

# Development and Formulation of Choco-Muffins Enriched with Millets

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## Abstract

The current project deal with the development, sensory evaluation and production of Choco-muffins enriched with millets. Ingredients like wheat flour, foxtail millet flour, finger millet flour and sorghum flour were all used and formulated. Sensory evaluation was carried out by a trained panel using the 9-point hedonic scale method. The muffins were also nutritionally analyzed. The muffins contain nutritional components that have been shown to have certain health benefits like calcium and dietary fibre in finger millet maintains the health of bones, and reduces the bad cholesterol levels, phenolic compounds in sorghum act as antioxidants.

**Key words:** Muffins, Calcium, Millets

The term "millet" is loosely applied to several species of cereals which produce small grains compared with those of maize. They are in general smaller leafier plants and are characterized by maturation period and drought resistance. Millets are grown almost for local human consumption. These small grained millets are used as food, in the form of flour or cakes. They are also used for poultry food. Principle millets are pearl millet, pros millet, foxtail millet, jowar and ragi or finger millet [1]. Muffin is a type of semi-sweet cake or quick bread that is baked in portion appropriate to one person [2]. They are similar to cupcakes, although they are usually less sweet and lack icing. Muffin gets their characteristic rise from baking powder or sometime baking soda instead of yeast. Muffins are often eaten for breakfast, alternatively they may be served for tea or at other meals [3].

## Objectives

Keeping in view the health benefits of cereals and millets, the present study was designed with following objectives.

1. To formulate and develop Choco-muffins enriched with millets.
2. To conduct sensory evaluation of the developed muffins.
3. To assess the nutritive value of the developed muffins.
4. To determine the shelf life of the products and effects of storage.
5. To popularize the muffins among college students.
6. To estimate the cost of production of the developed muffins.

## MATERIALS AND METHODS

Designing a suitable methodology for preparation of a new food product is very important in carrying out this research

titled 'Development and formulation of Choco-muffins enriched with millets'.

This research is focused on formulating a new product. The present investigation was undertaken to study the selection and processing of raw materials, standardization of the process to formulate the product, evaluate the acceptability of the prepared new product, nutrient analysis of the product.

### Procurement of raw materials

The ingredients used for development of Choco-muffins such as wheat flour, finger millet [ragi], sorghum [jowar], foxtail millet, cocoa powder, leavening agents [baking powder, baking soda, vinegar], sugar, instant coffee powder, toppings [Choco chips and sprinkles], vanilla essence, vegetable oil, and milk were purchased from local market.

### Processing of raw material

The whole millets were grinded and made into flours. The sugar was powdered. The millet flours and the powdered sugar were stored in an air tight container. Milk is stored at refrigeration temperature.

### Measuring of ingredients

The ingredients were measured using measuring cups and spoons. Every dry and wet ingredient is measured and kept in a separate vessel to make it easier during mixing of all the ingredients together.

### Preparation of muffins

The wet ingredients are mixed in a separate vessel. Take a vessel. Add milk, vegetable oil, and vanilla essence in it. To the mixture, add powdered sugar and whisk it well.

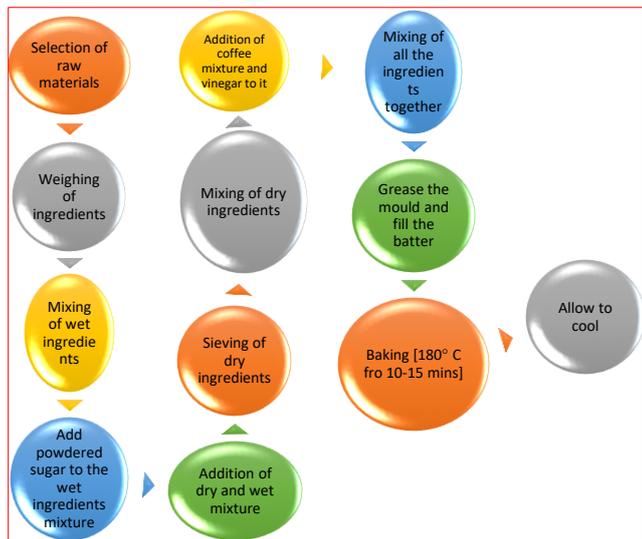
The dry ingredients namely wheat flour, finger millet flour, sorghum flour, foxtail millet flour, baking powder, baking

soda, and cocoa powder are added to a sieve and well sifted in a separate container.

To the mixture of powdered sugar and wet ingredients, the sifted dry ingredients are added batch by batch and whisked well until it's all combined together.

