

# DEVELOPMENT AND EVALUATION OF BAKED PRODUCT WITH STEVIA REBAUDIANA AND FENUGREEK AS NATURAL SWEETENER AND ANTIDIABETIC AGENTS

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## ABSTRACT

*This research project is dedicated to the development and evaluation of a novel functional baked product – bread – that is enriched with natural sweeteners, specifically stevia and fenugreek. These ingredients are chosen for their renowned polyphenolic compounds, which hold potential antidiabetic and antioxidant properties. The primary objective of the bread formulation is to create a product that not only meets the sensory expectations of consumers but also aligns with the increasing demand for functional foods in managing diabetes. The study encompasses a detailed and systematic process, starting from the careful sourcing of ingredients to rigorous sensory evaluations and comprehensive nutritional analyses. This thorough approach ensures that every aspect of the bread's development is scrutinized, from its taste and texture to its impact on blood sugar levels. Preliminary findings from the research are promising, indicating that the incorporation of stevia and fenugreek not only imparts sweetness to the bread but also contributes to potential antidiabetic benefits. The polyphenols present in these natural sweeteners may go beyond merely enhancing flavour, exhibiting antioxidant properties that can further support health. As part of the project's holistic approach, marketing strategies have been devised to educate consumers about the health benefits of the product.. This interdisciplinary endeavour bridges the realms of nutrition, culinary science, and market dynamics. By integrating insights from various disciplines The project's outcomes contribute not only to advancing knowledge in diabetes management but also lay the groundwork for future innovations in the field of functional foods.*

**Keyword :** - Diabetes, Fenugreek, Stevia, Anti-diabetes, baked product, glycemic index

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## 1. Introduction

According to the IDF Diabetes Atlas (2021), 10.5% of adults (20–79 years old) have diabetes, and nearly half of them are not aware that they have the disease. According to IDF forecasts, 783 million adults, or 1 in 8 of the population, will have diabetes by 2045—a 46% rise. Significant antioxidant and antidiabetic properties are seen in fenugreek. It may help regulate blood sugar by improving insulin sensitivity. Moreover, it has a wealth of antioxidants, like as polyphenols, which help combat oxidative stress and may reduce the risk of acquiring chronic illnesses. Natural sweetener stevia rebaudiana is well-known for its capacity to increase sweetness without elevating blood sugar, which makes it a suitable sugar replacement for diabetics. Because of its anti-diabetic properties, it's a perfect choice for those who prefer sweetness without losing their health. The shelf life of the fenugreek-enriched bread is crucial since

it affects both its commercial viability and customer happiness. Due to its possible antioxidant qualities, fenugreek may help prolong the product's shelf life by reducing oxidative processes that cause staleness and spoiling. Monitoring alterations in freshness, texture, and microbiological stability over time is necessary to investigate the shelf life. Clarifying the nutritional and antioxidant potential of fenugreek-enriched bread is the main goal of the experiment. We'll examine the quantities of flavonoids and total phenolic content, two important markers of antioxidant action. It is expected that adding fenugreek seed powder, especially at 5%, will greatly increase these bioactive ingredients and add to the bread's overall health-promoting qualities. The project will utilize existing tests, such as  $\beta$ -carotene, FRAP (ferric reducing antioxidant power), and DPPH (2,2-diphenyl-1-picrylhydrazyl) assays, to evaluate antioxidant activity. By using these techniques, the bread enriched with fenugreek will be measured for its capacity to scavenge free radicals and maintain the product's oxidative stability. A crucial part of product development is sensory evaluation. In order to determine the ideal concentration that guarantees both nutritional advantages and consumer acceptance, the study will measure the sensory response to three distinct supplementation levels: 5%, 10%, and 15%. Using sensory panels, factors like taste, scent, and overall appeal will be evaluated. Finally, this project sets out to investigate the physicochemical characteristics, antioxidant potential, and shelf life of fenugreek-enriched bread in detail. The software also supports statistical analysis by offering solid insights into the importance of each variable and how they interact. Using a systematic methodology improves the findings' dependability and facilitates data-driven decision-making during the formulation phase. We hope to increase the project's scientific rigor and guarantee a thorough grasp of the various facets of fenugreek-enriched bread by incorporating DOE software. This analytical strategy is in line with modern techniques, which improves the project's dependability and advances the development of functional foods. As we all know that the invasion of bakery products in our daily diet is irremovable. Modern cultural development and adaptation of western culture in India makes it vital in the sense, people move towards readymade and ready to cook, premix food items. Bakery products are much more greater than these products. By this invasion we all lost our cussion style cooking and ingredients. The fenugreek is easily available in the indian style kitchen cussion also easily available in market the cost effective of the fenugreek made the final product also affordable and even cheeper

