“DEVELOPMENT AND SENSORY FEATURE AS WELL AS PROXIMATE ANALYSIS OF GLUTEN-FREE FLAXSEED BREAD”

BY

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Submitted to the Department of Nutrition and Food Engineering in the partial fulfillment of B.Sc. in Nutrition and Food Engineering

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APPROVAL

This Project titled **"Development and Sensory Feature as well as Proximate Analysis of Gluten-Free Flaxseed Bread"** submitted by **Humayra Kabir Sweety** to the Department of Nutrition and Food Engineering, Daffodil International University, has been accepted as satisfactory for the Partial fulfillment of the requirements for the degree of B.Sc. in Nutrition and Food Engineering and approved as to its style and contents. The presentation has been held on April 2023.

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DECLARATION

This thesis report on **"Development and Sensory Feature as well as Proximate Analysis of Gluten-Free Flaxseed Bread"** is being submitted to the Department of Nutrition and Food Engineering under Faculty of Allied Health Science at Daffodil International University. I, **Humayra Kabir Sweety,** hereby certify that the thesis report I have created does not contain any paraphrases of any reports or sources. Here, I've only written about what I developed and analyzed through my project work.

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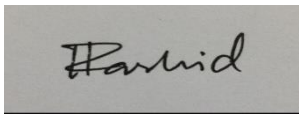

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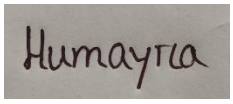

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ABSTRACT

Flax seeds referred to as a "functional food" by certain individuals, which suggests that someone can eat it to improve their health. It's an ancient crop. In the modern era, flaxseed is offered as seeds, oils, powder, tablets, capsules, and flour. Humans take it as a dietary supplement to fend off a variety of illnesses, including cancer, diabetes, high cholesterol, heart disease, and constipation. There is no flax seed breads available in the market. Therefor the aim of this study was to develop a bread using flax seeds flour and its proximate composition as well as sensory quality has been analyzed. The bread has higher fiber content (9%) compare to any of the traditional bread. It is also contained 10% fat, since flax seeds is a good source of unsaturated so the bread may contained those healthy fat from flax seeds. The sensory acceptance of the newly developed flax seed bread was also auspicious since 49% participants liked it very much. Since the flax seed bread is very uncommon and its texture quite different from traditional bread around 10% participants slightly dislike it.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

1. Introduction

Since ancient times, bread has been a staple food, made from flour or meal that has been moistened, kneaded into dough, and frequently fermented with yeast. According to history, the earliest bread was manufactured in the Middle East, notably Egypt, in or around 8000 BC. The first known grinding tool was the quern. The bakers crushed the grain to create what we now most often associate with tortillas or chapatis (India) (Mexico). The food pyramid classifies bread as a source of grains in terms of nutrition. Moreover, it is a wonderful source of carbs as well as vitamins, and nutrients like dietary fiber, magnesium, iron, and selenium etc. There are three primary types of bread in the world: flatbreads, which barely rise at all, and the highest-rising breads, such rye and French breads, which are baked in pans. The Middle East, Central Asia, North Africa, Europe, as well as cultures descended from Europeans such those in the Americas, Australia, and Southern Africa, all eat bread as a staple diet. For many years, bread has been a part of human history. It is a crucial part of daily life and a representation of history, culture, poverty, prosperity, war, and peace. It is essential and has played a crucial role in human survival. Bread organized our way of life and formed the framework for contemporary society [1].

A plant-based alternative called flaxseed contains fiber, antioxidants, and healthy fat. It is referred to as a "functional food" by certain individuals, which suggests that someone can eat it to improve their health. Flax is a crop that was grown in both ancient Egypt and China. It has been used in Ayurveda treatment in Asia for countless years. In the modern era, flaxseed is offered as seeds, oils, powder, tablets, capsules, and flour. Humans take it as a dietary supplement to fend off a variety of illnesses, including cancer, diabetes, high cholesterol, heart disease, and constipation.

Flaxseed bread can be eaten because it is said to be a high-fiber bread. In terms of dietary fiber, one tablespoon of ground flaxseed has about 2 grams. Flaxseed can be easily added to the diet by baking. Because flaxseed flour has such a high oil content, it can be used in some baked items in place of eggs or fat as well as some of the flour. An excellent complement to a gluten-free diet is smooth whole-milled flaxseed, which can replicate the beneficial effects of gluten in both baking and cooking. In addition to serving as a binding agent, flaxseed gives baked goods moisture and suppleness [2].