Now instant coffee powder is added to a little amount of water and boiled. This coffee mix and a little amount of vinegar is also added to the mixture and mixed well.

The muffin liners are added to the muffin mould. The liners are filled with batter. Baking is done at 180 °C for 10 to 15 minutes and allow the muffins to cool. Then the muffins are stored in PET boxes and stored in an ambient temperature.



Flow chart for preparation of muffins

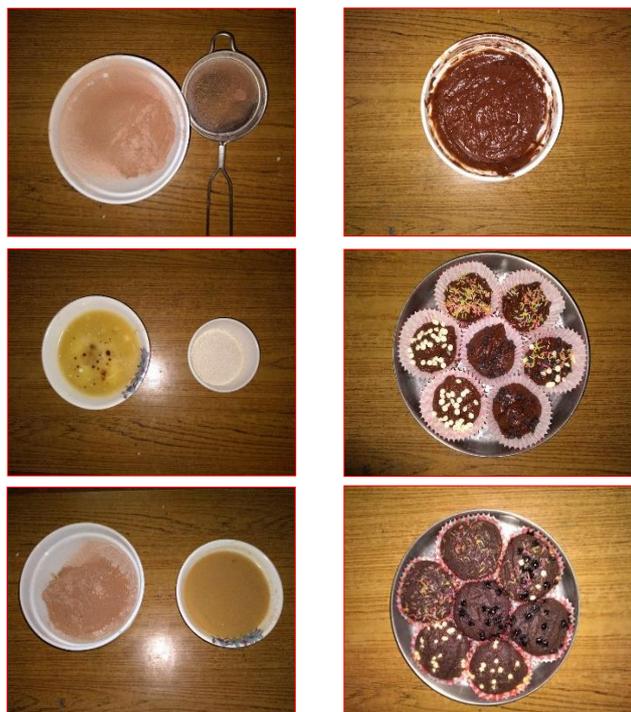


Figure 1 Preparation of muffin

#### Formulation of recipe

Formulation of the recipe gives a detailed report on how to make a certain food item. It is a formula of putting the ingredients together in proper amounts and by the best method's view.

The amount of ingredients used for the recipe is optimized by trial-and-error method and the product with overall acceptability was finalized for the further research.

Ingredients	Amount
Wheat flour	250 g [1cup]
Foxtail millet flour	40 g
Finger millet flour	40 g
Sorghum Flour	40 g
Powdered sugar	1 cup
Vegetable oil	1/3 cup
Milk	½ cup
Cocoa Powder	¼ cup
Baking powder	¼ tsp
Baking soda	¼ tsp
Vanilla essence	2 tsp
Vinegar	1.5 tsp
Instant coffee powder	1 tsp
Water	1.5 tbsp
Toppings	As required

#### Packaging and storage of muffins

Air tight plastic containers were bought from the local market. The muffins were stored in air tight plastic containers and stored for one week at ambient temperature and stored for one month at refrigerated temperature. They were evaluated periodically at 30 days interval for their organoleptic properties.



Figure 2 Packaging

#### Sensory evaluation

Sensory analysis of Choco-muffins was done according to a 9-point hedonic scale parameter by semi trained panel in Sarah Tucker College, Tirunelveli in Department of food Science and nutrition by professors. The 8 panellists were asked to give scores for Colour, texture, taste, flavour, appearance and overall acceptability.



Figure 3 Sensory Evaluation

#### Nutritional analysis

Macronutrient content of muffins were calculated in a laboratory. The sample of 100g was packed properly and sent through postal services to the lab in Chennai named "AZODI LABS PVT LTD". Estimation of Protein, Fat, Carbohydrate, Energy, Crude Fibre and moisture content was determined in the chemical analysis done by the lab technician in the

laboratory. The test report sent by the lab was attached in the appendix for reference. Micronutrient content of the muffins were calculated manually. The micronutrients like calcium, iron, phosphorus, carotene, niacin and folic acid were calculated.

### Keeping quality of the muffins

Keeping quality of the sample was done for the formulated product and they were stored at room temperature packed in an air tight container. The muffins stayed fresh without any change in taste and texture for up to 7 days.

### Naming the new product

Different names were selected based on the modern acceptance and the suitable name which influences the marketing strategy of the product was selected. The product was marketed in the same name.

### Nutrient labelling

Nutrient labelling is the preparing a new label for the product which includes the nutritional facts, ingredients and the date of manufacturing and expiry of the product. The nutrition label provides the necessary details for the satisfaction of the customers which also plays an important role in the marketing strategy of the developed product. The label is given in the appendix.

