



DEVELOPMENT AND QUALITATIVE ASSESSMENT OF A FIBER-RICH MINI KHAKRA FOR DIABETES MANAGEMENT

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ABSTRACT: Diabetes mellitus (DM) is a prevalent global health issue characterized by hyperglycemia resulting from inadequate insulin secretion or insulin sensitivity. This study addresses the challenges of type 2 diabetes, emphasizing dietary interventions to improve glycemic control. Specifically, the research explores the development and evaluation of a diabetic-friendly product containing whole wheat, barley, flaxseed, and cinnamon. A simple random sampling method was utilized to select 50 individuals for sensory evaluation of the product's acceptability. Results indicate favorable acceptability, suggesting the potential of the product as a practical and nutritious option for managing blood sugar levels. The incorporation of fiber and cinnamon aims to mitigate hyperglycemia by providing a low glycemic index alternative with anti-hyperglycemic properties. This research contributes to ongoing efforts in diabetes management, highlighting the importance of dietary interventions in supporting glycaemic control and improving health outcomes for diabetic individuals.

Keywords: Diabetes mellitus, Type 2 diabetes, Hyperglycemia, Insulin sensitivity, Whole wheat, Barley, Flaxseed, Cinnamon, Low glycemic index.

1. INTRODUCTION:

Diabetes mellitus (DM) stands as a prevalent cause of global mortality. It is a complex ailment affecting individuals of diverse races and ethnicities, resulting from either inadequate insulin secretion or insulin sensitivity. Recognized by the term hyperglycemia, diabetes mellitus represents a condition wherein elevated blood glucose levels occur due to the impaired functionality of insulin. Symptoms such as polyphagia, polydipsia, polyuria, and hyperglycemia serve as indicative markers of this disorder. Various diagnostic tests are employed to identify diabetes based on the manifestation of these symptoms. (4)

Various types of diabetes exist, some of the common types are Type 1 (insufficient insulin production.), Type 2 (insulin resistance) and Gestational diabetes mellitus (GDM) (hormonal changes during pregnancy that affect insulin utilization). Additional specific diabetes types include genetic defects in β -cell function, genetic defects in insulin action, diseases affecting the exocrine pancreas, endocrinopathies, drug or chemical-induced diabetes, infections, unusual forms of immune-mediated diabetes, and other genetic syndromes occasionally linked to diabetes. (6)

Type 2 diabetes mellitus (DM) involves insulin resistance, reduced insulin production, and the eventual failure of pancreatic beta cells. This leads to reduced glucose transport into the liver, muscle cells, and fat cells, coupled with increased fat breakdown, resulting in elevated blood sugar levels (hyperglycemia). Recent findings highlight impaired alpha-cell function in the condition, contributing to elevated levels of glucagon and hepatic glucose during fasting, which are not adequately suppressed after a meal. Insufficient insulin and heightened resistance collectively contribute to the occurrence of hyperglycemia. (7)

Fiber, sometimes referred to as roughage, is a type of carbohydrate that is included in plant-based diets but is indigestible and insoluble by humans. It contains materials like lignin and non-starch polysaccharides including cellulose, hemicellulose, and pectin. In those with type 2 diabetes, consuming a significant amount of dietary fiber—especially the soluble kind—improves blood sugar regulation, lowers hyperinsulinemia, and lowers plasma lipid concentrations. (8)

In integrative medicine, cinnamon is being explored as a potential supplementary treatment for type 2 diabetes.(3) Additionally, regular consumption of flaxseeds has been found to improve glycaemic control in overweight pre-diabetic individuals, contributing to the treatment of type 2 diabetes by reducing fasting plasma glucose concentrations. (4)

This product is developed using whole wheat, barley, flax seed, and cinnamon to increase the intake of dietary fiber and cinnamon, regularly by individuals who are diagnosed with diabetes as these ingredients and components in these ingredients have shown promising results in reducing hyperglycaemia in diabetic patients.

2. RESEARCH METHODOLOGY:

2.1 STUDY DESIGN:

The study design used here is simple random sampling where 50 individuals aged between 18 years and 50 years are selected. The sensory evaluation was done to know the product's acceptability. The study subjects were asked to give scores according to a 9-point hedonic scale.