1.1 Nutritional facts of Flaxseed

Flaxseeds contain 534 calories in 3.5 ounces (100 gm), or 55 calories per tablespoon (10 grams) of entire seeds. They include 29% carbohydrates, 42% fat, and 18% protein [3]. The following nutrients are included in one tablespoon (10 grams) of whole flax seeds:

Table 1: Nutrients per 10 gm. (1 tablespoon) of flaxseed

Nutrients	Amount
Calories	55
Water	7%
Protein	`1.9 gm.
Carbs	3 gm.
Sugar	0.2 gm.
Fiber	2.8 gm.
Fat	4.3 gm.

1.1.1 Carbs and Fiber

Among 29% carbohydrate of flax seed, 95% are fiber. This makes them a low-carb food since they have a low net digestible carb content, which is the quantity of total carbs minus the amount of fiber. About 6 grams of fiber are included in two teaspoons (20 grams) of flax seeds. For both men and women, this is approximately 15–25% of the Recommended Daily Intake (RDI) [3]. The fibers that make up the content are

- soluble fiber, 20–40% (mucilage gums)
- Insoluble fiber, 60-80% (cellulose and lignin)

1.1.2 Protein

18% of flax seeds are protein. Although having all the necessary amino acids, they are deficient in lysine. The amino acids arginine and glutamine, which are both crucial for the health of the heart and immune system, are abundant in flax seeds [3].

1.1.3 Fat

The amount of fat in one tablespoon (10 grams) of flax seeds is 42%, or 4.3 grams. Alpha-linolenic acid (ALA), an omega-3 fatty acid, and other polyunsaturated fatty acids, make up 73% of this fat composition. 27% of the fats are monounsaturated and saturated.

One of the best food sources of ALA is flax seeds. Because ALA is an essential fatty acid, our body cannot make it. As a result, we must get it from the food you consume [3].

1.2 Health benefits of flaxseed

The flax plant is used to obtain flaxseed. If consumed consistently and correctly, flax seeds have a number of health advantages. It is well known to be high in fiber and low in carbohydrates. Moreover, they are devoid of gluten, high in Omega-3 fat, and loaded with antioxidants. Every active component is advantageous to health in some way. It encourages the care of the skin and hair, weight loss, digestive health, and lowers the amount of harmful cholesterol. Moreover, it reduces menopause symptoms, controls the menstrual cycle, and may even aid in the prevention of some cancers. Because of this, flaxseed is regarded as a super food [2].

1.3 Who can eat this bread?

People from all races can eat flaxseed bread. One of the healthiest breads one can consume is flax bread, which is prepared mostly from whole-grain flours and flax seeds. This is due to the fact that flax seeds are very nutritious and have a lot of health advantages Flaxseeds have 534 calories per 3.5 ounces (100 grams) corresponding to 55 calories for each tablespoon (10 grams) of whole seeds. They consist of 42% fat, 29% carbs, and 18% protein.

Due to its low carb and low sugar content, one of the most significant benefits of flaxseed bread is that it is suitable for diabetics as well. As a result, those who have diabetes can indulge in a wonderful sandwich or slice of bread at any time. But if anyone has allergies from flaxseed then they should avoid it [4].

1.4 Objectives of the study

After knowing all the nutrients and health benefits of flax seeds, the objective of this study is set as below-

- ➔ To make a gluten free bread with lots of nutritional value.
- ➔ To make a new form of eating flaxseed.
- ➔ To analyze quality and nutritional properties of flax seed bread.
- ➔ To evaluate sensory properties of flax seed bread.
- ➔ To find out microbial analysis.

CHAPTER 2

2. Review of Literature

One of the most practical, simple-to-make, and widely-accepted bakery products is bread. End users most frequently consume bread made from wheat because it has a strong nutritional profile. Individuals with celiac disease must limit their consumption and must use gluten-free bread as a substitute for wheat bread. With an estimated mean frequency of 1% in the general population and affecting children equally, it is one of the most prevalent chronic conditions among young people and one of the most prevalent lifelong disorders worldwide. Diets high in gluten cause serious damage to the intestinal mucosa and decrease its ability to function. The only therapy for treating celiac patients that is now available is adhering to a gluten-free diet, which entails a strict avoidance of grains including wheat, rye, barley, and maybe oats that contain the protein known as gluten or prolamins [4].

Due to its significant amounts of high-quality proteins and minerals and extraordinarily high content of -linolenic acid, omega-3 fatty acid, lignans, and dietary fiber, flaxseed (Linum usitatissimum L.) has become a widely available nutritional and functional food. Several studies have documented the development of premium flaxseed-enriched cereal products with the intended health benefits and comparable or better shelf lives than comparable goods [5].

For instance, Kaur et al. examined the impact of substituting flaxseed flour for wheat flour on the nutritional, practical, and antioxidant aspects of cookies and found that composite flour mix-produced cookies included more protein, fat, ash, and fiber than control items [6].

Under the right storage and processing conditions, flax seeds are a safe food ingredient. Those who consumed 50 g of flaxseed per day revealed no negative effects [7].

