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Development of cereal and millet based multigrain cerelac using variety of mixes: A Nutritious Food Option for Children

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Abstract

This study focusses on creating wholesome and tasty multigrain chips using a range of cereal and millet blends, including wheat, rice, ragi, toor daal, skinned daal, red lentil, black gramme, and nuts, in response to the increased need for healthier and varied snack choices. The goal of this research is to create a kid-friendly and nutrient-dense meal substitute that combines the health and nutritional advantages of several grains. It is feasible to improve the product's total nutritious content and sensory qualities by using the nutritional advantages of various grains. This study contributes to the field of food creation by offering fresh perspectives on children's food formulation, acceptance, and nutritional content. Ingredient selection, formulation mixing, processing optimisation, nutritional calculations, and sensory assessments are some of the phases included in this study. To make multigrain cerelac, a variety of multigrain flour (MF) mixes (MF1, MF2, MF3) were created utilising wheat, rice, ragi, toor daal, skinned daal, red lentil, black gramme, and nuts in varying proportions. The produced multigrain cerelac has excellent nutritional qualities and is enhanced with protein, minerals, and dietary fibre. In terms of nutrition profiles, flavour qualities, textural properties, and general acceptance across all three kinds, the expert panel found Formulation MF 3 to be very acceptable. The study highlights the potential for innovative food for children's creations that are in line with current nutritional trends and preferences by providing insight into the successful development of cereal and millet-based multigrain cerelac through the use of various grain combinations. Additionally, the study offers the foundation for the product's commercial manufacturing employing automated procedures.

Keywords: Multigrain flour, millets, multigrain cerelac, wholesome food for children, child nutrition

Introduction

Globally, there is a growing demand for a variety of nutrient-dense food products as people become more conscious of the significance of eating a balanced diet for optimum health. Because of their rich nutritional profiles, cereals and millets are staple food crops that people have been eating for ages (Srilakshmi, 2020; Gupta, 2014). These grains supply vital micronutrients like vitamins and minerals as well as macronutrients like proteins, carbs, and dietary fibre (Kumari and Sangeetha, 2017). Although each grain has its own special nutritional advantages, the idea of multigrain food items has drawn a lot of interest lately. Multigrain meals offer a wider variety of nutrients and

improve total nutritional value by combining the benefits of many grains. A well-balanced, adaptable, and sustainable dietary choice might be produced by combining several grains and millets into a single food product (Dighe et al., 2022).

Weaning food is specifically designed to help infants between the ages of three and nine months make the switch from nursing or bottle feeding to regular solid food consumption (Jadhavar et al., 2022). The semi-solid food that the kid is fed at this point is typically referred to as weaning food since it is made by processing foods to increase their nutritional value and digestion. It falls under the category of ready-to-eat food. High-protein, high-digestibility, and high-energy-density weaning food supplements must be made from easily accessible, reasonably priced basic ingredients. Malnutrition in impoverished nations can be decreased by using this weaning food to satisfy the demands of developing children (Satter et al., 2022). By lowering antinutritional factors and increasing overall digestibility and nutrient absorption, roasting, soaking, fermenting, and sprouting improve the bioavailability of micronutrients. They also lower the high bulk of complementary food by lowering viscosity (Rasane et al., 2013). In order to create a wholesome and tasty ready-to-eat meal, this study intends to investigate the various combinations of cereals and millets. The creation of such a food item can increase nutritional diversity and give customers an alternative to single-grain goods.

Materials and Methods

Cereals and millets are chosen and described according to their availability, sensory qualities, and nutritional makeup. Taste, texture, and nutritional balance were taken into consideration when creating various cereal and millet blends. Consumer acceptance of the multigrain food product was evaluated using sensory assessment techniques. In order to ascertain the total nutrient content of the created product, its nutritional makeup was also examined.

Selection of Raw Material

All of the foundation flour mix's ingredients—wheat, rice, ragi, toor daal, skinned daal, red lentils, black gramme, and nuts—as well as additional additives like lactogen and powdered sugar were optional and bought from a nearby grocery in Lucknow.