2.2 SAMPLING SIZE:

50 Participants

2.3 DATA ANALYSIS:

The collected data from sensory evaluation gives the overall acceptability of the diabetic-friendly product. Descriptive statistics such as mean and standard deviation will be used for continuous variables.

2.4 INCLUSION CRITERIA

Participants are willing to give informed consent.

2.5 EXCLUSION CRITERIA

1. People who are allergic to millets
2. People who are allergic to seeds

2.6 TOOLS FOR DATA COLLECTION

9-point hedonic scale

Table 1. 9-Point Hedonic Scale

Attribute	9 Like extremely	8 Like very much	7 Like Moderately	6 Like slightly	5 Neither like or dislike	4 Dislike slightly	3 Dislike moderately	2 Dislike Very much	1 Dislike extremely
Appearance									
Flavour/ taste									
Aroma									
Texture									
Mouthfeel									
Overall acceptability									

Table 2. Formulation of mini Khakra

INGREDIENTS	QUANTITY
Whole wheat flour	35 g
Barley	35 g
Flax seeds	15 g
Cinnamon	6 g
Peri-Peri masala	3 g
Pepper	2 g
Oil	3 g (3.2ml)
Salt	1 g
Total	100 g

For dough preparation, mix the wheat flour, barley, flax seeds, Cinnamon powder, peri-peri masala, turmeric powder, pepper powder, salt and oil.



