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DEVELOPMENT OF COMPOSITE FLOUR CRACKERS ENRICHED WITH CHICKPEA FLOUR

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ABSTRACT

Today's consumers nowadays want healthy food, but still prefer foods that are easy to eat, store, and handle. Crackers, with their varied taste, long shelf life, and low cost, are a favorite snack food consumed by a wide range of people. The current study explores the feasibility of using chickpea flour instead of wheat flour in the development of composite flour crackers. Six variations of crackers were made by substituting the wheat flour with 10%, 20%, 30%, 40%, and 50% of chickpea flour. As a control, wheat flour crackers without adding chickpea flour were prepared. A sensory evaluation was performed on the samples. According to the findings, the variant containing 30% chickpea flour had the highest ranking for the sensory attributes. the most acceptable sample was subjected to proximate nutrient analysis and Shelf-life assessment, which revealed the formulated had a good protein and fiber content and was shelf stable for one month without addition of preservatives and when compared the formulated product had a higher protein content, than the popular crackers on the market.

Keywords: Snacks, Crackers, Composite Flour, Chickpea Flour (Cicer Arietinum), Sensory Evaluation, Protein Rich, Shelf Life.

INTRODUCTION

Consumers' understanding of the links between diet, health, and the environment has improved, and so has their nutritional awareness. Snacking is now regarded by consumers as more than just a means of delectation; it is also regarded as a component of a healthy diet, as it is an important component of consumers' daily eating habits.

Novel health-oriented snack products, such as high protein, low-calorie, high-fiber snacks that can provide health benefits, are becoming increasingly popular among consumers. As a result, additional research into snacks that provide consumers with both enjoyment and health advantages is required. **[1]**

Crackers are one of the fastest-growing bakery product segments, owing to rising consumer demand for convenience foods.**[2]**

The crackers are extremely popular as snacks and are consumed by a wide range of people due to their varied taste, long shelf life, and low cost. It acts as a conduit for meeting consumer demand for nutritious, convenient, and tasty snacks.

Crackers are thin, crisp wafers or biscuits made of unsweetened and unleavened dough.**[3]**

The enhancement of nutritional value of bakery products such as crackers is accomplished by modifying their nutritive composition, by using the Composite flours to improve the nutrition quality of otherwise nutritionally poor products. **[4]**

The composite flour can be defined as "flour produced by combining or mixing varying proportions of non-wheat flours with or without wheat flour and used for the production of leavened or unleavened baked or snack items that are typically made from wheat flour and increase nutrient density of the food product."

Composite flour, when used to make food products, can retain similar properties to full-wheat flour-made products. Hence, the use of composite flour has a positive impact on the final product in terms of functional and physicochemical properties, as well as the health benefits. Overall, composite flour is a promising new approach to utilizing unusual food products, as the use of composite flour produced products with varying characteristics and quality **[5]**

Legume proteins play an important role in complementing cereals in the development of ready-to-eat snacks. Their use in food formulations is gaining popularity. **[6]**

Legume flours have a good amino acid composition and fiber content, making them great additives for boosting the nutritional value of baked items. [7]

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Chickpea flour can be used as a fortifier to improve the nutritional composition of the bakery products without affecting their sensory attributes.**[8]**

Protein content in chickpea seeds ranges from 12.6 to 30.5 percent. The biological value of chickpea proteins ranges from 75 to 85 percent, which is much greater than the biological value of other legume and grain proteins. Functional qualities of crops, which are becoming increasingly essential in terms of different and novel food uses, play a key role in its in the utilization of chickpea in cereal-based composite flours.**[9]**

Chickpeas can improve a product's nutritional value while also lowering its acrylamide levels. Acrylamide is a chemical present in bread, crackers, and chips that is antinutritive. Chickpea flour and protein could be a new strategy to lower acrylamide levels in snack products.[10]

Taking these considerations in mind, the current research intends to create composite flour crackers that are enriched with chickpea flour.