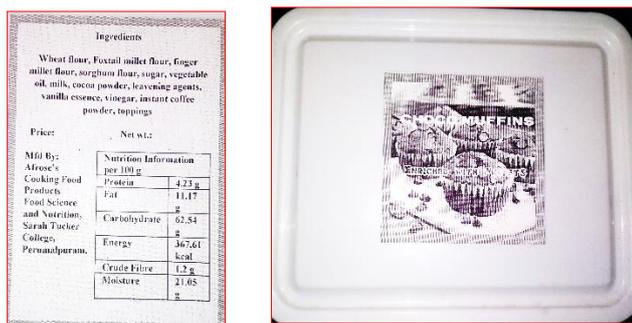


Figure 4 Nutrient labelling

### Popularization

Popularization is the function connected with researches in the production and distribution of goods. The newly prepared muffins were popularized among the college students and mothers with young children.

### Cost analysis

Cost analysis was carried out to find the gain incurred in selling of the new product.

### SWOT analysis

The SWOT analysis was also carried out to know the marketing strategy of the food product. In the marketing field, the SWOT analysis is a tool that allows a business to figure out its strengths and weaknesses, as well as its advantages and disadvantages compared to the competition. On the other hand, the company can take important decisions based on the real opportunities and threats from the market

## RESULTS AND DISCUSSION

The present study was based on the development of muffins using millets. The developed product was tested for their sensory scores and the overall acceptability. This was further investigated by Nutritional Analysis and SWOT analysis.



Figure 3 Choco-muffins

### Sensory evaluation of choco-muffins

Sensory evaluation was carried out with 8 trained and 4 untrained panel members. Appearance, taste, aroma, texture and overall acceptability were evaluated. The sensory scores were found out and displayed in (Figure 3).

Table 1 Sensory scores of Choco-muffins

Sensory parameters	Total score	Average score
Appearance	106	8.8
Taste	106	8.8
Aroma	104	8.6
Texture	105	8.7
Overall acceptability	106	8.8

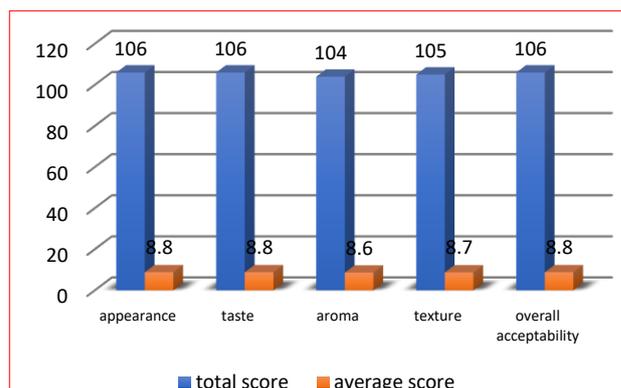


Figure 2 Sensory scores of Choco-muffins

### Analysis of the appearance of recipe

Appearance encompasses the positive and negative aspects of the product [Potter, 1996]. Surface characteristics of food product contribute to the appearance. Interior appearance can also be evaluated. Appearance covers not only the colour, but shape, size, transparency and brightness and so on.

The average score of response for appearance of Choco-Muffins is calculated and it is found to be 8.8.



Figure 3 Score for appearance of Choco-muffins

Product	Total score	Average score
Choco-Muffins	106	8.8

*Analysis of the taste of recipe*

Taste is the deciding index for food like and dislike as it is a natural response of people to taste foods that is pleasing to the eyes and smell good. The organs responsible for the taste are the taste buds (Rao 2001).

The average score of response for taste of Choco-Muffins is calculated and it is found to be 8.8.

Product	Total score	Average score
Choco-Muffins	106	8.8

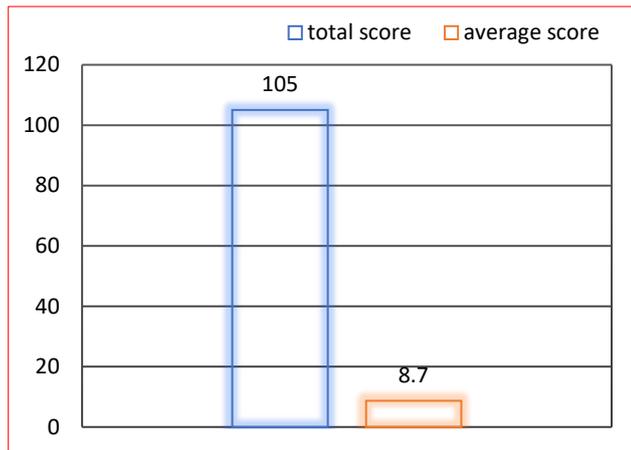


Figure 4 Score for taste of Choco-muffins

*Analysis of the aroma of recipe*

Aroma is an odour arising from spices, plants, cooking etc., especially an agreeable scent; fragrance (Flexner 1993).