In both animal and human research, the flax seed has demonstrated substantial antioxidant and anti-inflammatory properties. In conditions like cardiovascular risk, some types of cancer, and other metabolic diseases, the addition of flaxseed to the diet showed prospective health benefits. Many studies have shown the benefits of raw flaxseed and the baked products made from it for maintaining good health and preventing disease [8].

Flax seed can be used in baked goods in a variety of forms, including whole, milled, ground, roasted, and oil. Current research suggests that flaxseed has been utilized at varying quantities in a variety of bakery goods, including bagels, breads, biscuits, cookies, muffins, pizza, buns, and patties [9].

The addition of flax seeds to several baked goods and cereal items improved the nutritional value overall. Functional bread produced by adding 10 g of flaxseed to 100 g of refined flour increased in water absorption, dough stickiness, and crumb softness [10].

When used as a baking component, ground flaxseed doesn't significantly lose ALA during the process [11].

The primary factor that determines whether a product is loved or hated is its flavor. Flaxseed has a distinct, pleasant nutty flavor that goes well with many other foods. Butter containing flax seed additives had a natural, creamy flavor and aroma without any additive flavor or aroma, was yellow in color, had an excellent spread ratio, and was plasticity [12].

Lipid oxidation, which is a major factor in the nutritional and sensory quality loss of processed foods, is the main reason for worry during storage. During processing, lipid oxidation can be controlled, but it could get worse during storage. Putting processed food in opaque containers or under nitrogen or vacuum may further safeguard it during storage. Also, when storing processed food goods, environmental elements like temperature, light exposure, and oxygen exposure must be taken into account [9].

The use of flaxseed in products has recently been the focus of numerous studies. To enhance the nutritional value of foods, it can be added to a variety of products as ground flaxseed, flaxseed oil, flaxseed mucilage, or flaxseed hulls. Flaxseed has an impact on these goods' quality attributes [13].

CHAPTER 3

3. Materials and Methods

The project work of flaxseed bread is conducted in the laboratories of the department of Nutrition and Food Engineering at Daffodil International University, Dhaka, Bangladesh. Here the project is evaluated, designed and successfully completed.

3.1 Materials

Collection and Preparation of Raw materials

All the required materials for the project are collected from the local market of Dhaka city.

Whole flax seeds were collected from the market then the seeds were ground in a blender. And it gave the seeds a flour form which is known as flaxseed flour.

Figure 1: Raw flax seeds

Ingredients:

- Ground Flax seed - 240 gm. (2 cups).
- Psyllium husk - 18 gm. (2 Tbsp.).
- Baking powder - 12 gm. (3 Tsp.).
- Salt - 1/2 to 1 Tsp.
- Apple cider vinegar - 28 ml (2 Tbsp.).
- Egg white - 5/6.
- Boiling water - 1 cup.

Equipment's:

- Electric measuring balance.
- Blender.
- Knife.
- Bowl.
- Hand mixer.
- Cooking pan.
- Oven.
- Pan greased.
- Parchment paper.

3.2 Bread Preparation

Step 1: After the preparation of flaxseed flour, weight all the ingredients.
Put all the dry ingredients together in a bowl and mix it properly.
Step 2: Egg whites, vinegar and water are added one by one in the dry mixture and prepared a dough, water is required as much as needed for making a perfect dough.
Step 3: Proofing the dough for 1hr. After proofing, fill the dough in a greased pan.
Step 4: Put the pan in the oven for baking at 180 degree Celsius for 1 hour. During baking, check the dough after 30 minutes with a pick.
Step 5: After baking, cool the bread for 30 minutes. And then slice and present the final product.

Figure 2: Prepared dough in a greased

Figure 3: Final Product (Bread)