## 2. OBJETIVES AND METHODOLOGY

The three main objectives are Preparation of baked product (bread) with added stevia rebaudiana and fenugreek, characterisation study of baked product and Shelf life analysis and quality parameters of baked product.

1. Preperation Of Baked Product With Added Stevia And Fenugreek: The main goal of this experiment is to prepare the baked product which is suitable for daily consumption (bread) with stevia rebaudiaina and fenugreek as natural sweetener and antidiabetic agents by using traditional method of bread making with natural sweetener and antidiabetic agents in which the dough is prepared and the temperature and time of the baking is determined then the fenugreek seeds are dried and grinded into fenugreek powder and ratio of wheat and fenugreek powder is determined then the dough is prepared and kept for proofing and baked and it is done with different ratio (5%,10%,15%) of fenugreek powder for identification of proper proposition with fenugreek powder which are pan roasted, germinated and tray dried sample for comparison and it is baked.

2.Characterisation study of baked product : The characteristics analysis of the bread is done by sensory evaluation, organoleptic evaluation humidity chamber analysis feedback from the faculty. In sensory evaluation using human senses like taste, smell, touch, and sight to evaluate different facets of the bread is known as sensory evaluation. Its flavour profile, texture, smell and appearance are all evaluated in this process. Sensory evaluation helps testers to feel the texture, see the colour and shape of the bread, determine any off flavours or odours, and notice small changes in taste.

3.Shelf Life Analysis And Quality Parameter Of Baked Product: Shelf life and quality parameters can be verified by water activity, moisture analysis, colour analysis ambient condition analysis, polyphenol and antioxidant composition. A complete assessment that takes along a wide range of characteristics is required to guarantee that the shelf life and quality parameters of bread fulfil consumer expectations as well as industry standards. Since water activity and moisture analysis have a direct impact on texture, mould growth, and overall freshness, they are essential. Colour analysis offers visual clues about appearance as well as possible signs of staleness or deterioration in quality. Analysis of ambient conditions assesses storage conditions, such as variations in humidity and temperature, which might impact

microbial activity and shelf stability. Evaluations of the bread's polyphenol and antioxidant composition provide information about its nutritional profile and its health advantages, which increases its market appeal. Combining these analyses gives a thorough grasp of the bread's quality characteristics. With this knowledge, they can decide on formulation, processing techniques, packaging, and storage settings that will increase shelf life without compromising the integrity of the product. Customers are guaranteed to receive bread goods that are not only delicious but also adhere to high quality and safety standards because of to our entire approach

