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Development of an energy dense millet-based Chakri cones for undernourished young adults

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Abstract

Aim and Objectives: The main aim of the study was to develop a millet-based, energy dense Indian snack enriched with pulses, cereals and oilseeds. Objectives included standardizing the product, conducting sensory evaluation, microbial analysis, evaluating its nutritional value and analyzing its market acceptance.

Methodology: The study consisted of various phases including formulation of idea, preparation and standardization of the product, followed by the sensory evaluation and microbial analysis, analysis of nutritional parameters and analyzing its market acceptance. The product was conceptualized from two already existing popular Indian snacks.

Results and Discussion: A flaky, crispy product with a soft inner core was developed. The sample developed by us was tested and sensory evaluation was conducted on a naive panel. This product received the highest overall acceptable sensory score based on five parameters- taste, texture, smell, appearance and innovation. The microbial analysis was done and approved. Nutritional analysis of the product showed that this product was rich in protein (20%), fiber, amongst other micronutrients, especially iron. This product helped in improving gut function, had antioxidant and immune modulating properties and had an overall impact on the protein status of the subject. The product has a long shelf life when kept in a hermetically controlled condition.

Conclusion: The Chakri Cones so developed were energy dense and free of preservatives and other additives without compromising on the taste and texture in comparison to commercially available products. The nutrient packed Chakri Cones are best suited as a snack for children, adolescents, and adults.

Keywords: Millet, traditional Indian, standardization, food product, chakri

Introduction

Cereals and millets are important for the human diet all over the world. After rice and wheat, millets like ragi, are the main sources of carbohydrate in the Indian diet. Both rice and ragi do not have gluten and therefore become ideal replacements for gluten and wheat products especially for people with gluten intolerance. In Ancient India, ragi or finger millet was well cultivated and was traditionally called nachni in Maharashtra, umi in Bihar, etc. (Patekar *et al.*, 2017)^[8].

Indian cuisine is influenced by traditional culture. Indian cuisine is known for its diversity and we have widespread options for appetizers, hors d'oeuvres, and snacks. (Agrawal & Sengupta, n.d.). Snacking influences other food choices that individuals consume throughout the day. (Julie Hess, 2017)^[4]. Indian snacks are popular and are made from a variety of foods like pulses, cereals, or combination of two. (Patekar *et al.*, 2017)^[8] The preference for snacks has increased in recent years as people prefer to carry light weight, easy to consume foods in pace of an elaborate one or two course meal. Snack items can be carried anywhere and acts as a replacement for main meals. (Kolhe *et al.*, 2021)^[5] Chakli is an Indian snack made up of either a single flour or combination of flours and is preferred over other snacks for its crispy and friable texture. (Patekar *et al.*, 2017)^[8] A kachori is an Indian snack option popular in Uttar Pradesh, arid regions of Gujarat and Rajasthan and Maharashtra, it is a stuffed ball of flour. The studding in a kachori depends on the region it originates from. (Agrawal & Sengupta, n.d.) In a study conducted by Steyn *et al.*, 2011 showed an increase in fast food consumption and is

is threatening the role of a public health advisor. Most Indian snacks are deep fried and pose a serious threat to the country's health status.

Traditionally the main ingredients in chakli and kachori are refined flour, moong dal, besan, urad dal, carom seeds, fennel, methi and other spices and the main method of cooking is deep frying. We have modified it and replaced the main ingredient- refined wheat flour with ragi flour, rice flour, besan and soya flour. Also, we have switched to baking and sun drying as a form of cooking in place of deep frying.

The main objective of our study was to develop a millet based, nutritionally and energy dense product which is much healthier and can be a suitable snack option for all age groups. In the newly developed product, we have used rice flour, ragi flour, besan and white soya bean flour as the base for the chakli and the main ingredients in the filling are moong dal, urad dal and besan. Complete removal of wheat and other gluten flours makes our product a gluten free, high protein snack. Soya bean is a worthy alternative to meat as it is a rich source of essential amino acids and thus helps in completing the protein content of any product.

Hence, keeping all these points in mind, we developed a new product out of two already existing Indian snacks which is superior in terms of palatability, nutritional content, shelf life and stability.

Material and Method

Ingredients.

Good quality Finger millet flour, Soy flour, Besan, Moong dal, urad dal flour, Spices, and Rice bran oil was procured from the local market of Matunga, Mumbai.

Equipment

Various equipment was used in the procedure which includes large plates, a chakli maker, steel cones, kadhai, a perforated spoon, measuring spoons, a ladle, and a weighing scale.

Chemicals

The final product was free from any additives and preservatives. For Microbial analysis, the chemicals were used from the Microbiology Laboratory of Dr. BMN College of Home Science.