Development of multigrain flour mix

The aforementioned ingredients were combined in varying amounts to create three samples of multigrain flour (MF) mixtures (Table 1).

Table 1: Ingredients used in different proportions for formulation of multigrain flour mix.

Ingredients	Multigrain Flour formulations		
	MF1	MF2	MF3
Wheat (%)	10	20	20
Rice (%)	5	10	10
Toor daal (%)	15	10	10
Black gram (%)	15	10	10
Ragi (%)	15	10	10
Skineed daal (%)	15	20	10
Red lentil (%)	15	10	20
Nuts (%)	10	10	10

Note: Lactogen and powder sugar is optional.

Formulation of multigrain cerelac

All three of the developed multigrain flour mixes were used to make multigrain cerelac. Using various amounts and types of multigrain flour mixes, three examples of multigrain cerelac were made using the recipe method described below (Fig. 3).

Standardized process of making nutritious multigrain cerelac

Weigh each flour according to the ratios listed in Table 1. After a few minutes of dry roasting on a hot pan, let the ingredients cool. Once they have cooled, transfer them to a blender and grind until they are a fine powder. Add lactogen and powdered sugar based on the child's age after combining all the ingredients in a bowl (note: avoid powdered sugar for children under one year old). Cerelac can be kept at room temperature in an airtight container.

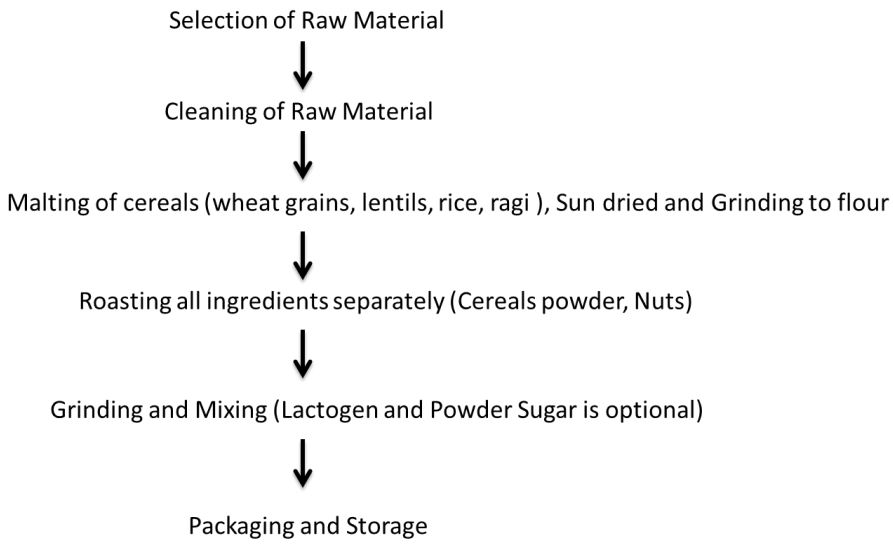

Fig. 1: Process Flowchart of Multigrain Cerelac.

Fig. 2: Showing different formulation of multigrain cerelac.

Nutritional analysis of the formulated flour mixes and developed product

The nutritive value of the formulated flour mixes and developed product was calculated based on ICMR Indian food composition table (Longvah et al., 2017).

Sensory evaluation

The samples of developed product i.e., multigrain chips underwent a sensory assessment to gauge their acceptability, conducted by group of panelist using the 5-point hedonic scale.

Shelf life studies

Low density polypropylene (LDPE) pouches were used to package the product into 0.5 kilogramme unit packs, which were then kept at 27 °C and 65% relative humidity (ambient) or 38 °C and 92% relative humidity (accelerated). The control sample was stored in a refrigerator. The samples were regularly removed from accelerated storage settings at intervals of 15 days to 3 months and from standard storage conditions at intervals of 30 days to 3 months. Changes in moisture and free fatty acid levels, as well as sensory characteristics, were examined in the preserved samples.

