



RESEARCH ARTICLE

DEVELOPMENT AND EVALUATION OF FENUGREEK SEED ENRICHED KHAKHRA

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ARTICLE INFO

Article History:

Received 20th June, 2022
Received in revised form
27th July, 2022
Accepted 09th August, 2022
Published online 30th September, 2022

Key words:

Adults, Fenugreek seeds, Flaxseeds,
Sesame seeds, Diabetes, Snack, Breakfast.

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Citation: Sharavathi V. and Dr. Usha Devi, C. 2022. "Development And Evaluation of Fenugreek seed Enriched Khakhra". *International Journal of Current Research*, 14, (09), 22352-22355.

ABSTRACT

Khakhra is a ready-to-eat snack or breakfast food that is popular in India. For centuries, fenugreek (*Trigonella foenum-graecum*) has been used to increase the sensory characteristics of cuisines all across the world. It has anti-diabetic, anti-carcinogenic, hypocholesterolemia, antioxidant, and immunologic characteristics. Fenugreek Enriched Khakhra was evaluated for sensory properties. To make preparations, the three variations were used. Besan flour (60%) is the primary ingredient, followed by sesame seeds (7%), flaxseed (7%), chilli powder (6%), salt (3%), and oil (2 per cent), Soaked Fenugreek seeds (20%), soaked Fenugreek seeds (15%), and soaked and germinated Fenugreek seeds were used in the studies (15 per cent). Sensory quality was assessed using a 9-point hedonic rating scale by semi-trained panelists. A 30-day shelf-life evaluation was performed. Sensory evaluation found that 15% of Soaked and germinated fenugreek seeds in Variation 3 were highly accepted, obtaining an 8.5 score, compared to 20% of Soaked Fenugreek seeds in Variation 1 and 15% of Soaked Fenugreek seeds in Variation 2. The statistical F - test (-7.67) reveals that the variations were statistically significant (P >0.05). It can also be carried on a trip with oneself. It is widely used for general public in the prevention of diabetes.

INTRODUCTION

Khakhra is a popular ready-to-eat snack or breakfast food in India's North-Western region. In Gujarat, this product is extremely popular. It is popular as a travel snack since it does not require any additional processing at the point of consumption, requires minimum packaging, and has a long shelf life. Traditionally, wheat flour and oil were used. A nutritious Indian diet snack that is crispy, crunchy, delicious, nutritional, and light in weight. Coffee, tea, chutney, pickles, butter, ghee, topping veggies, cheese, or yogurt are common accompaniments. They are easy to transport, and most people eat them as a snack while travelling. Snack food is a smaller proportion of a meal that can be consumed in between meals. It is useful because it is quick and easy to put together. Snack food comes in a range of shapes and sizes, including commercial meals and traditional cuisines. The vast majority of snack foods are intended to be consumed immediately and have a shelf life of 1-2 days. Breakfast is becoming more interesting as a result of quick solutions and appetizing options that are generating a stir in the Indian market. The Indian customer understands the value of maintaining a healthy lifestyle and beginning each day with a king's breakfast. People are increasingly preferring a basic, quick manner of preparing over spending too much time in the kitchen due to pressure of contemporary life.

"Ready to eat foods" are types of food that have been prepared or made for direct human consumption without any need for cooking or other processing that simply eliminates or reduces microorganisms of concern to an appropriate standard. *Trigonella foenum-graecum* L. (Fenugreek) is an essential spice in Indigenous culture and is recognized for its therapeutic benefits all over the world. The seeds are available in a variety of forms, including whole and smashed, and are used to season a wide variety of foods. Fenugreek seeds can help with digestion as well as modifying the flavour of food. Hypercholesterolemia, lactation support, antimicrobial, gastrointestinal stimulant, appetite stimulant, pharmacological agents, emmenagogue, chemo-preventive impact, and anticancer characteristics are all pharmacological qualities of fenugreek seeds. When used in low amounts, fenugreek has been declared safe to consume.