Figure 4: Bread Baking

3.2.1 Flow chart of bread making process

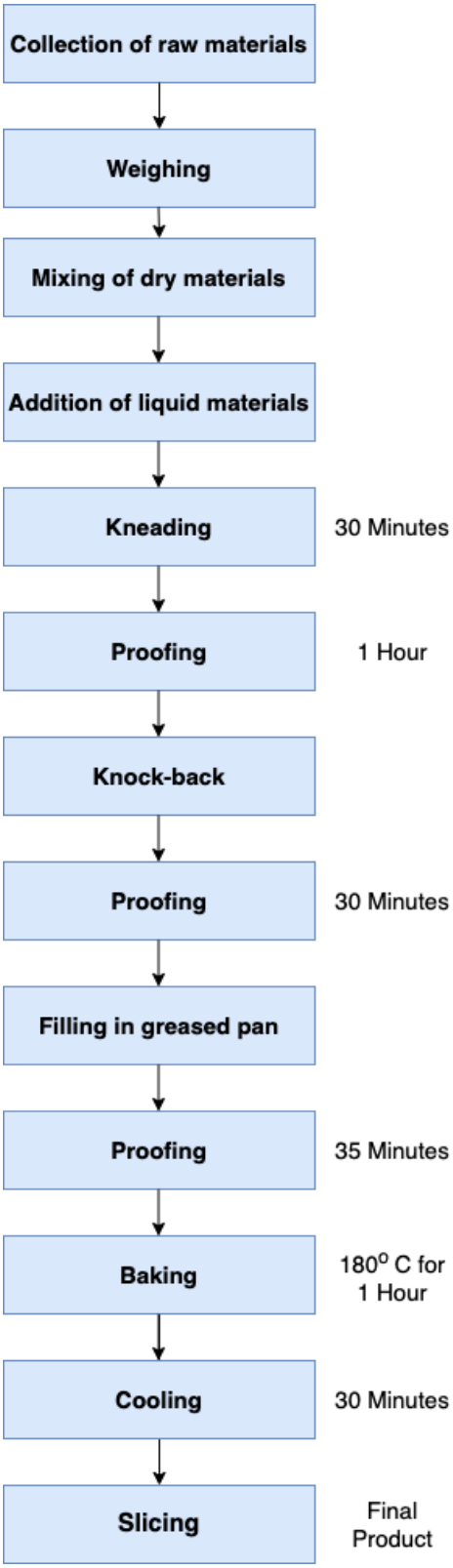

Figure 5: Flow chart of bread making process

3.3 Proximate Analysis of Flaxseed Bread

3.3.1 Determination of Moisture

Depending on the reporting method, the moisture content is computed as the amount of water divided by the dry weight or total weight after deducting the dry weight from the original weight to find the amount of water.

Apparatus:

- ➢ Crucible with lid.
- ➢ Desiccator.
- ➢ Electronic balance machine.
- ➢ Oven.

Sample:

2gm Sample

Procedure:

1. First of all, take a clean crucible and preheat the crucible for 20 minutes at 150degree Celsius.
2. Then weigh the crucible and note it.
3. After that take the measured sample in the crucible and weigh it with the crucible.
4. Oven dry the sample at 105 degree Celsius for 2 hours.
5. Take out the sample from the oven and put it in the desiccator to cool down.
6. Weight the sample with the crucible and note it.

Calculation:

%Moisture = {(W2-W1)/ (W2-W)}*100

Figure 6: Moisture analyzer

3.3.2 Determination of Ash

Ash measurement is a component of proximate analysis for nutritional assessment. The initial step in preparing a food sample for a particular elemental analysis is ashing. Ash content is significant because some foods are high in specific minerals. The sample must be heated to a very high temperature, roughly 600 °C, to eliminate all moisture, volatiles, and organics in order to quantify the amount of ash in food. After that, the leftover inorganics undergo necessary analyses.

Apparatus:

- Crucible
- Air dry oven
- Electronic balance machine
- Muffle furnace
- Desiccator

Sample:

2gm sample

Procedure:

1. Oven dry the crucible at 105 degree Celsius for 30 minutes.
2. Weigh the crucible and note it (W1).
3. Weight the sample and note it (WS).
4. Put the crucible containing the sample in the muffle furnace at 600 degree Celsius for 6 hours.
5. Take out the crucible and put it in the desiccator to cool down. Then weigh the crucible with remaining ash (W2).

Calculation:

$$\%Ash = (w2-w1/wS) * 100$$

3.3.3 Determination of Fiber

The weight of the residue less the weights of the protein and ash is used to determine the amount of dietary fiber, which is then expressed as a percentage of the initial sample weight.

Apparatus and Equipment:

- Electric balance machine
- Muffle furnace
- Hot plate

- Hot air oven
- Measuring cylinder
- Conical flask
- Funnel
- Beaker
- Crucible
- Cotton cloth

Reagents:

- 0.128M Sulfuric Acid
- 0.313M Sodium Hydroxide

Sample:

5gm sample

Procedure:

1. Measure 200 ml of 0.128M Sulfuric Acid and pour it into a 500ml conical flask.
2. Weigh the sample in the electric balance machine and note it.
3. Transfer the sample in the conical flask to mix with acid solution.
4. Place the flask on a hot plate and boil the sample for 30 minutes. Shake the flask periodically to ensure the proper boiling of the sample.
5. After 30 minutes of boiling take a discard conical flask of 1000ml. set a funnel with cotton cloth with discard flask. Filter the boiled sample to drain acid solution. Wash the flask and filtrate with hot water to remove the acid residue completely.
6. Place another funnel to the cleaned conical flask. Measure 200 ml of 0.313M NaOH solution and pour the NaOH solution into the conical flask washing the filtrate.
7. Shake the flask to mix the filtrate with NaOH solution and place it again in the hot plate for boiling. Boil the sample for another 30 minutes.
8. After boiling, filter the sample using cotton cloth and wash it with hot water to remove the NAOH residue completely.
9. Collect the filtrate in a clean and dried crucible till no filtrate is left. Place the crucible on a hotplate to evaporate the excess water.
10. Place the crucible in the hot air oven at 130 degree Celsius for 2 hours.
11. After drying, take out the crucible from the oven and cool in the desiccator for 20 minutes.
12. Take the weight of the crucible containing fiber. Note the weight.
13. Place the crucible inside the muffle furnace and burn the fiber at 550 degree Celsius for 2 hours.
14. After 2 hours take out the crucible and cool in a desiccator for 20 minutes.
15. Take the weight of the crucible with ash and note it.