## **2.1 Materials and Method**

### **Pre Treatment.**

The first and foremost challenge in the preparation of bread by incorporating fenugreek is the bitterness taste of the seeds. We undergo several process and methods to eliminate or reduce the bitterness of seed. First we soak the seeds around 8 hrs. in the RO water which swallows the water and some bitterness may dilute to the water. Then we go for another process the germination here the soaked seed is tie in a clean muslin cloth and spray some water than leave it alone undisturbed for 24 hrs. after completion of interval untie the muslin cloth and watch over the sprouts in the seeds, the sprouting size should be in 5mm to 7mm. the germination of seeds which may also called as sprouting is a good source of energy it enhances the efficiency and nutrient values of the seeds. Also sprouting reduces bitterness. Which is the major advantage for developing our project into stage. There is also another important steps in the process which almost reduce the major amount of bitterness from seed and make the taste of seed into acceptable level. Press cook the seed around 10 minutes in kettle and at temperature around 90 degrees Celsius. Then pretreated seed is filtered and used for further process. The seemed seed is than dry by using tray dryer. The temperature of tray dryer is around 70 degrees Celsius and time up to 120 minutes. The dry fenugreek is the powder by using milling process. These fenugreek is taken for the preparation of bread. We just incorporate the fenugreek according to the acceptance level.

### **2.2 Ingredients Required For The Preparation Of Bread.**

- Wheat flour
- Maida
- Stevia act as a natural sweetener with 0 glycemic index (0 calories)
- Salt
- Butter
- Yeast (activate the yeast before using for preparation)
- Preprocessed fenugreek seed powder

### **2.3 Methodology of Reducing Bitterness in Fenugreek Seeds**

Fenugreek seeds, while known for their health benefits, can have a strong, bitter flavor that may be undesirable in certain recipes, particularly baked goods like bread. This essay outlines a simple method for reducing this bitterness before incorporating fenugreek seeds into your culinary creations. The process begins with an overnight soak. Fenugreek seeds are submerged in water for approximately eight hours. This allows the seeds to rehydrate and soften, potentially contributing to a milder taste. After soaking, the seeds are removed from the water and secured within a muslin cloth. The bundled seeds are then left undisturbed for a full day, permitting further hydration and potentially promoting the release of some bitter compounds. Next comes a brief blanching step. The muslin cloth containing the seeds is dipped in hot water for a short period. Blanching serves a dual purpose: it inactivates enzymes that could affect flavor or texture during storage, and it may further leach out bitterness. After blanching, the seeds need to be thoroughly dried. This can be achieved by briefly patting them dry with a clean cloth or by spreading them out in a single layer to air dry. The final step involves grinding the dried seeds into a powder. This powdered fenugreek can then be incorporated into your recipe. By following these steps, the bitterness of the fenugreek seeds is significantly reduced, allowing their unique flavor and health benefits to shine through without overpowering the overall taste of your dish.

## 2.4 Baking process of the bread:

The baking process, is a journey from raw ingredients to a finished baked good. It begins with gathering the necessary components, with a specific emphasis on maintaining a particular ratio (though the exact ingredients for this ratio are not shown). Next comes the crucial step of activating the yeast, which plays a vital role in making the dough rise. The ingredients are then prepped, categorized as either wet or dry. Wet ingredients, like oil, water, butter, and sugar, are combined, while dry ingredients, such as wheat flour, fenugreek powder, and salt, are prepared separately. Once prepped, the wet and dry components are brought together for mixing. Following mixing comes a one-hour kneading stage. This step is essential for developing the gluten structure within the dough, which ultimately impacts the bread's elasticity and texture. After kneading, the dough enters a proofing stage, lasting two hours, where it rises comfortably in a mold. Finally, The risen dough is baked in a preheated oven at 170 degrees Celsius for 45 minutes. Once baked through, the product is allowed to cool before being packaged, ready to be enjoyed. This flowchart provides a concise overview of the key steps involved in transforming basic ingredients into a delicious baked good.

## 3. PROPOSED WORK MODULES AND ANALYSIS

Optimization of Fenugreek Powder Addition for Baking Wheat Bread The purpose of this experiment is to determine the ideal amount of fenugreek powder to add to wheat bread in order to achieve the greatest baking outcomes.

### Independent Variable:

Fenugreek Powder (%): We will test three levels of fenugreek powder addition to the wheat flour: 5%, 10%, and 15%.

