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Neha Vishwakarma

Research Scholar, Govt.

Maharani Laxmi Bai Girls P.G.

College, Barkatullah University,

Bhopal, Madhya Pradesh, India

Dr. Meenal Phadnis

Professor, Govt. Maharani

Laxmi Bai Girls P.G. College,

Barkatullah University, Bhopal,

Madhya Pradesh, India

Development of cereal and millet based multigrain chips using variety of mixes

Neha Vishwakarma and Dr. Meenal Phadnis

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Abstract

In the era of growing demand for healthier and diverse snack options, this study focuses on the development of a nutritious and flavourful multigrain chips by incorporating variety of cereal and millet blends such as Wheat, jowar, bajra, rice, maize, ragi and Bengal gram. The aim of this study is to develop a convenient and nutritious snack alternative that harnesses the nutritional and health, combined benefits of different grains. By leveraging the nutritional benefits of different grains, it is possible to enhance the overall nutrient content and sensory attributes of the product. This study helps to provide the new insights in the field of food development and their formulation, acceptability, and nutritional composition as well. This study involves several stages, including ingredient selection, formulation mixing, processing optimization, nutrients calculation and sensory evaluations. Variety of multigrain flour (MF) blends were formulated (MF1, MF2, MF3) using Wheat, jowar, bajra, rice, maize, ragi and Bengal gram in different proportion for making multigrain chips. The developed multigrain chips exhibit great nutritional attributes, being enriched with dietary fiber, protein, and minerals. Results showed that Formulation MF 3 was well accepted by the expert panel in terms of Nutrition profiles, flavor characteristics, textural attributes, and overall acceptability among all the 3 varieties. The study gives an insight for successful development of cereal and millet based multigrain chips through the utilization of diverse grain mixes underscores the possibilities for novel snack creations that align with contemporary dietary trends and preferences. The study also provides basis for the commercial production of the product using mechanised processes.

Keywords: Multigrain flour, millets, multigrain chips, snacks

1. Introduction

The demand for nutritious and diverse food products is increasing worldwide due to the growing awareness of the importance of a balanced diet in maintaining good health. Cereals and millets are staple food crops that have been consumed by humans for centuries and are known for their rich nutritional profiles^[1, 2]. These grains provide essential macronutrients, such as carbohydrates, proteins, and dietary fibre, as well as micronutrients, including vitamins and minerals^[3].

While individual grains have their unique nutritional benefits, the concept of multigrain food products has gained significant attention in recent years. Multigrain foods combine the goodness of different grains to provide a broader range of nutrients and enhance overall nutritional value. The incorporation of various cereals and millets into a single food product offers the potential to create a well-balanced, versatile, and sustainable dietary option^[4].

This study aims to explore the diverse combinations of cereals and millets to formulate a nutritious and flavourful product. The development of such a food product can provide consumers with an alternative to single-grain products and contribute to dietary diversity.

2. Materials and Methods

The methodology involves the selection and characterization of cereals and millets based on their nutritional composition, sensory attributes, and availability. Different mixes of cereals and millets were formulated, considering factors such as taste, texture, and nutritional balance. Sensory evaluation techniques were employed to assess the acceptability of the multigrain

Corresponding Author:

Neha Vishwakarma

Research Scholar, Govt.

Maharani Laxmi Bai Girls P.G.

College, Barkatullah University,

Bhopal, Madhya Pradesh, India

food product among consumers. Additionally, the nutritional composition of the developed product was analysed to determine its overall nutrient content.

2.1 Selection of Raw Material

All the ingredients such as Wheat, jowar, bajra, rice, maize, ragi and Bengal gram flours for base flour mix and other ingredients such as cumin powder, chilli flakes, refined oil and salt were purchased from local supermarket in Bhopal.

2.2 Development of multigrain flour mix

Three sample of multigrain flour (MF) Mixes were prepared using the ingredients mentioned above in different proportions. (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
Jowar (%)	15	10	10
Bajra (%)	15	10	10
Ragi (%)	15	10	10
Maize (%)	15	20	10
Amaranth (%)	15	10	20
Bengal Gram (%)	10	10	10

2.3 Formulation of multigrain chips

Multigrain chips were prepared using all three formulated multigrain flour mixes. Three samples of multigrain chips were formulated using different proportions and varieties of multigrain flour mixes by following the recipe procedure mentioned below (Fig. 3).