Calculation:

Fiber% = (W1-W2)/WS* 100

Figure 7: Sample boiling in a flask

Figure 8: Residue of fiber

3.3.4 Determination of Fat

In order to extract the lipids from food using the Soxhlet method, the sample is first dried, ground into tiny pieces, and put in a porous thimble. It primarily consists of a flask, an extraction chamber, and a condenser. Only when the target component has a restricted solubility in a solvent and the impurity is insoluble in that solvent is Soxhlet extraction necessary.

Apparatus:

- Electric balance machine.
- Thimble.
- Crucible.
- Hot air oven.
- Round bottle flask.
- Soxhlet apparatus.
- Desiccator.

Reagent:

N-Hexane

Sample:

3 gm mashed sample.

Procedure:

1. Take the required amount of sample and measure it in a balance machine. Take the measured sample in a crucible and put it in a hot air oven to remove moisture.
2. Weigh the thimble and note it (W1). Then fill the thimble with the sample.
3. Set the soxhlet extractor and put the thimble in the soxhlet apparatus.
4. Put 200 ml of n-Hexane in a 250 ml round bottle flask and set it in the soxhlet. Let the n-Hexane come to a boil.
5. The extraction process would take 6 hours to be done.
6. After 6 hours let the apparatus cool completely. Then take out the thimble from the extractor and oven dry it for 30 minutes.
7. Put the thimble in a desiccator for 30 minutes.
8. Weigh the thimble with the remaining sample (W2).

Calculation:

$$\% \text{ Fat} = \{(W2-W1)/ WS\} * 100$$

Figure 9: Mashed sample

3.3.5 Microbial Analysis

The application of biological, biochemical, molecular, or chemical procedures for the detection, identification, or enumeration of microorganisms in a substance is known as microbiological analysis of food items (e.g., food, drink, environmental or clinical sample). It is frequently used to treat germs that cause sickness and spoilage.

Apparatus and Chemicals:

- Agar Purified
- Nutrient agar (PCA)
- NaCl
- Distilled water
- Sterile petri dish
- Test tube
- Beaker
- Micro pipettes
- Conical flask
- Aluminum foil
- Analytic balance machine
- Laminar air flow
- Autoclave
- Incubator

Procedure:

1. Take a conical flask and add 2.3 gm PCA media, 0.5 agar in 100 ml refined water and mix it.
2. In another conical flask take 5gm NaCl in 100 ml distilled water and mix it properly.
3. Put all the equipment including conical flask, petri dish, pipette in autoclave for 30 min at 121 degree Celsius and pressure is 15 Ibs. After that, cool them in a water bath at 45 degree Celsius.
4. Take 6 test tubes and fill it with 9 ml distilled water and mark them all with a dilution number.
5. Add 1 ml sample to the first test tube to make 10 ml and mix well.
6. Then 1ml from the first test tube to second then second to third, it will continue for 6 test tubes.

7. Take 6 petri dishes and inoculate them with bacterial dilution.
8. Add melted nutrient agar to the plate and swirl to mix.
9. Put the plates in an incubator for 24 hours to grow the microbes.
10. Colonies grow in and on the solidified medium.

Calculation:

Calculate CFU/mL = (number of colonies x dilution factors) /Volume of culture plates

Figure 10: Microbial analysis of the sample

3.3.6 Determination of Shelf life

The sample was stored at two conditions one is room temperature and the other one is refrigeration. The sample in both states showed a minor rise in microbial growth but storage time varies. Sample, which was stored at room temperature, showed a minor microbial growth in 3 days. On the other hand, the sample which was refrigerated was good for approximately 7-10 days. After that it showed very little growth of microbes and became hard day by day. So, the overall shelf life of the bread is 5-10 days, which is appreciable for any baking goods.

3.3.7 Sensory Evaluation

Developed sample has been analyzed for the sensory parameters (color, flavor, taste, texture, and overall acceptability) of bread based on the effect of flaxseed. For the sensory evaluation of the developed bread, I had chosen 30 people, from whom 22 people are diet conscious and maintained a diet plan for their weight loss or healthy weight and the rest are from a non-diet background.