Methodology

The Chakri Cones was innovated and inspired by traditional millet Chakri and traditional kachori filling. Initially, For preparing the filling.

The ingredient mentioned in table 1 was weighed and dry-roasted well in a pan on a low flame until the aroma is released from the spices. Besan is then added to the pan and roasted until the mixture changes color. Grounded Moong dal paste is added after a few minutes and mixed well.

For preparing the dough

On a plate add all the dry flour, ginger garlic paste, spices, and salt as mentioned in table 2.

Add warm water (40 degrees) to form a dough. Add ghee to the dough and knead it well. Cover the dough with a clean cloth and keep it aside for 10 min for a smooth consistency.

For preparing the cones

Grease the chakli maker with $\frac{1}{3}$ tsp of oil and transfer the dough to a chakli maker and roll out a circular cone-like shape around the steel cones. In a Kadhai add 250 ml of oil and warm it at 184-degree celsius for 10 minutes. Once the oil

is warm enough, put the glass flame at medium flame and add steel cones. Fry for a few minutes. Do not let it cook completely. Remove the cones halfway and let them cool at room temperature.

For preparing the final product

Remove the cone-shaped chakli from the steel cones. Fill those cones with the prepared filling and stuff well. Fry the stuffed cones again until they turn crisp for the next 2-3 minutes. Remove the cones from the oil and place them on the paper towel and let them cool.

Sensory and organoleptic evaluation of Chakri cones

Sensory and organoleptic evaluation of the Chakri cones was done by the naive judge panel using the 5-point Likert scale and recommendations were given to improve the protein content of the cones. The quality of the product was evaluated using the characteristics such as appearance, taste, texture, and flavor. According to the sensory scorecard and suggestions from the panel, required modifications were made to the product.

Characteristics of Chakri cones

1. Taste: spicy, fresh, and minty
2. Smell: aromatic
3. Texture: crunchy, flaky, ridged
4. Color: reddish brown
5. Sound: crispy, cracky when broken



Fig 1: Chakri cones

Modification

To improve the recipe's nutritive value the following ingredients were changed, Jowar flour was replaced by urad dal flour and soya flour was added to improve the protein content of the recipe.

Sugar was replaced by kharik powder and additional spices such as garam masala were added to the recipe. The procedure for preparing the Chakri cones remained the same. In the final stage instead of frying the cones, it can be placed in the oven and later fried after filling for less than one minute.

Table 1, 2: Comparison between unmodified Ingredients (S0) and modified Ingredients (S1)

Ingredients (S0)	Amounts	Ingredients (S1)	Amounts
For Dough		For dough	
Ragi Flour	20g	Ragi flour	20g
Rice flour	25g	Rice flour	25g
Jowar flour	20g	Soya flour	20g
Besan	20g	Besan	20g
Ginger-garlic paste	1 tsp	Ginger-garlic paste	1 tsp
Sesame seeds	1 tsp	Sesame seeds	1 tsp
Ajwain	1 tsp	Ajwain	1 tsp
Red chili powder	1 tsp	Red chili powder	1 tsp
Salt	As per taste	Salt	As per taste
For Filling		For Filling	
Moong dal (cooked and ground)	30g	Moong dal (cooked and ground)	30 g
Besan	15g	Besan	15g
		Urad dal flour	15g
Fennel seeds	15g	Fennel seed	15g
Turmeric powder	¼ tsp	Turmeric powder	¼ tsp
Coriander powder	½ tsp	Coriander powder	½ tsp
Amchur powder	½ tsp	Amchur powder	½ tsp
Cumin seeds	2 tsp	Cumin seed	2 tsp
Chili powder	1 tsp	Chili powder	1 tsp
		Gram masala	1 tsp
Sugar	2 tsp	Khareek	2 tsp
Oil	40 ml	Oil	15 ml

Shelf life And Microbial Analysis

The shelf life of the Chakri cones was analyzed by keeping the content in an airtight container for 1 month. After one month of period, the cones did not retain moisture and the texture remained the same. Microbial Analysis was conducted using the pour plate method in the microbiology laboratory of Dr. BMN College of Home Science.