2.3.1 Standardized process of making Nutritious Multigrain Chips

1. Weigh all the flours in the same proportions as given in the table 1.
2. Combine all the ingredients in a bowl and add adequate amount of water along with some chilli flakes, Cumin powder and salt to taste.
3. Knead the formulated flours mixes to form a soft dough and allowing the dough to rest for 10-20 minutes. (fig.1)
4. Roll the dough balls into thin sheets and cut them in shape of chips. Deep fry the chips in hot oil till done. (fig.2&3)
5. For an added tangy flavour, amchur powder and some spices is incorporated.
6. Chips can be stored in an airtight container at room temperature.



Fig 1: Showing variety of Multigrain dough formulations.



Fig 2: Showing Sundried Multigrain chips formulation



Fig 3: Showing Deep fried Multigrain Chips.

2.4 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 (2017) [5].

2.5 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.

3. 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.

3.1 Proximate Nutritional value of formulated Flour Mixes

The proximate nutritional analysis values for the multigrain chips sample are given in table-4 in detail.

The data revealed that variations in the proportions of the flour mixes did not significantly impact the overall nutritional content across the blend mixes. The moisture content in the multigrain flour mixes (MF1, MF2 and MF3) was 9.67%, 9.40%, and 9.72%, respectively. The essential nutrient for body growth and development, protein, exhibited variation with values of 10.84%, 10.67%, and 11.67% in MF1, MF2, and MF3, respectively. Carbohydrate content was recorded as 62.66%, 63.34%, and 63% in multigrain flour mixes MF1, MF2, and MF3, respectively.

Regarding fat content, MF1, MF2, and MF3 flour mixes contained 3.45%, 3%, and 3.25%, respectively. The dietary fiber content was measured at 11.68%, 11.55%, and 11.08% in MF1, MF2, and MF3 flour mixes, respectively. Calcium and iron content were noted as 106.9%, 81.8%, 97.1%, and 4.94%, 4.3%, 4.9%, respectively, for MF1, MF2, and MF3 flour mixes.

(Table 2).

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

Nutrient	MF1	MF2	MF3
Moisture (gm)	9.67	9.40	9.722
Protein (Gm)	10.84	10.67	11.67
CHO (Gm)	62.66	63.34	63
Fat (gm)	3.45	3	3.25
Dietary fibre (gm)	11.68	11.559	11.082
Calcium (mg)	106.94	81.814	97.12
Iron (mg)	4.94	4.3	4.9

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

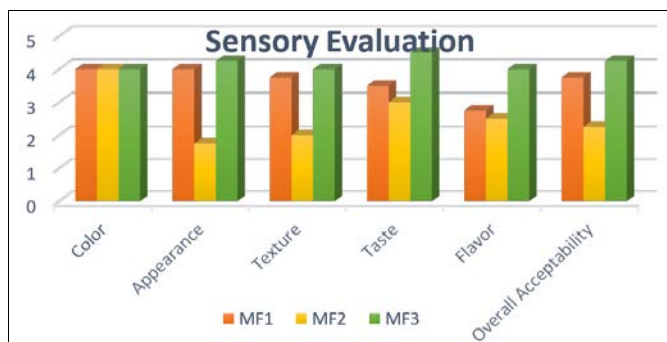
Nutrient	Values (g/100gm)
Protein (Gm)	11.06
CHO (Gm)	63
Dietary fibre (gm)	11.4
Calcium (mg)	95.2
Iron (mg)	4.71

3.2 Sensory Evaluation of the Multigrain Chips

Sensory evaluation of the formulated multigrain chips was done by the panel using 5-point hedonic scale method. The panel analysed and assessed the color, appearance, texture, taste, and flavor of all three formulated multigrain chip (Table-4). The overall acceptability score of the third multigrain chip (MF3) was found to be the highest among the other two (Fig - 4).

Table 4: Sensory Evaluation of the Multigrain Chips

Samples	Sensory Attributes					Overall Acceptability
	Color	Appearance	Texture	Taste	Flavor	
MF1	4	4	3.75	3.5	2.75	3.75
MF2	4	1.75	2	3.25	3	2.25
MF3	4	4.25	4	4.5	4	4.25

**Fig 4:** showing sensory Profile of the Multigrain chip formulations

4. Conclusion

The development of a cereal and millet-based multigrain food product that is multigrain chips using a variety of multigrain flour mixes found to have the great choice in terms of adopting healthy food choices. The MF3 multigrain chip formulation found to have best overall acceptability rate in comparison to the other two formulations. Along with good sensory attributes, MF3 also had better nutritional content. This can be particularly beneficial for individuals with specific dietary requirements or those looking for healthier snack food options.

The formulation of multigrain chips using multigrain flour mixes, which are rich in protein, fibre and low in fat and are healthy choice for all age group in comparison to the packed

potato chips available in the market.

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