### Dependent Variables:

Bread Quality: A number of criteria will be used to assess this:

Rise Height: Measured to determine how fenugreek powder affects dough strength and gas retention,

both after proving and after baking. Crumb Texture: Grain, evenness, and general feel (softness, flexibility) are examined. Taste, fragrance, and the impact of fenugreek on the overall flavor are assessed in the flavor profile

Color: The color of the crust and crumb is evaluated to detect any browning or color alterations brought on by fenugreek.

### Controlled Variables:

Base Wheat Bread Recipe: To maintain uniformity throughout the experiment, a regular wheat bread recipe will be utilized. This covers any and all common ingredients, like as flour, water, yeast, and salt.

Mixing Time and Techniques: To isolate the effects of fenugreek powder, consistent mixing techniques and timings will be used.

Conditions for Fermentation and Baking: Throughout all adjustments, the baking time, temperature, and proofing time will remain consistent.

### Design of Experiments:

There will be three different batches of wheat bread made, each with the main recipe plus the specified amount of fenugreek powder (5%, 10%, and 15%).

After proofing and baking, each batch will be evaluated for the selected dependent variables (color, flavor profile, rise height, and crumb texture). We can determine the ideal amount of fenugreek powder to use in order to achieve the best overall bread quality by comparing the outcomes of the three batches.

Expected outcome:

The goal of the experiment is to find the right amount of fenugreek powder to improve the bread's properties without detracting from its flavor, texture, or overall baking performance. There can be a sweet spot where the structure and flavor of the bread are preserved while fenugreek adds advantages like higher fiber content or distinct flavor notes.



**BAKED BREAD IN MOULD**



**BAKED BREAD CUTTED INTO SLICES**

### **3.1 Exponent Connect software:**

Exponent Connect will be used to seamlessly acquire data from the texture analyzer, ensuring accurate and consistent measurements.

#### **Analyzing Data:**

Important textural metrics will be extracted from the collected data using the software's robust analytical tools. These specifications could consist of: Hardness: The amount of effort needed to first break up the bread crumbs.

Cohesiveness: The bread's propensity to cling together when being chewed. The bread's springiness is its capacity to regain its original shape following deformation. Chewiness: The amount of effort needed to chew bread until it can be swallowed. Gumminess: The amount of force needed to chew through bread to break it down.

**Probe Selection and Analysis:** We'll use a variety of probes, including shear blades, cone probes, and cylinder probes, which are frequently used for bread examination. In order to analyze how the probe selection affects the measured textural characteristics, Exponent Connect will be essential. We may receive a more comprehensive grasp of the textural qualities of the bread by comparing the data obtained with several probes and determining which probe offers the most relevant information for our particular needs.

**Reporting and Visualization:**

The visualization capabilities of Exponent Connect will be utilized to generate illuminating graphs and charts that accurately depict the textural data for every bread sample and probe combination. The software will generate reports that are specific to each user.

### 3.2 Analysis of physical Parameter

**colour analysis -5% tray dried fenugreek bread**

L\*- 54.58

a\*- 3.81

b\*-25.25

**5% untreated fenugreek bread**

L\*- 47.18

a\*- 3.17

b\*-15.96

Observation

- L\* - lightness has high value in required product thus treating the fenugreek will improve lightness of the final product

**water activity** – increases from day 1 to day 4.

day 1- 0.976 to day 4- 0.997

### 3.3 ORGANOLEPTIC EVALUATION

In the field of food science, a product's ability to satisfy consumers' senses is equally as important as its nutritional content. This is when sensory assessment, or organoleptic evaluation, comes into play. Food is evaluated by skilled experts who consider flavour, scent, texture, appearance, and even the crucial "mouthfeel." It's similar to having a full-body experience. Consider a bakery creating a brand-new bread formula. More than just "does it taste good?" goes into an organoleptic review. Assessors could characterise the crumb of the bread as "fluffy and slightly chewy," or the crust as "golden brown with a slight sheen." Bakers can better understand how customers would see their product by using this comprehensive analysis. An effective instrument is created by identifying the strengths and shortcomings of the organoleptic evaluation.