MATERIALS AND METHODS

Materials

Wheat Flour, soy flour and chickpea flour (fortune) and other minor ingredients like baking powder, salt, sugar, milk and oil were procured from a local supermarket of Hyderabad, India.

Formulation of Blends

The blend formulations used for preparation of six cracker samples were made by replacing the wheat flour with the chickpea flour at the levels of 10%, 20%, 30%, 40% and 50% respectively. The sample one was the control in which no chickpea flour was added; while the other five variations were enriched with chickpea flour.The ratio of each blend is outlined in **Table 1.**

Cracker Preparation

The wheat flour, soy flour and chickpea flour and other ingredients were weighed accurately. The pre-weighted ingredients were mixed. Milk was added followed by oil into the dry ingredients. Water was added accurately to form dough. The dough was then kneaded and kept at rest for 15 minutes. Then it was rolled to a uniform thickness of 3 mm. The crackers were cut out into a 5 mm diameter using a knife. The crackers were baked at 350C for 12-15 minutes, cooled to ambient temperature and packed in an airtight container.

Table 1: Composition of composite flour crackers

Sample	Wheat Flour [%]	Soy Flour[%]	Chickpea Flour[%]	Milk [ml]	Oil [ml]	Water [ml]	Salt [gm]	Sugar [gm]	Baking Soda [gm]
Sample-1 [control]	80	20	-	20	15	30	1.5	1.0	2.0
Sample-2	70	20	10	20	15	30	1.5	1.0	2.0
Sample-3	60	20	20	20	15	30	1.5	1. 0	2. 0
Sample-4	50	20	30	20	15	30	1.5	1. 0	2. 0
Sample-5	40	20	40	20	15	30	1.5	1.0	2. 0
Sample-6	30	20	50	20	15	30	1.5	1.0	2. 0

3.Sensory Evaluation

Sensory evaluation was carried out with untrained panelists. Each panelist was served with 6 randomly arranged cracker samples on a rectangular plastic glass tray. The 6 samples consisted of 5 variations of chickpea flour incorporated crackers and a control. Water was provided to neutralize the mouth between the tasting of samples. Panellists were required to evaluate the colour, crispiness, taste and overall acceptance of the crackers using the 5-point hedonic scale.

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4. Shelf-Life Analysis

Based upon the results of sensory evaluation of the crackers samples. The sample IV was then subjected to chemical, microbial and organoleptic analysis to evaluate its storage stability, over a period of one month i.e., at Zero-day, 15th and 30th day, respectively. The results of shelf-life study are presented in the **table.**

RESULTS AND DISCUSSION

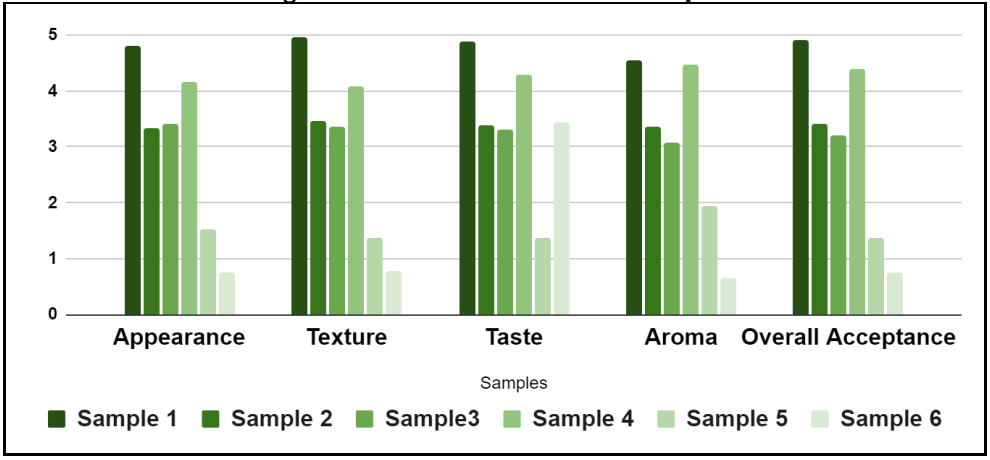
To determine whether there was a significant difference between the six cracker samples used in the study, statistical tests such as the chi square test, standard deviation tests, and advanced tests such as the Krushkal-Wallis test were performed using information obtained from sensory evaluation (where n=50).