The Hedonic Rating test is used for this sensory evaluation. Hedonic scales have been successfully used in consumer research to collect data on consumer preferences (Stone & Sidel, 1985). A 9-point hedonic rating scale was used to do the sensory analysis.

A sample example of a nine-point hedonic scale is shown in a figure. This version is frequently used with customers in preference mapping research to record like scores.

Table 2: Hedonic scale table

Level of Acceptance	Point
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither Like nor Dislike	5
Dislike Slightly	4
Dislike Moderately	3
Dislike Very Much	2
Dislike Extremely	1

Procedure of Hedonic Test:

- ➢ A hedonic scale is a series of verbal statements that convey increasing degrees of likeness or hate.
- ➢ Simple illustrations of facial emotions, cheerful faces with kid-friendly terminology, or a 9-point scale can all be used to communicate how much something is liked or disliked.
- ➢ The taster may also want to offer feedback on the product's look, texture, flavor, and smell.
- ➢ I have finally examined the results.

Figure 11: Sensory evaluation among random students

CHAPTER 4

4. Result & Discussion

4.1 Proximate composition

The proximate nutrient content of the sample (bread) is added. Flaxseed bread is a low-carb food, the only carbohydrates in the seeds are fiber, which are not included in the total amount of carbohydrates because they cannot be digested. Flax seeds are a strong source of protein and have a high fiber content. They are one of the best plant-based sources of heart-healthy omega-3 fatty acids and are also high in fat.

Table 3: Proximate Nutrient Composition of Flaxseed Bread

Nutrient	Moisture	Fiber	Fat	Ash
Amount (per100gm)	41%	9%	10%	1.8%

Therefore, the nutrient content analysis of the developed product (Flaxseed bread) showed high fiber content which makes it a low-carb food product. Breads made with flaxseed flour have greater levels of moisture, ash, fat, protein, and dietary fiber compared to normal bread. Approximate range of moisture, fat, fiber and ash content of bread is respectively 30-40%, 1-5%, 2-4% and 0.5-1.5%, which are less than flaxseed bread.

4.2 Sensory quality/acceptance

30 people participated in the sensory evaluation test. The people who are diet conscious surprisingly liked the taste of the bread. I presented two forms of the bread, one was normal baked bread and another one was toasted bread. The people who were from a non-diet background liked the appearance of the bread mostly. They were expecting more sweet type bread. However, the diet conscious people, who were bored with their diet with the same food, same taste, found the bread very interesting. They enjoyed having the bread. Mostly they loved the taste and texture of the bread, as it was so soft as well as healthy.