Results

The main aim of modifying the chakri cone was to make it energy dense for nutrient deficiency and undernourished young adults, millet based Indian snack which can be enjoyed by all age groups. This aim of the experiment was successfully achieved. The following table gives the Nutritive value of the recipe table no.3 and Nutritive value per serving. Table no 4

Table 3: Nutritive Value of the final recipe

Ingredients	Amount (g/ ml)	Energy (kcal)	CHO (g)	Protein (g)	Fat (g)
Ragi flour	20	64	13.3	1.43	0.38
Soya flour	30	113.22	3.05	11.34	5.83
Rice flour	10	35.64	7.82	0.79	0.05
Besan	30	135	20.3	7.7	2.45
Moong dal	30	97	15.7	7.16	0.41
Urad dal flour	15	48.61	7.65	3.46	0.25
Sesame seeds	5	33.3	1	2	2.6
Khareek powder	5	16.01	3.75	0.12	0.02
Oil	15	135	-	-	15
Total	160	677.78	72.57	34	26.99

Table 4: Nutritive Value per serving

Macronutrient	Amount (Per 160 g)	Amount (Per serving = 3 cones = 50 g)
Energy (kcal)	677.78	211.8
Carbohydrate (g)	72.57	22.6
Protein (g)	34	10.62
Fat (g)	26.99	8.43

Carbohydrates and protein play a very important role in maintaining the energy balance and maintaining the healthy body weight. The chakri cone provides 42% of carbohydrate from total energy and 20 % protein from total energy making the recipe energy dense and high protein snacks. Chakri cones are also rich in dietary fibre that helps in providing a good digestive system and preventing metabolic diseases.

Sensory analysis

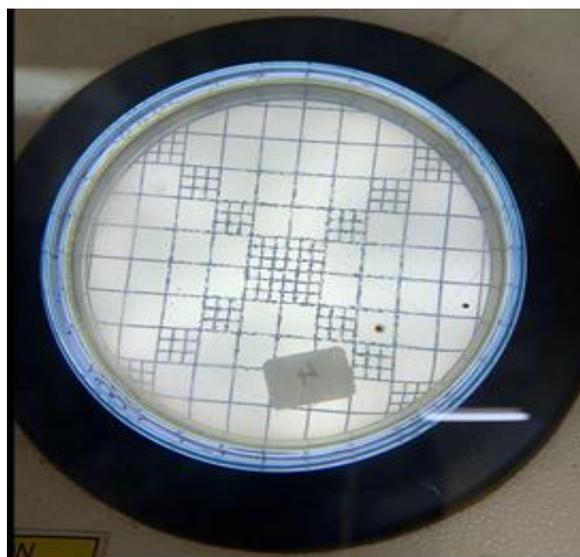
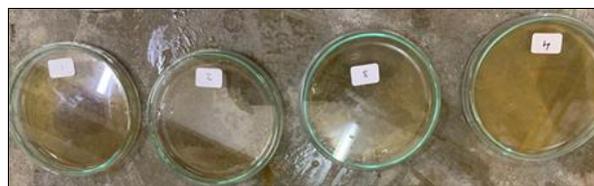
On the sensory and organoleptic analysis of the chakri cone it was found that most of the points were given to the appearance and innovation of the product as shown in the table 5.

Table 5: Sensory scorecard

Sr. No	Appearance	Taste	Aroma	Texture	Innovation	Overall appearance
1	4	3	2.5	4	4	4
2	3.5	3.5	3	3.5	4	3.5
3	4	3	2	2	4	4

Microbial analysis

Microbial analysis was performed using the pour plate method and it was observed that the TLTC level was too low to count.

**Fig 2:** TLTC count**Fig 3:** Pour plate method

Discussion

Modification and fusion of the traditional products was seen successful in the given experiment. This helps us to understand that the traditional recipes of millet chakri and kachori can be fused to make the product more appealing, tasty and nutrient dense by replacing some of the millets with pulses and soya flour.

Soya flour has proved to reduce various metabolic chronic illness. (Kumar Anil 2020) [6] The process of frying can be replaced by the process of dehydrating the product in the sun.

The product so formed can be used in rasam and can be consumed as a dumpling. Dehydrating foods helps to increase the shelf life of the product by reducing the moisture content in the food (Digvir *et al.*, 2016) [2]. This would help to reduce the fat content of the food product. Addition of soya flour and pulse flour helps to improve the protein content in the recipe. The traditional chakri is made from rice flour and kachori is made from processed flour however the modified product is made from finger millets, besan and soya flour with the filling of traditional kachori. Finger millets have polyphenols which helps to reduce the incidence of metabolic diseases (Palanisamy Bruntha Devi *et al.*, 2011).

2014, 3(3).

Conclusion

The project was undertaken to develop and standardize the production of chakri cones. An investigation was undertaken to standardize the processing for chakri cones which are multigrain, energy dense and protein rich. The multigrain flour prepared with ragi, jowar, rice flour was found to be acceptable as compared with other level of proportion. The sensory score of chakri cones prepared from multigrain flour was found to be rated high as compared to chaklis which are available in market, this was in terms of innovation, taste, flavour, texture and overall acceptability of the product. The microbial analysis performed on the product showed results that the microbes were 'too low to count' which makes the product sustainable hence increasing its shelf life. Hence, it is concluded that the chakri cones prepared from using multigrain flour and pulse mixture as a filling was found to be evidently more satisfactorily acceptable.

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