Add water to the dough and knead it well



Divide the dough into smaller portions and make it into tiny balls

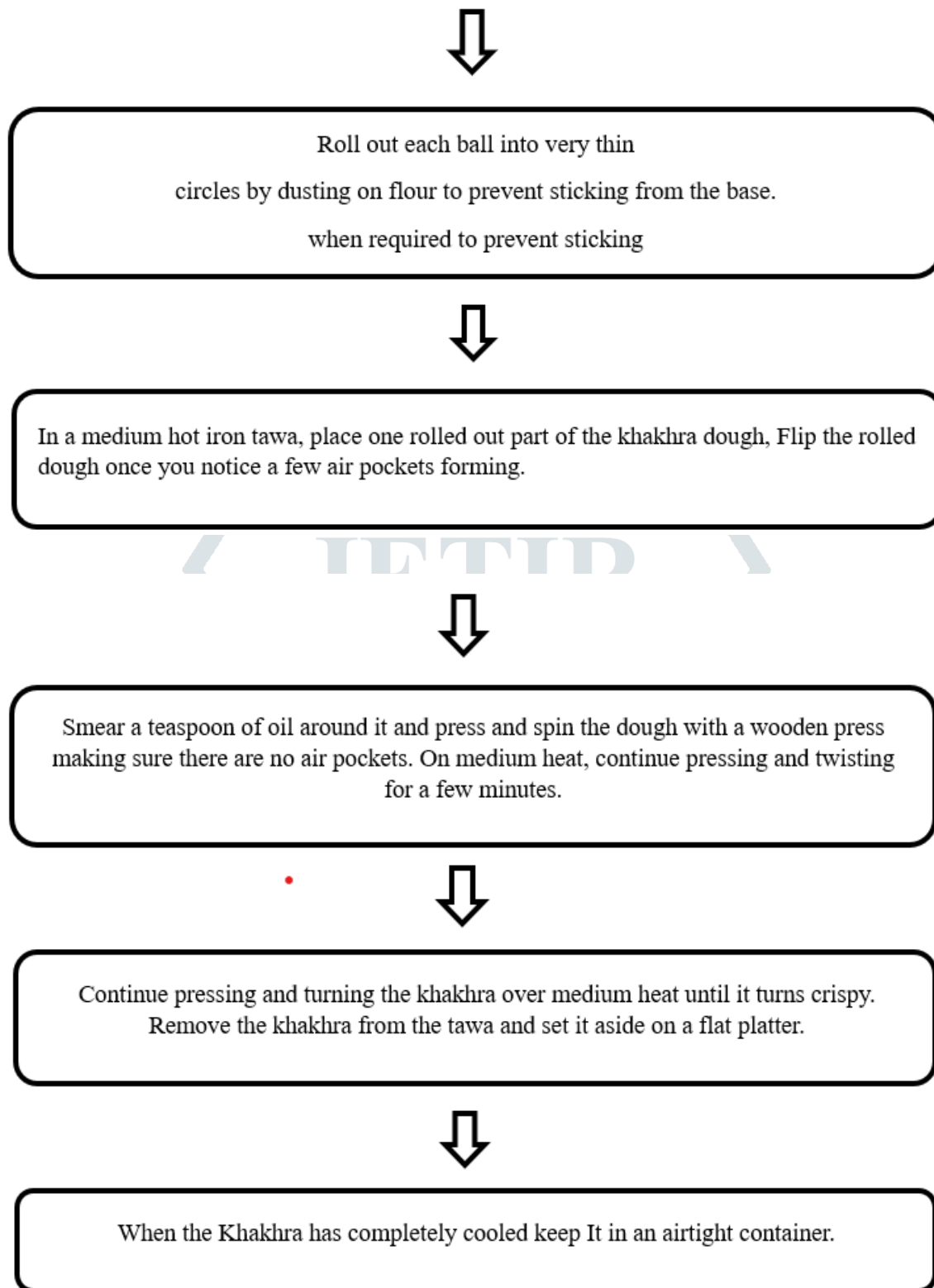


Figure 1. Process flow sheet for preparation of Mini Khakra

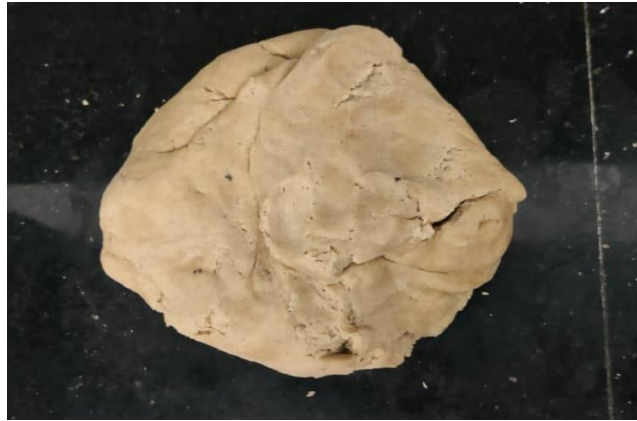


Fig 2. Preparation of Dough



Figure 3. Roll out the dough into a thin sheet

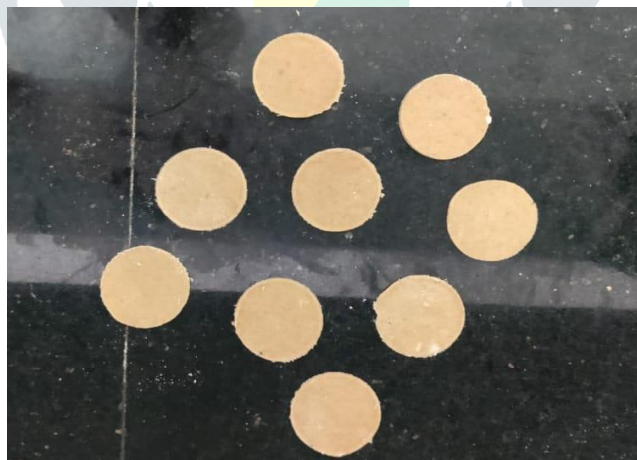


Figure 4. Cut the dough into small circles



Figure 5. Mini Khakra

3. RESULTS AND DISCUSSION:

Table 3. Organoleptic characteristics of mini Khakra

Attribute	Appearance	Flavor/ Taste	Aroma	Texture	Mouthfeel	Overall Acceptability
Sample	8.72±0.49	8.26±0.66	8.32±0.71	8.46±0.64	8.36±0.59	8.58±0.49

