1, TF2, and TF3—were designed by altering the ratios of Kodo and finger millet while maintaining constant proportions of other ingredients. Each formulation totaled 400g.

| Ingredient | TF1 (g) | TF2 (g) | TF3 (g) |
|---|---|---|---|
| Kodo Millet | 200 | 190 | 180 |
| Finger Millet | 100 | 110 | 120 |
| Maida | 20 | 20 | 20 |
| Jaggery | 60 | 60 | 60 |
| Milk Powder | 10 | 10 | 10 |
| Baking Powder | 3 | 3 | 3 |
| Cardamom Powder | 2 | 2 | 2 |
| Emulsifier | 0.5 | 0.5 | 0.5 |
| Salt | 1 | 1 | 1 |

### Analytical Procedures
The samples were evaluated for nutritional parameters including protein, fat, carbohydrates, total sugars, moisture, ash content, and calorific value. Standard AOAC (1990) [1] and other validated laboratory protocols (Sadasivam & Manickam, 2020) [9] were employed. Protein was estimated by the Kjeldahl method. Fat content was determined using Soxhlet extraction. Carbohydrates were calculated by difference. Moisture was measured by oven drying. Ash was obtained by incineration in a muffle furnace. Total sugar was determined using the Lane-Eynon method.

### Energy value was computed using Atwater factors
### Sensory Evaluation
Pancakes prepared from each formulation were evaluated by a five-member semi-trained panel using a 9-point hedonic scale. Attributes such as color, aroma, taste, texture, and overall acceptability were assessed under standard sensory lab conditions.

## Results and Discussion
The findings from this study indicate that the incorporation of Kodo millet and finger millet in pancake premixes significantly enhances their nutritional value and sensory attributes. The three formulations (TF1, TF2, TF3) were assessed for key nutritional parameters including protein, fat, carbohydrate content, energy value, total sugars, moisture, and ash content, in addition to sensory evaluation conducted through a hedonic scale rating system.

Among the three formulations, TF3 demonstrated the most favorable nutritional and sensory outcomes. This formulation, which used 180g of Kodo millet and 120g of finger millet, presented the highest carbohydrate content and energy value while having the lowest moisture percentage. The higher carbohydrate content is attributed to the optimal balance of millets, which are naturally rich in complex carbohydrates and dietary fiber. A higher energy value supports the utility of the premix as a high-energy breakfast option, catering to the dietary requirements of both children and adults.

The protein values, although slightly reduced in TF3 compared to TF1, remained within an acceptable range for functional breakfast items. Kodo millet and finger millet both contribute valuable plant-based proteins, though the substitution with finger millet in higher proportion appears to have caused a marginal drop in protein concentration. However, this trade-off was offset by the improved sensory profile and increased dietary fiber content, especially due to finger millet's fibrous outer seed coat.

Moisture content is a crucial determinant in the shelf-life of powdered food formulations. TF3 recorded the lowest moisture level among all samples, suggesting enhanced storage stability and a reduced risk of microbial spoilage. This finding aligns with studies indicating that lower moisture content in dry mixes increases product shelf-life (Ragaee *et al*., 2006) [7].

Fat content among all three samples showed minimal variation, maintaining around 3.3-3.4g per 100g, which is acceptable for low-fat dietary regimes. The low fat content can be attributed to the natural characteristics of millets, which are typically low in lipid content. Ash content, indicating total mineral presence, remained relatively consistent across all three formulations, affirming the mineral richness of the ingredients used, particularly the jaggery and millets.

From a sensory perspective, TF3 received the highest scores across all evaluated parameters. Panelists reported a more appealing texture and mouthfeel in TF3, likely due to the balanced ratio of coarse and fine millet flours. The naturally sweet flavor imparted by jaggery complemented the nutty and earthy flavors of the millets, resulting in enhanced taste and overall acceptability.

The appearance and aroma were also rated higher in TF3. The darker color, derived from finger millet and jaggery, was perceived positively, resonating with the increasing consumer interest in natural and whole-grain products. According to Santos and Vasconcelos (2023) [10], consumers are increasingly aware of the visual and olfactory indicators of food healthiness, making such traits important for market acceptance.

Comparing with literature, Ravindran *et al*. (1992) [8] and Chethan & Malleshi (2007) [3] have emphasized the benefits of using finger millet in ready-to-use food products due to its unique nutritional components like calcium, iron, and antioxidants. These elements play a role in maintaining bone health, cognitive functions, and metabolic activity. The sensory benefits observed are consistent with previous work done on millet-based bakery and breakfast products, reinforcing the notion that millets can be used innovatively without compromising consumer preferences.

Furthermore, jaggery's inclusion as a natural sweetener in place of refined sugar added multiple health benefits, including increased iron content and antioxidant potential (FAO, 2007) [4]. Jaggery also helped to moderate the glycemic load of the pancake mix, making it a better option for individuals managing blood sugar levels.

In a broader context, the use of millets aligns with sustainable agricultural practices, particularly in semi-arid regions. Millets require less water and chemical inputs compared to wheat and rice, thereby supporting agroecological farming goals (FSSAI, 2016) [5]. From a socioeconomic standpoint, promoting millet-based products can enhance the livelihoods of farmers and revive interest in underutilized crops.

The success of TF3 in sensory and nutritional evaluation suggests its strong potential for commercial viability. The premix format allows for ease of packaging, long shelf life, and rapid preparation, which appeals to health-conscious consumers, working professionals, and schoolaged children. Moreover, the formulation's gluten-free and nutrient-dense characteristics make it suitable for niche markets such as those with gluten intolerance or malnutrition risks.

In conclusion, the results support the hypothesis that integrating millets and jaggery into premix formulations not only enhances the nutritional profile but also ensures desirable organoleptic properties. TF3, in particular, can serve as a model formulation for developing health-oriented convenience foods that meet contemporary dietary demands and support traditional grain consumption in a modern format.

## Conclusion

The study successfully developed a pancake premix incorporating Kodo millet, finger millet, and jaggery, which significantly enhanced both nutritional value and sensory appeal. Among the formulations tested, TF3 emerged as the most favorable option. This innovation provides a viable alternative to conventional pancake mixes, aligning with current health and sustainability trends.

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