Results and Discussion

By incorporating a variety of cereals and millets into a single food product, it becomes possible to offer a more diverse range of nutrients and Flavors.

Proximate Nutritional value of formulated Flour Mixes

Table 2 provides detailed proximate nutritional analysis data for the multigrain Cerelac sample. The results showed that the total nutritional value of the blend mixes was not much affected by

differences in the quantities of the flour mixes. The multigrain flour mixes (MF1, MF2, and MF3) had moisture contents of 9.87%, 9.74%, and 9.39%, respectively. With levels of 10.34%, 10.65%, and 11.67% in MF1, MF2, and MF3, respectively, protein—a vital component for bodily growth and development—showed variance. The multigrain flour mixes MF1, MF2, and MF3 have carbohydrate contents of 62.66%, 63.34%, and 63.84%, respectively.

MF1, MF2, and MF3 flour mixes have fat contents of 3.45%, 3.23%, and 3.25%, respectively. The MF1, MF2, and MF3 flour mixes have dietary fibre contents of 11.48%, 11.25%, and 11.88%, respectively. For MF1, MF2, and MF3 flour mixes, the calcium and iron contents were recorded as 97.12%, 81.81%, 106.9%, and 4.24%, 4.3%, and 4.91%, respectively (Table 2).

Table 2: Nutritive value of variety of flour mixes per 100 gm.

Nutrient	MF1	MF2	MF3
Moisture (gm)	9.87	9.74	9.40
Protein (Gm)	10.34	10.65	11.67
CHO (Gm)	62.66	63.34	63.84
Fat (gm)	3.45	3.23	3.11
Dietary fibre (gm)	11.48	11.25	11.88
Calcium (mg)	97.12	81.81	106.94
Iron (mg)	4.24	4.3	4.91

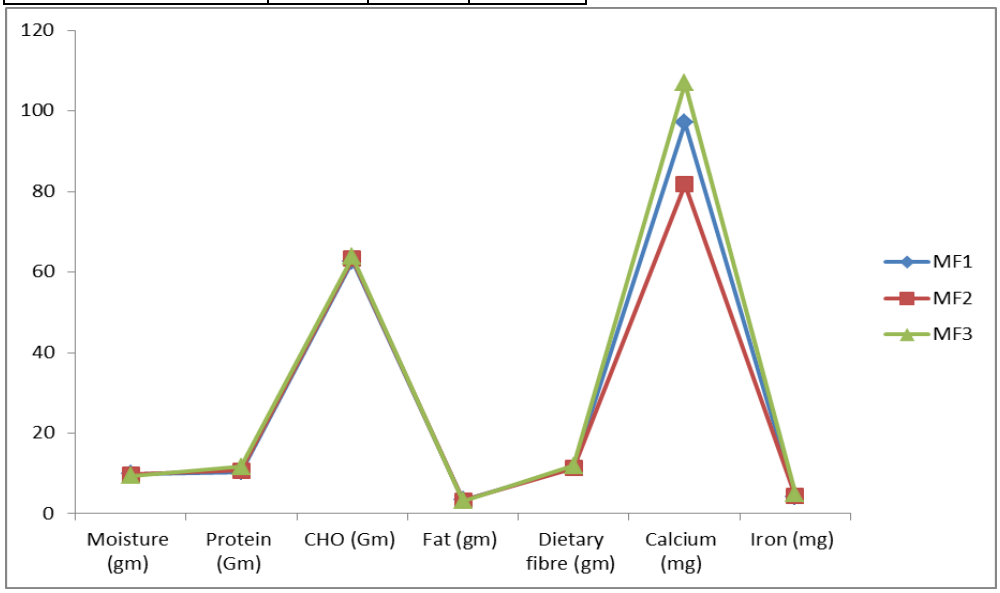

Fig. 3: Proximate Analysis of formulated multigrain cerelac sample.

Table 3: Average Nutritional value of all 3 Formulated Multigrain Cerelac sample.