Flaxseed is a common oilseed crop that is utilised in a variety of applications including industrial, culinary, feed, and fibre. In Latin Flaxseed (*Linum usitatissimum* L.) is called "vital". Flaxseeds have a triangular, curve, with an embryo encircled cotyledons, a thin endosperm, and a lustrous yellow to dark brown pericarp (hull). The seed contains omega-3 fatty acids, edible protein, and lignans. Soluble fibre in flaxseeds lowers blood cholesterol and lowers the risk of heart disease.

METHODOLOGY

Aim: Development of the value addition with fenugreek seed enriched khakhra for adults.

Objective

- To prepare value added item that is appropriate for all age groups.
- To assess the sensory qualities of all three variations using 9-point hedonic scale
- To standardize and study the acceptability of the best-selected products.

Plan of Work

- Choosing raw materials from an e-commerce site.
- Product processing using appropriate methods such as soaking, germination, blending, and kneading.
- Different variations are being used to develop distinct khakhra varieties.
- Sensory evaluation was conducted to determine the overall acceptability of the developed product.
- Conducting shelf-life study of the product at room temperature.

Place of Study: The Experiment was carried out at Maharani Cluster University in the Department of Food and Nutrition and Research Center. Sensory evaluation was performed by 50 semi-trained panelists in Food and Nutrition laboratories.

Selection of the product to be developed: Khakhra is consumed by all age groups. Khakhra made by value addition of fenugreek seeds can be consumed by the general public to prevent Diabetes. It is the best ready-to-eat food and it can also carry while traveling.

Procurement of raw materials required for developing khakhra: Besan flour (bengal gram flour), fenugreek seeds, sesame seeds, flax seeds, red chili powder, salt oil. The prices of raw materials are within budget, and reasonably priced ingredients were ordered online.

Soaking and germination Fenugreek seeds

Making a paste/powder of fenugreek

Seeds

Roasting flaxseeds and sesame seeds

Sieving of Bengal gram flour

Measuring Khakhra

Packaging and Storage

Figure 1. Flow chart of development and evaluation of fenugreek seed enriched Khakhra.

Development and Method of Processing of Khakhra: The technique applied in product development is highly experimental. Various variations were performed with a slight alteration. After that, the products were compared in the trials.

Three different variants were designed and evaluated. In the variants, different processing methods and percentage levels were tried. The sensory evaluation was conducted by a 50-semi trained panelist using a 9-point hedonic scale. Based on the findings and overall acceptance shows that 15% of soaked and germinated fenugreek seeds were selected and standardized with shelf-life tests, nutrient analysis, nutritional labelling, packing, and marketing.

Variation: Different variations were tried out. All three variation was prepared with besan flour (bengal gram flour). The major ingredients added for the product are 20g and 15g of soaked fenugreek seed, 15g of germinated fenugreek seed. Flaxseeds and sesame seeds are the other two ingredients that were added to enhance the nutritive value of the product.

Basic: Wheat flour: 60% + Chilli powder: 15% + Turmeric powder: 5% + Salt: 5% + Oil: 3%

Variation 1: Besan flour: 60% + Soaked fenugreek seeds: 20% + Sesame seeds: 9% + Chilli powder: 6% + Salt: 3% + Oil: 2%

Variation 2: Besan flour: 60% + Soaked fenugreek seeds: 15% + Sesame seeds: 7% + Flaxseed: 7% + Chilli powder: 6% + Salt: 3% + Oil: 2%

Variation 3: Besan flour: 60% + Soaked and Germinated fenugreek seeds: 15% + Sesame seeds: 7% + Flaxseed: 7% + Chilli powder: 6% + Salt: 3% + Oil: 2%

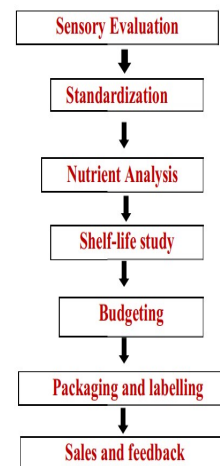


Figure 2. Different variations with value addition of khakhra and basic as plain khakhra