The average score of response for aroma of Choco-Muffins is calculated and it is found out to be 8.6.

Product	Total score	Average score
Choco-Muffins	104	8.6

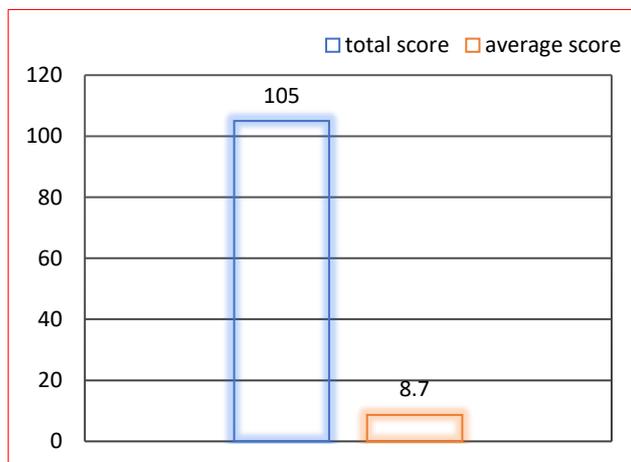


Figure 4 Score for aroma of Choco-muffins

*Analysis of the texture of recipe*

Texture is the visual or tactile surface characteristics and appearance of something; a basic scheme or structure (Mish 2003).

The average score of response for texture of Choco-Muffins is calculated and it is found out to be 8.7.

Product	Total score	Average score
Choco-Muffins	105	8.7

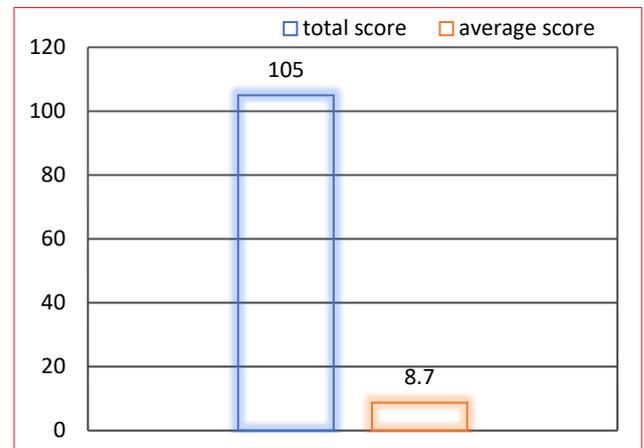


Figure 6 Score for texture of Choco-muffins

*Nutritional analysis*

*Macronutrient analysis*

The result of macronutrient analysis shows that the Choco-Muffins were a good source of energy, carbohydrates, also provides protein and fibre in certain amounts. Following table shows the result of macronutrient analysis of Choco-Muffins.

Nutrient	Unit	Result
Protein	g/100g	4.23
Fat	g/100g	11.17
Carbohydrate	g/100g	62.54
Energy	Kcal/100g	367.61
Crude Fibre	g/100g	1.2
Moisture	g/100g	21.05

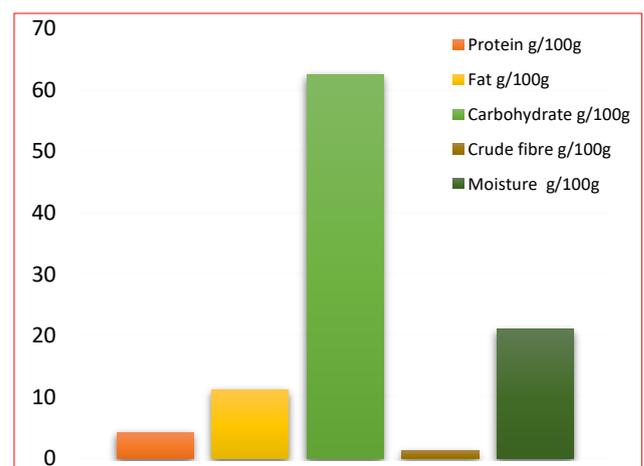


Figure 7 Macronutrient analysis

*Micronutrient analysis*

The result of the micronutrient analysis shows that the Choco-Muffins are a good source of calcium, Phosphorus and also provide iron, carotene, niacin and folic acid in certain amounts. Following table shows the result of micronutrient analysis of Choco-Muffins.