Nutrient	Values (g/100gm)
Protein (Gm)	11.05
CHO (Gm)	63
Dietary fibre (gm)	11.3
Calcium (mg)	95.6
Iron (mg)	4.52

Sensory Evaluation of the Multigrain Cerelac

The panel used a 5-point hedonic scale to evaluate the multigrain cerelac's sensory qualities. The panel examined and evaluated each of the three multigrain chip formulations' colour, look, texture,

flavour, and taste (Table 4). Out of the two, the third multigrain cerelac (MF3) had the greatest overall acceptance score (Fig. 4).

Table 4: Sensory Evaluation of the Multigrain Celerac

Samples	Sensory Attributes					
	Color	Appearance	Texture	Taste	Flavor	Overall Acceptability
MF1	8	8	6.75	8	8.25	7.75
MF2	8	7.75	6	8.25	8	7.25
MF3	8.67	8.65	7.89	9.18	9.33	8.66

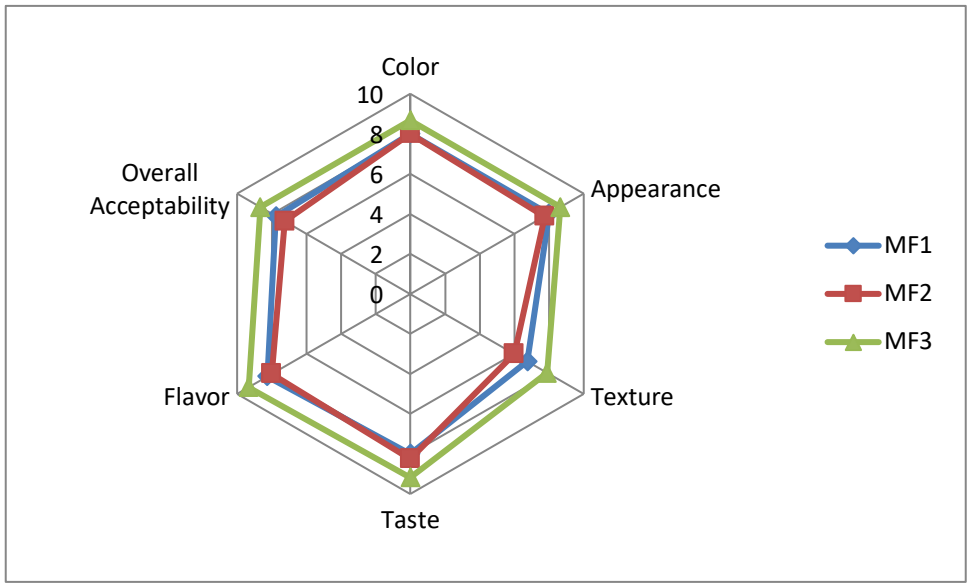

Fig. 4: Sensory evaluation of formulated multigrain cerelac sample.