Sensory Evaluation of the Khakhra: The sensory assessment provides valid and reliable information of the overall sensory qualities to the research department, production, and marketing. Sensory evaluation delivers one-of-a-kind information that is extremely valuable in the marketplace. Using a 9-point hedonic scale, sensory evaluation was used to determine Khakhra's acceptability. On a scale of 9 to 1, various aspects such as appearance, color, texture, taste, aroma, flavor, and overall acceptability were rated. The rankings were classified as follows:

- 9 – Like Extremely
- 8 – Like Moderately
- 7 – Like Moderately
- 6 – Like Slightly
- 5 – Neither Like nor Dislike
- 4 – Dislike Slightly
- 3 – Dislike Moderately
- 2 – Dislike Moderately
- 1 – Dislike Extremely

Sensory evaluations were conducted by 50 semi-trained panels using a 9-point hedonic scale, and the results were collated.

Statistical Analysis: Mean scores for each sample examined by the semi-trained panelist are included in the data. The sensory evaluation results were analyzed individually to see if there were significant differences in mean scores for appearance, colour, taste, odour, texture, and overall acceptability.

Shelf-life studies: Safety is the most significant aspect in determining a food's shelf life, followed by quality, which includes physical, chemical, and sensory attributes. Consumers can benefit from shelf-life research since they can ensure a high-quality product during the storage term. The shelf-life tests were carried out at room temperature (34°C).

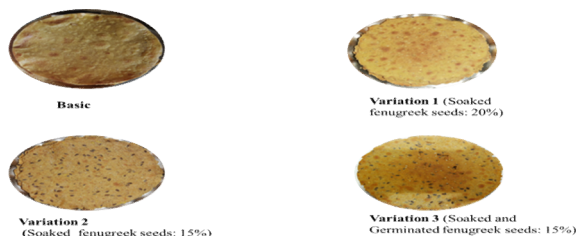


Table 1. Standardization of Khakhra

Ingredients	Percent (variation 3)
Besan flour	60
Fenugreek seeds (soaked and germination)	15
Sesame seeds	7
Flaxseed	7
Chilli powder	6
Salt	3
Oil	2

Table 2. Nutritional composition of standardization of Khakhra

Nutritional Information per 100g	
Energy	1330.8 KJ 318.3 kcal
Carbohydrate	31.04g
Protein	19.56g
Fat	11.3g
Total Fiber	19.23g
Insoluble Fiber	14.2g
Soluble Fiber	5.02g
Total Saturated fat	1054.7mg
Omega 3 fatty acid	2113.2mg
Omega 6 fatty acid	4387.4 mg
Sodium	21.9mg
Potassium	785.8mg
Glycaemic Index	24.1

Source: Indian Food Composition Table; NIN 2017

Packaging material: Food-grade plastic pouches: Food packaging helps to protect food from physical, chemical, and environmental elements that could contaminate the entire batch if not properly packaged. Food-grade polypropylene pouches aid in air and humidity resistance. The greatest way to safeguard individuals from hazardous pollutants and bacteria entering the body is to use food-grade pouches.

Nutritional Labelling: Nutrition labels are used to identify the nutrient content of foods and to assist consumers in making dietary choices. The nutrition information presented must be chosen based on whether it corresponds with dietary guidelines. Label size, analytical feasibility of measuring the particular nutritional component within the food matrix, and the relative cost of such studies should be considered when selecting specific nutrients or food components to be included.