Nutrient	Unit	Result
Calcium	mg	424
Phosphorus	mg	1285
Iron	mg	16.9
Carotene	mg	.14
Niacin	mg	13.77

Folic Acid	mg	.11
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#### Cost analysis

The data on cost of muffin production is presented in (Table 8). This cost was worked out on the basis of cost of raw materials and chemicals used and labour charges at prevailing rates of raw material period.

Table 3 Cost analysis

Ingredients	Cost of ingredients [Rs]	Cost incurred by the recipe	
		Quantity of the ingredients [g]	Price [Rs]
Wheat flour	50/kg	250 g [1cup]	12.5
Foxtail millet flour	68/kg	40 g	2.7
Finger millet flour	40/kg	40 g	1.6
Sorghum Flour	51/kg	40 g	2
Sugar	20/kg	250 g [1 cup]	5
Vegetable oil	90/litre	40 g [1/3 cup]	3.6
Milk	32/500 ml	60 g [½ cup]	3.8
Cocoa Powder	210/225g	30 g [¼ cup]	28
Baking powder	37/100g	1.2 g [¼ tsp]	.5
Baking soda	20/100g	1.2 g [¼ tsp]	0.2
Vanilla essence	67/100ml	10 ml [2 tsp]	6.7
Vinegar	85/litre	7.5 ml [1.5 tsp]	0.6
Instant coffee powder	54/50g	5 g [1 tsp]	5.4
Toppings	55/100g	7.5 g [1.5 tsp]	4
Total cost incurred for the recipe			76.6

Overhead charges [including labour, fuel, electric charges, misc.] [Rs]	:	23.4
Total cost [Rs]	:	100
Total servings of muffins prepared	:	10
20% profit [Rs]	:	120
Selling price of the muffins [Rs/serving]	:	12

After the estimation of cost, the product was popularized among college students and among the mothers of young children. On the first day of popularization, free samples were distributed. From the next day, the product was sold according to the demand of the product. It was labelled attractively and was popularized. Labels played an important role in marketing the product formulated.

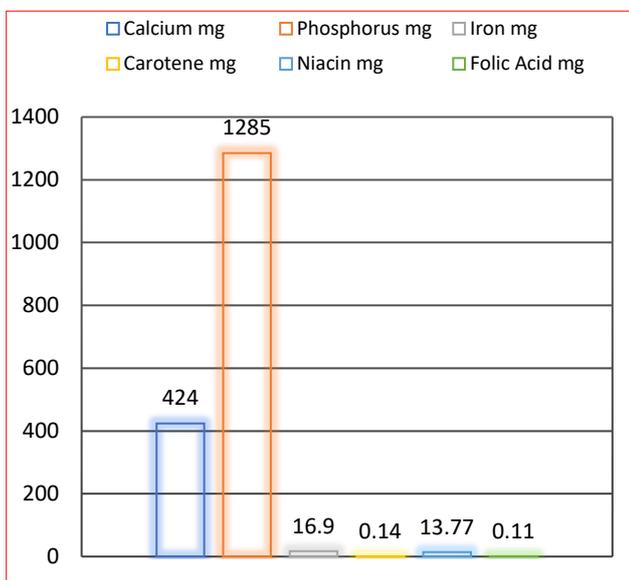


Figure 8 Micronutrient analysis



Figure 9 Popularization

#### SWOT analysis

Strength, Weakness, Opportunities, Threats of response is tabulated in (Table 9).

#### Popularization of the product

Strength	Weakness
<ul style="list-style-type: none"> <li>➤ Health benefits</li> <li>➤ Modern snack incorporated with traditional ingredients</li> <li>➤ Adequate availability of raw materials</li> <li>➤ Acceptable by all age groups</li> <li>➤ Attractive and Palatable</li> </ul>	<ul style="list-style-type: none"> <li>➤ Brand Acknowledgement</li> <li>➤ Late entry into market</li> <li>➤ Less variety</li> </ul>

Opportunities	Threats
<ul style="list-style-type: none"> <li>➤ Competitive advantage over other bakery products</li> <li>➤ Increasing health consciousness</li> <li>➤ Fast paced lifestyle</li> <li>➤ Interests among people to buy healthy foods</li> </ul>	<ul style="list-style-type: none"> <li>➤ New products are being introduced in the market</li> <li>➤ Existing brands can introduce variants of the recipe to enhance it nutritional benefits</li> <li>➤ Interest to eat junk foods</li> </ul>

## CONCLUSION

From the discussion it can be concluded that good quality muffins can be prepared from millets. From the storage studies, it may be concluded that muffins could be stored for about 7

days at ambient conditions without affecting sensory quality. This was an initial effort to shift the people's attitude from conventional way to modern way of consuming millets instead of eating unhealthy snacks.

## LITERATURE CITED

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