The following table shows the findings of the statistical analysis:

Table 2: Mean Rank of cracker samples

Samples		Appearance	Texture	Taste	Aroma	Overall Acceptance
1	Mean	4.81	4.96	4.89	4.55	4.9
	N	50	50	50	50	50
2	Mean	3.34	3.46	3.38	3.36	3.41
	N	50	50	50	50	50
3	Mean	3.42	3.37	3.3	3.08	3.21
	N	50	50	50	50	50
4	Mean	4.15	4.08	4.3	4.46	4.4
	N	50	50	50	50	50
5	Mean	1.52	1.38	1.38	1.93	1.36
	N	50	50	50	50	50
6	Mean	0.76	0.78	39.44	0.66	0.76
	N	50	50	50	50	50

Figure 1:Mean Rank for cracker samples



Appearance -Appearance of sample 1 (98%) for rank 5 was preferred maximum followed by 4th (66%) sample, whereas 5th and 6th samples are least preferred.(70% and 72% for rank 3).All chi square values are significant as p value is **<0.05.**

Taste-Taste of sample 1 (100%) for rank5 was preferred maximum followed by 4th (72%)sample, whereas 5th and 6thsamples are least preferred(82 and 68 % for rank 3). All chi square values are significant as p value is **<0.05**.

Texture-Texture of sample 1 (100%) for rank 5 was preferred maximum followed by 4th (58%) sample, whereas 5th and 6thsamples are least preferred(66 and 82% for rank 3)All chi square values are significant as p value is **<0.05**.

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Aroma-Aroma of sample 1 (80%) for rank 5 was preferred maximum followed by 4th (76%)sample, whereas 5th and 6thsamples are least preferred(58 and 42 % for rank 4). All chi square values are significant as p value is **<0.05**.
Overall Acceptance -Overall acceptance of sample 1 (100%) for rank 5 was preferred maximum followed by 4th (76%) sample, whereas 5th and 6th samples are least preferred. All chi square values are significant as p value is **<0.05**.

As per the results obtained from statistical analysis, it is evident that **Sample IV incorporated with 30% chickpea flour is most preferred after the control.**

Table 3: Percentages within the sample

Crosstab								
			Sample					
			1	2	3	4	5	6
APPEARANCE	1	Count	49	36	34	66	35	36
		% Within sample	98%	72%	68%	66%	70%	72%
TASTE	2	Count	50	36	38	36	42	34
		% Within sample	100%	72%	76%	72%	82%	68%
TEXTURE	3	Count	50	36	38	29	42	33
		% Within sample	100%	72%	76%	58%	84%	66%
AROMA	4	Count	40	36	42	38	21	37
		% Within sample	80%	72%	84%	76%	58%	42%
OVERALL ACCEPTANCE	5	Count	50	36	41	38	44	29
		% Within sample	100.0%	75%	82%	76%	88%	58%

Nutrient Analysis

The test sample with the highest overall acceptability was analyzed for its nutrient content. The Energy was 443.93 k.cal/100gm, Carbohydrate was 56.01 gm/100gm, Protein was 18.77 gm/100gm, Fat was 16.09 gm/100gm, Sugar was 4.73 gm/100gm, Dietary fibre was 9.81 gm/100gm, Calcium was 119.18 gm/100gm and Iron was 4.73 gm/100gm.