RESULTS AND DISCUSSION

The study had shown that efforts were made to formulate the fenugreek seed enriched khakhra. Prepared product for assessment of its statistical analysis and sensory acceptability of prepared khakhra. Furthermore, the formulated product was evaluated for storage characteristics in order to analyze the shelf life. The result obtained is discussed as follows. Sensory Evaluation of wheat flour-based khakhra: Basic (Wheat flour: 60% + Sesame seeds:12% + Chilli powder: 15%+ Turmeric powder: 5% + Salt: 5% + Oil: 3%).Basic was prepared with wheat flour. The taste of the product was best accepted among the semi-trained panel. The mean value for appearance was 7.8, color was 7.8, the taste was 8.5, the texture was 7.9, the odour was 8 and the overall acceptability of the product mean score was 7.9. Sensory Evaluation of Besan flour-based khakhra: (Besan flour: 60% + Soaked fenugreek seeds: 20% (Variation 1)/Soaked fenugreek seeds: 15% (Variation 2)/ Soaked and

Germinated fenugreek seeds: 15% (Variation 3)+ Sesame seeds: 9% + Chilli powder: 6% + Salt: 3% + Oil :2%).Variation 1 was prepared byBesan flour: 60% + Soaked fenugreek seeds: 20% + Sesame seeds: 9% + Chilli powder: 6% + Salt: 3% + Oil :2%. The overall acceptability of the product was rated as 7.6 (like moderately). The taste was rated as 7.1 because the taste was bitter. Variation 2 was prepared by Besan flour: 60% + Soaked fenugreek seeds: 15% + Sesame seeds: 7% + Flaxseed: 7% + Chilli powder: 6% + Salt: 3% + Oil :2%. The appearance, color, odour, texture, of the product, was better accepted comparatively to variation 1. The taste was a little better than variation 1. The overall acceptability of this product is 7.8. Variation 3 was prepared byBesan flour: 60% + Soaked and Germinated fenugreek seeds: 15% + Sesame seeds: 7% + Flaxseed: 7% + Chilli powder: 6% + Salt: 3% + Oil: 2%.The texture of the product was better accepted. The taste was a little better than variation 2. Overall acceptability of this product was better accepted comparatively than variation 1 and variation 2 by a mean score of 8.5.

Statistical Analysis of the developed Product: The data provides mean scores for each of the 50 semi-trained panelists that were evaluated by each sample.The statistical F - test (-7.67) shows that there was a difference in texture and overall acceptability in the variations that was statistically significant (P >0.05).

Sensory Evaluation of best selected Product:

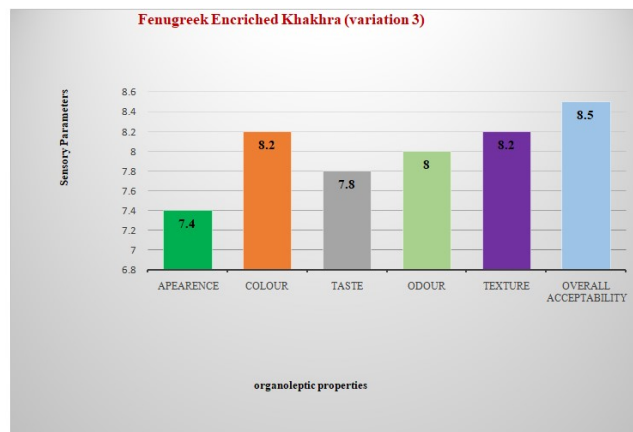


Table 4. Shelf-life study of Soaked and Germinated fenugreek seeds – 15 per cent khakhra

Product	Days	Appearance	Colour	Taste	Texture
Variation 3	15	Round Thin (Size)	Golden brown	Crispy	Crispy
	30	Round Thin (Size)	Golden brown	Very light bitterness, Good	Crispy

CONCLUSION

Fenugreek seeds, which provide an anti-diabetic effect, are used to make Khakhra. Fenugreek seeds and flaxseeds are used because they provide a variety of health benefits to people. The importance of developing this khakhra with fenugreek seeds as a value addition is due to the low GI recipe and high soluble fiber content. Because of the bitterness, variation 3 was more widely accepted than variations 1 and 2. Variation 3 had a good appearance, colour, taste, texture, and odour, and its overall acceptability was greater than the corresponding variants. As a result, it is the easiest ready-to-eat food for adults, and it can easily be taken while traveling. It is accessible to the general public for use in preventing diabetes.

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