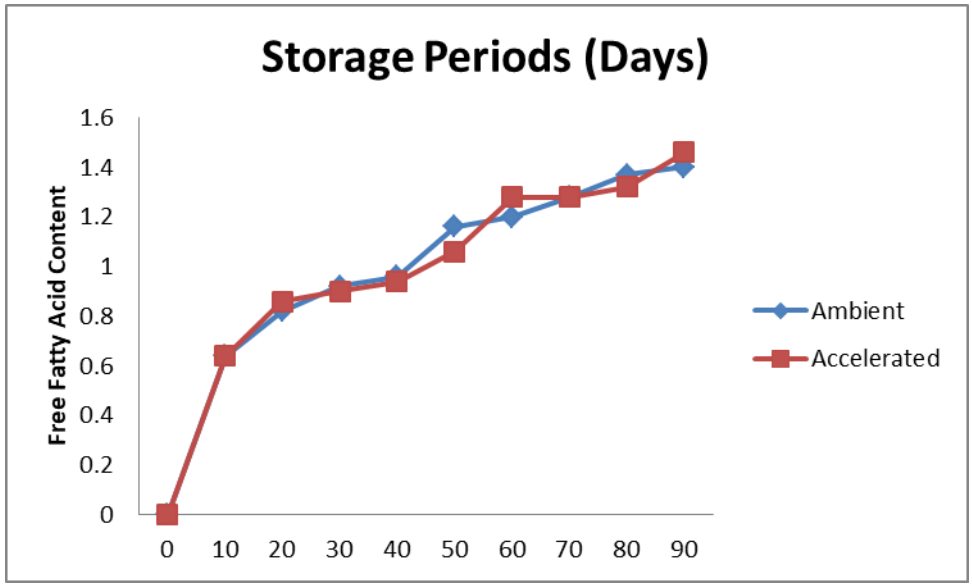

Fig. 5a: Changes in free fatty acid profile of ready-to-eat snack mix during storage. Mean values with different letters on each point of a particular series differ significantly ($p<5$), n=3.

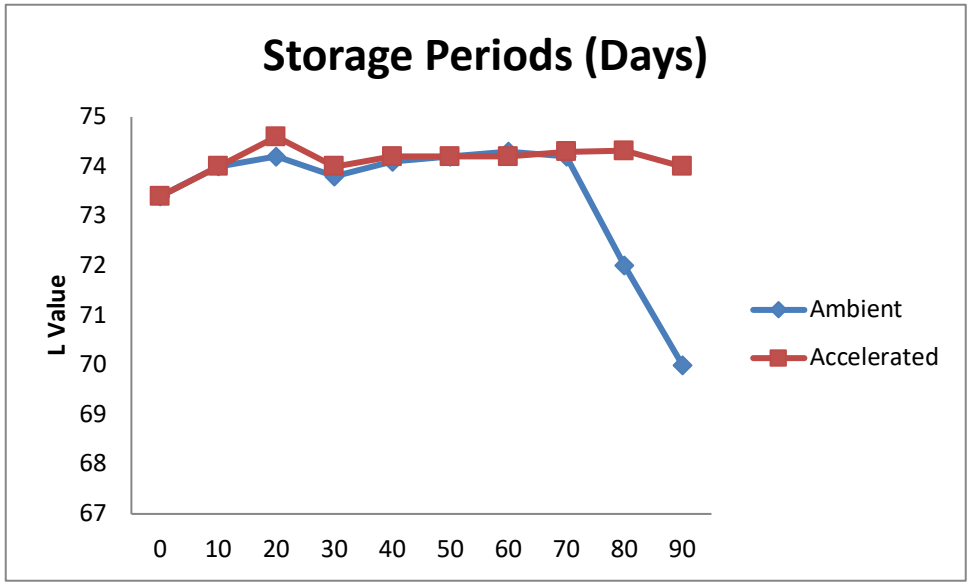

Fig. 5b: Changes in color values (L values) of ready-to-eat snack mix during storage. Mean values with different letters on each point of a particular series differ significantly ($p<5$), $n=3$.

Under both accelerated and standard storage settings, the formulation's free fatty acid (FFA) content rose from 0.035 to 1.32 and 1.46%, respectively (Fig. 5a). This was also evident in the product's lack of off flavour throughout storage, most likely as a result of lipase inactivation during high temperature short time (HTST) treatment. Since the product did not exhibit any mould development at the requisite humidity (RH) of less than 84%, the synthesis of FFA owing to microbial lipase is also ruled out. Fig. 5b illustrates how the product's colour changes during storage. Up to 60 days, there was no discernible change in the product's L* values under either normal or accelerated settings. A slight increase in the lightness values was observed at normal conditions after 60 days.

Conclusion

The creation of multigrain cerelac, a cereal and millet-based multigrain weaning food product, employing a range of multigrain flour mixes was proven to be an excellent option for adopting healthy eating choices. When compared to the other two formulations, the MF3 multigrain cerelac formulation was shown to have the highest overall acceptance rating. MF3 exhibited superior nutritional value in addition to favourable sensory qualities. People with specialised dietary needs or those searching for better weaning meal alternatives may find this very helpful. Compared to packaged cerelac on the market, multigrain cerelac is a healthier option for all age groups since it is made with multigrain flour mixtures, which are low in fat, high in protein, and fibre.

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