**Sample A – fenugreek**

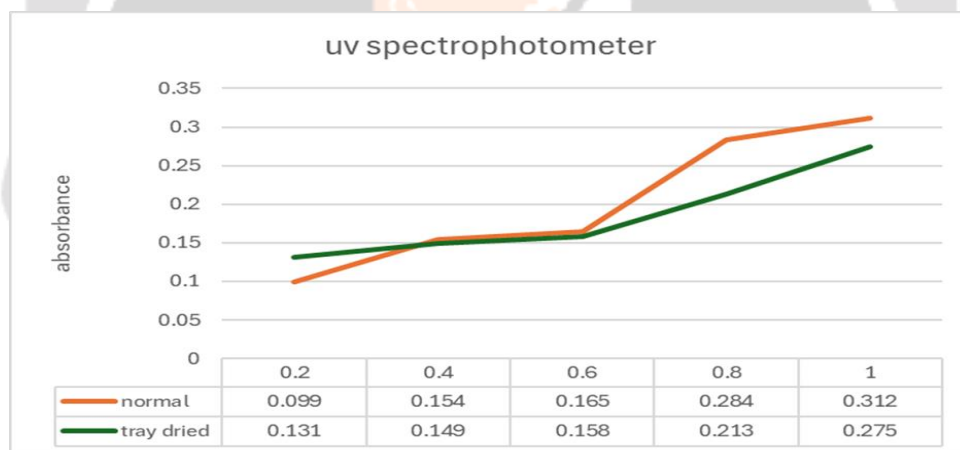
**Sample B – Pan fry**

**Sample C – germinated fenugreek**

**Sample D – germinated and tray dried**

PARAMETERS	SAMPLE A	SAMPLE B	SAMPLE C	SAMPLE D
TASTE	1.0	2.0	3.0	7.0
TEXTURE	1.0	4.0	4.0	9.0
MOUTH FEEL	2.0	3.0	3.5	9.1
APPEARANCE	2.0	6.0	5.5	8.9
AROMA	0	5.0	6.5	7.0
AFTERTASTE	0	3.0	6.6	7.9
OVERALL ACCEPTIBILITY	6	23	19.94	57.80

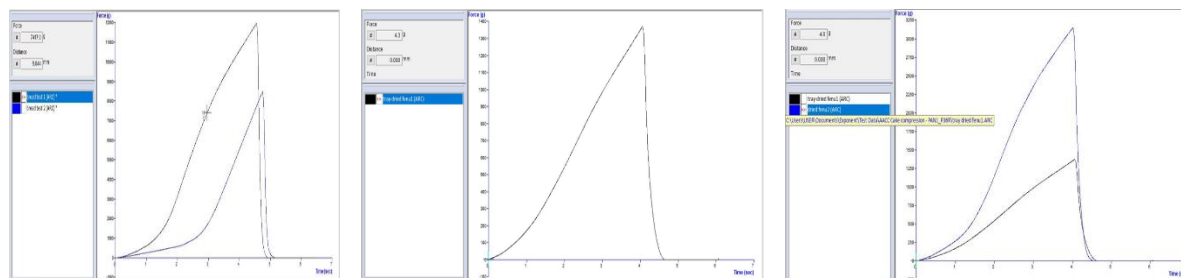
**3.4 UV-SPECTROPHOTOMETER:**



**Graph interpretation**

- The trend line show increase in absorbance .
- As wavelength increases, absorbance rises for both tray-dried samples and regular samples.
- This implies that the absorbing molecules' concentration is fluctuating over the range of wavelengths that are being measured.
- Since there is no significant loss of polyphenol content during the tray-drying process, the trend for tray-dried samples looks flatter as sample concentration increases. This will help to lessen bitterness and serve as a value-added product.