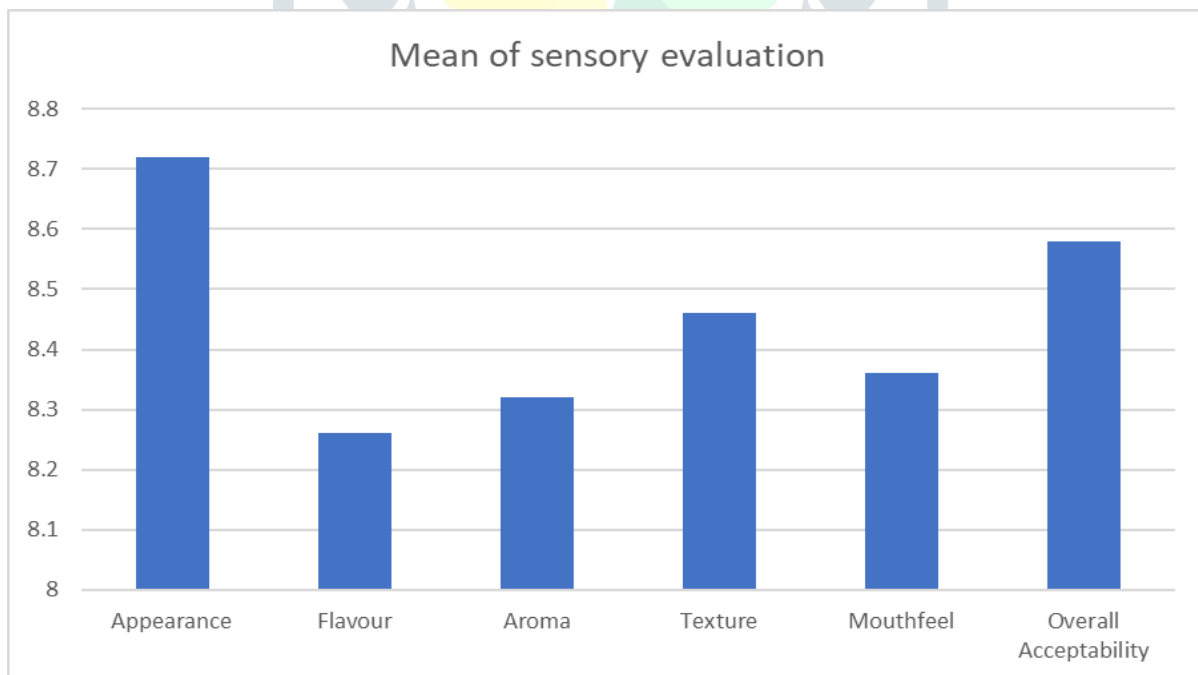


Figure 5. Mean of organoleptic characteristics

The product's development aligns intending to an increase in fiber and cinnamon intake to combat hyperglycemia in diabetic patients. This research contributes to the ongoing efforts to address the challenges posed by diabetes, offering a practical and nutritious solution for individuals diagnosed with the condition. This product is low in Glycemic index and contains anti-hyperglycemia components which can be beneficial for individuals looking to manage their blood sugar levels, especially those with conditions like diabetes.

The sensory evaluation of the diabetic-friendly product yielded valuable insights into its acceptability among individuals aged between 20 years to 50 years. Participants were asked to rate the product based on various sensory attributes, including appearance, flavor/taste, texture, aroma, and mouthfeel, using a 9-point hedonic scale.

Overall, the product received positive feedback from the participants, with a majority expressing satisfaction with its taste and texture. The incorporation of whole wheat, barley, flaxseed, and cinnamon contributed to a unique flavor profile that was well-received by the participants. The nutty undertones from flaxseed and flavors from peri-peri and pepper enhanced the sensory experience, making the product appealing to the target audience.

Texture was another important aspect evaluated during the sensory evaluation. The product exhibited a desirable texture, with a balance between crunchy and crispness. Participants appreciated the satisfying mouthfeel, which added to the overall enjoyment of consuming the product.

Aroma played a crucial role in enhancing the sensory experience of the product. The subtle fragrance of cinnamon combined with the earthy notes from whole grains created an inviting aroma that enticed participants to taste the product. The pleasant aroma contributed to the product's overall appeal, making it more enticing for consumption.

In terms of overall palatability, the diabetic-friendly product received favorable ratings from the participants. The combination of wholesome ingredients and carefully selected flavors contributed to a well-balanced and enjoyable eating experience.

These results suggest that the diabetic-friendly product holds promise as a practical and nutritious option for individuals managing diabetes. The positive feedback from the sensory evaluation underscores the importance of developing tailored dietary solutions to support glycaemic control and improve overall well-being in diabetic individuals. Further research and refinement of the product formulation may enhance its marketability and appeal to a broader audience seeking healthy food options for diabetes management.

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