4.2.1 Sensory Test (9-point hedonic scale)

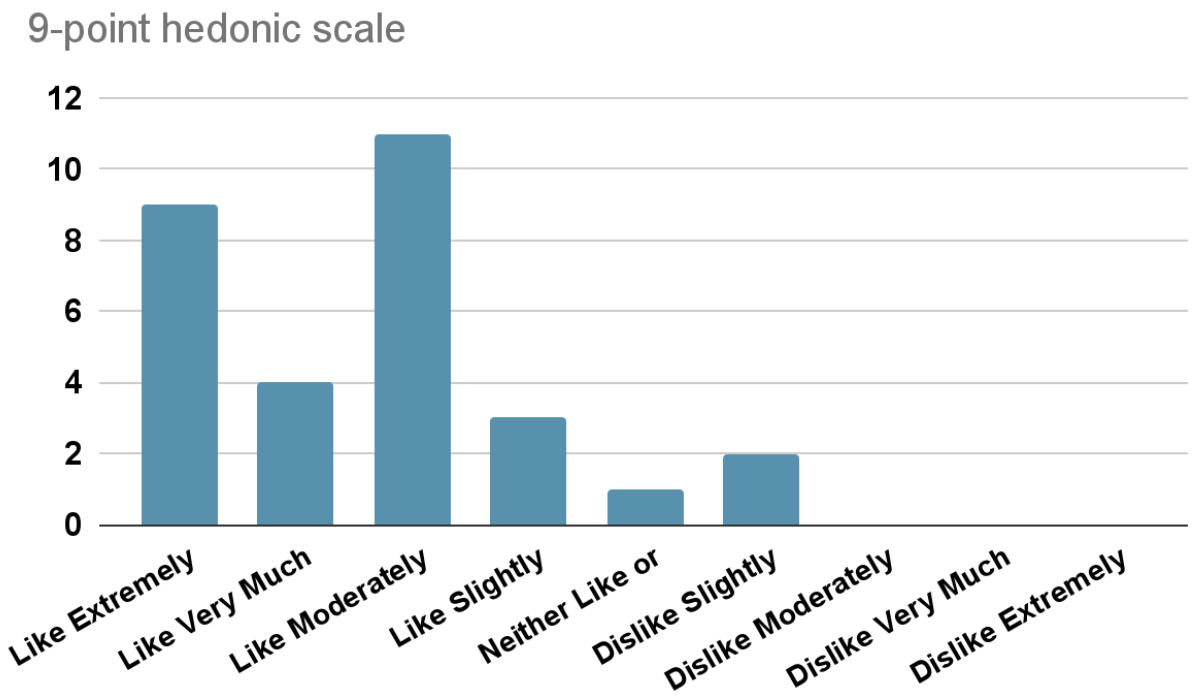

Figure 12: Sensory evaluation of the sample

Figure 12 shows that 30 random people participated in the sensory test of the sample and among them the majority of people like the bread moderately, the number of people is 11. And from the rest, 9 people liked extremely, 4 people liked very much, 3 people liked slightly, 1 person neither liked or disliked, 2 people disliked the sample slightly. Besides, the number of consumers who disliked moderately or very much or extremely is zero. So overall the sample was accepted by the consumer especially to the diet conscious consumers.

4.2.2 Sensory Analysis Based on Appearance

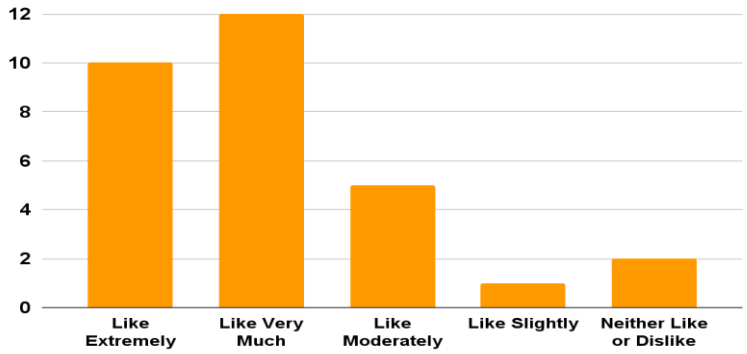

Figure 13: Sensory evaluation according to appearance

Figure 13 shows that most of the people from the 30 participants who took part in the sensory test liked the appearance of the sample. Among them 10 participants extremely liked the sample and 12 participants liked it very much. From the rest of participants liked moderately, liked slightly and neither liked or disliked respectively the number were 5, 1 and 2. At the first look participants liked the chocolaty color of the sample and they were quite impressed by the appearance of the sample. Some participants commented that was it a kind of chocolate bread or cake? However, as per appearance the participants accepted the sample appreciably.

4.2.3 Sensory Analysis Based on Texture

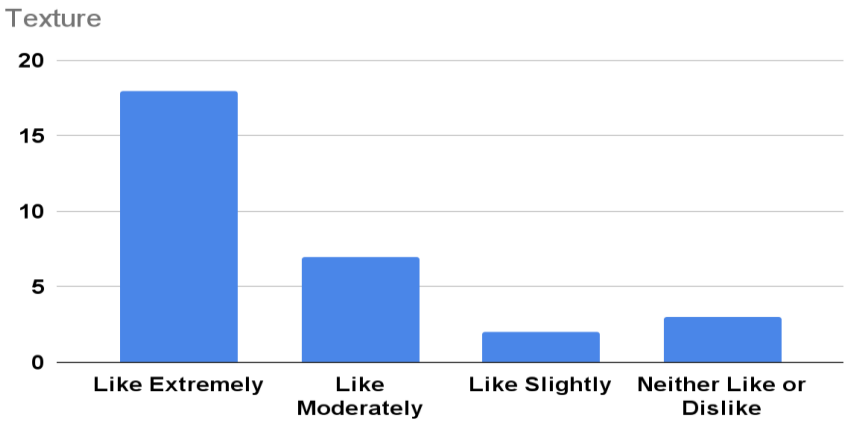

Figure 14: Sensory evaluation according to texture

Figure 14 shows that the participant of the sensory test mostly liked the texture of the sample. Among the 30 participants 18 people liked the sample extremely and from the rest of participants 7 liked moderately, 2 liked slightly and 3 people neither liked or disliked the texture, they were neutral for the texture. Participants found the sample very soft and easy to squeeze. They enjoyed the texture of the sample as it was freshly baked and presented to them. Some of the participants complained that the sample was more likely a cake rather than a bread. However, overall texture wise they accepted the sample.