### Texture analysis:

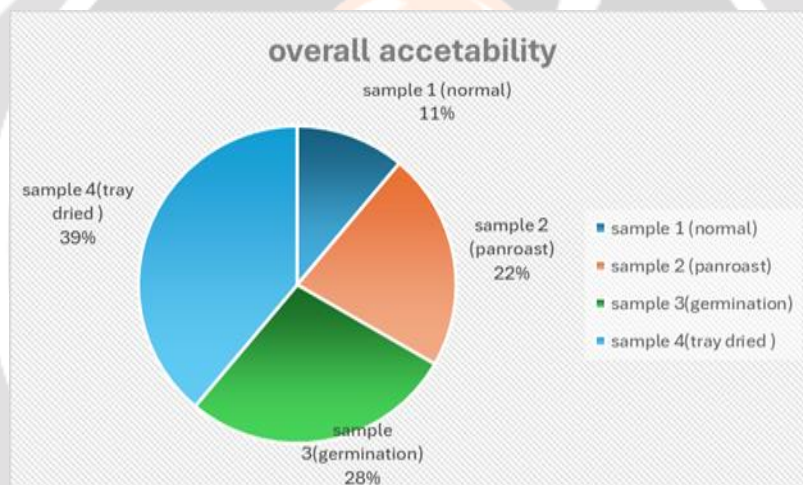


Sample 1- Fenugreek 20%

Sample 2- 5% Tray dried fenugreek

Sample 3- 5% untreated fenugreek

### 3.5 Overall result



From the pie chart we can interrupt the result by overall acceptability rate base on the analysis done in sample 4 which has the highest acceptance rate .In which the product is done by treating the fenugreek in tray drier after proper soaking in water over night and also adding required proportion to wheat flour with proper distribution of stevia.

### 4. CONCLUSIONS

This study showed the bread's potential as a functional food by successfully developing a product infused with 5% tray-dried fenugreek and stevia. By adding these ingredients, the bread surpassed a 39% consumer acceptability rate, which is essential for commercial success, and had good moisture and textural qualities.

- Due to the presence of fenugreek, which is known to lower blood sugar, people with diabetes or prediabetes may benefit from this bread. It would take more investigation with a UV spectrophotometer to measure the bioactive ingredients in the bread and validate its antidiabetic properties.
- Shelf Life: Although the bread has a 4-day shelf life at the moment, more research may be able to find ways to prolong it. This might entail improving packaging methods or using natural preservatives.
- In conclusion, this study shows that it is feasible to develop a bread product that is both functional and nutrient-dense while also having potential anti-diabetic qualities. A high acceptability rate of 39% was found during the sensory evaluation, indicating both consumer appeal and functional benefits.



This study looked into creating a unique functional bread with 5% tray-dried stevia and fenugreek. The outcomes show that it is possible to produce a bread product that appeals to consumers while having potential health benefits. A key component of the development of functional foods is highlighted by the high consumer acceptability rate of 39%. The bread's ideal moisture and texture characteristics guarantee a satisfying eating experience, which is frequently a crucial consideration for customers selecting bakery goods. This research implies that adding useful components like stevia and fenugreek does not always mean sacrificing sensory appeal. With the addition of fenugreek, a well-known herb that lowers blood sugar, this bread may have antidiabetic benefits. Additional examination with a UV spectrophotometer would be beneficial in order to measure the bioactive substances accountable for these outcomes. Future studies on the molecules in the bread and how they affect blood sugar regulation may benefit from the identification and comprehension of these particular molecules. An Issue to Be Solved Even though the bread can only be stored for four days at this point, there is still room for improvement. Longer shelf lives are typically preferred by consumers in order to save food waste and for convenience. Commercialization will require investigating ways to increase shelf life, such as the use of natural preservatives or efficient packaging methods.

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