Table 4: Results of Nutrient Analysis

S.No.	Parameters	Units	Results of Analysis
1	Energy	Kcal/100g	443.93
2	Carbohydrate	g/100g	56.01
3	Protein	g/100g	18.77
4	Fat	g/100g	16.09
5	Sugar	g/100g	4.73
6	Calcium	mg/100g	119.18
7	Iron	mg/100g	7.32
8	Dietary Fibre	g/100g	9.81

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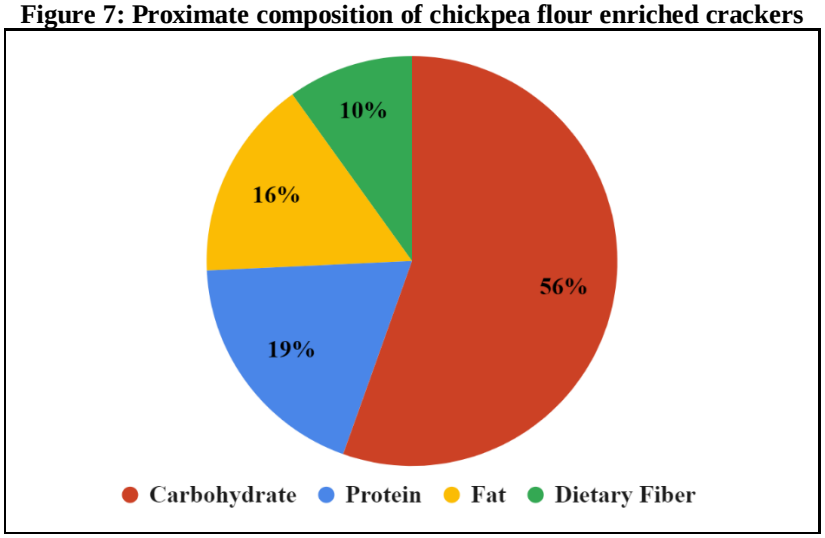
Figure 7: Proximate composition of chickpea flour enriched crackers



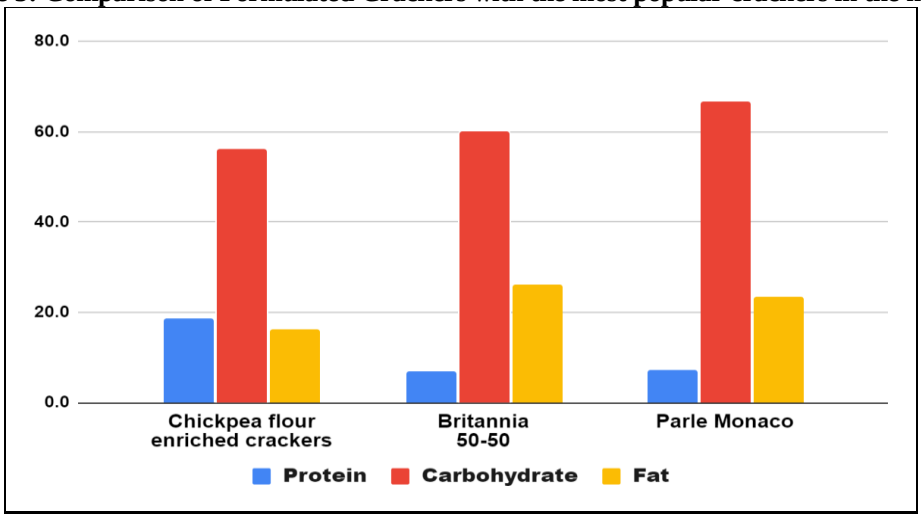
Comparison of Crackers

A Comparison of the formulated chickpea flour crackers with the popular crackers available in the market revealed that, the formulated crackers have lower energy and fat content and a higher proximate composition in terms of protein while no significant difference was found in the carbohydrate content.

Table 5: Comparison of Formulated Crackers with crackers available in the market

S,No.	Nutrients	Chickpea flour enriched crackers	Britannia 50-50	Parle Monaco
1	Energy	443.93	502	505
2	Protein	18.77	7	7.3
3	Carbohydrate	56.01	60	66.6
4	Fat	16.09	26	23.3

Figure 3: Comparison of Formulated Crackers with the most popular crackers in the market



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Shelf-Life Analysis

The shelf life of a food is the time period within which the food is safe to consume and/or has an acceptable quality to consumers. By performing shelf-life analysis; one can define accurate dates for products, ensuring that the quality remains acceptable and safe for consumers.

The Storage stability of the product analyzed for 0th, 15th and 30th day over 1 month cycle to assess the microbial and chemical parameters.

Microbial Analysis

The test sample with the highest overall acceptability was examined in real time on the zero day (immediately after obtaining the sample), the fifteenth day (after fifteen days), and the thirtieth day (after one month). Throughout the storage time, the sample was kept at room temperature.

The total viable count analyzed was > 10 cfu/g throughout the storage period, Coliform accounted for 10 cfu/g during the storage period, Ecoli and salmonella were absent on the zero-day, 15th day, and 30th day of shelf-life analysis, yeast and mould was within the specified limits i.e.,>10cfu/g which indicated absence of absence of pathogenic microorganisms.

Table 6: Results of Microbial Analysis

Tests	Units	Zero day	15th day	30th day	Specified Limits
Total viable count	cfu/g	<10	<10	<10	Max 104
Coliform	cfu/g	<10	<10	<10	Max 102
E coli	org/g	Absent	Absent	Absent	Absent
Salmonella	org/25g	Absent	Absent	Absent	Absent
Staphylococcus aureus	org/g	Absent	Absent	Absent	Absent
Yeast	cfu/g	<10	<10	<10	Max 102
Mold	cfu/g	<10	<10	<10	Max 102

Chemical Analysis

The test sample with the highest overall acceptability wasanalysedfor PH (5% Aqueous sol). the PH didn't increase significantly it was 6.26 on zero day and 6.30 on 15th day and 6.33 on the 30th day, Acidity of the product was 0.52 g/100gm on zero-day, 0.50 g/100gm on 15th day and decreased to 0.46 on the 30th day. Moisture content increased slightly over the period of 1 month it was ,4.89 g/100g 4.93 g/100g and 5.15g /100 g on zero day, 15tb day and 30th day respectively under ambient storage conditions. The crackers hence didn't undergo any significant chemical deterioration throughout the storage period.

Table 7: Results of Chemical Analysis

Tests	Units	Zero day	15th day	30th day	Specified Limits
pH (5% aqueous sol)	-	6.26	6.3	6.33	Not Specified
Acidity as citric acid anhydrous	g/100g	0.52	0.5	0.46	Not Specified
Moisture	g/100g	4.89	4.93	5.15	Not Specified

Organoleptic Evaluation

The formulated crackers, when analysed for the sensory attributes periodically at zero,15th and 30th day respectively, did not undergo any significant changes in the appearance, taste, texture and odour of the cracker and were scored 5 by the panelists throughout the storage period.

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Table 8: Results of Organoleptic evaluation

OrganolepticAttributes	Zero day	15th day	30th day	Preferred Scores
Appearance	5	5	5	3 to 5
Odour	5	5	5	3 to 5
Taste	5	5	5	3 to 5
Texture/ Consistency	5	5	5	3 to 5

CONCLUSION

The product formulated in the current research study, composite flour crackers enriched with chickpea flour, was found to be acceptable among the consumers, and nutrient analysis indicates that the product developed has a good protein and fiber content when compared to other popular snack crackers on the market. The shelf-life reports revealed that,the crackers were shelf stable as there was no significant chemical, microbial, or organoleptic changes observed in the product throughout its storage period of one month. Hence, the chickpea flour incorporated crackers can be successfully introduced into the Indian market, as the nutrient density is more compared to other cracker varieties available in the market and can be widely adopted by customers, as chickpea flour is one of the most commonly used flours to prepare various hit snack items commercially available such as murukkul, and also, the crackers as snack foods ,offer umpteen advantages including; wider consumption, good eating quality, highly palatable and acceptable by most individuals and as the product is shelf stable without any change in the organoleptic characteristics for about one month without addition of any preservative and can be a great choice for people preferring low or no preservative snacks.

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