4.2.4 Sensory Analysis Based on Taste

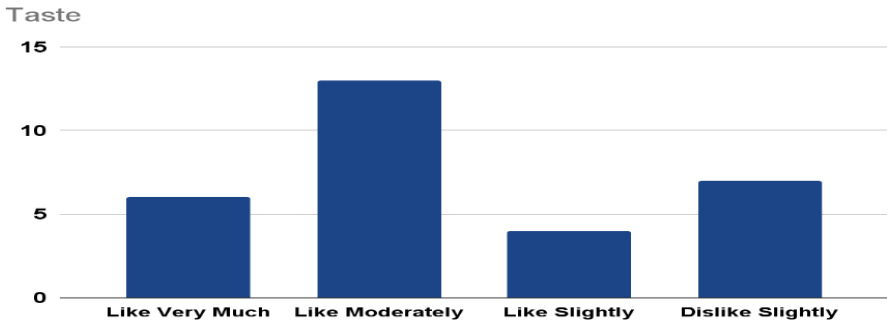

Figure 15: Sensory evaluation according to taste

Figure 15 shows that overall, the sample was accepted by the participants but didn't like that much according to the taste. From the 30 participants 6 people liked very much, 13 people liked moderately, 4 people liked slightly and 7 people slightly disliked the sample based on its taste. As it was not a normal kind of bread which could easily match up the taste bud of our general participants. Though the diet conscious people who maintained a diet liked the taste of the bread and most of them tried the sample both toasted and baked. Rest of the participants who were accustomed to consuming normal or sweet bread, didn't like the taste of the bread at all. Moreover, they didn't want to recommend the bread. But the people who liked the taste recommended it as a good healthy food and wanted to try it another time. So, I think overall I was successful as I developed the bread for diet conscious people who might want to add a different taste in their menu.

4.2.5 Overall Acceptability

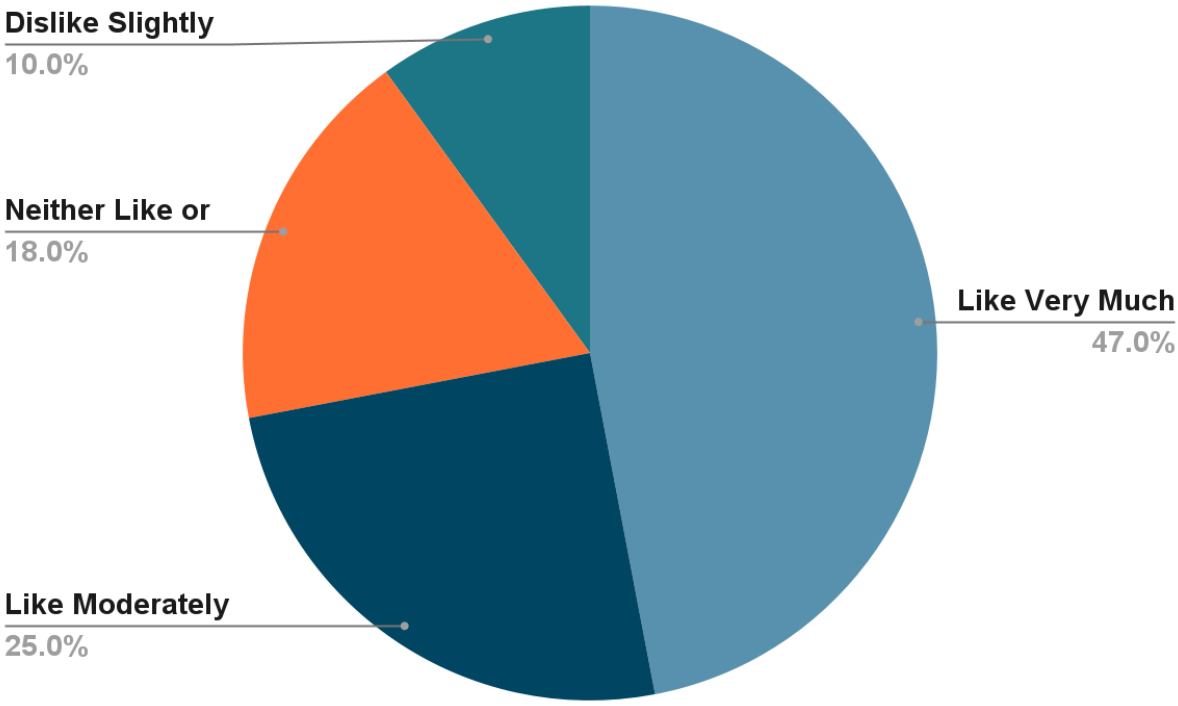

Figure 16: Overall acceptance according to the sensory test

Figure 16 presents the overall acceptance of the developed sample according to the sensory test among 30 participants. The chart shows that the sample is not fully accepted by the consumers but it gains a huge response. 49% of the participants receive the sample as very much likeable. Whereas 25% participants accepted it as moderately likeable, 19% neither like nor dislike it and lastly 10% slightly dislike the sample. So overall the sample is accepted on average by the consumers. It might bring some changes by adding different dimensions to the procedure and ingredients.

CHAPTER 5

5. Conclusion

As part of the project work, a bread based on flaxseed flour was developed. According to the quality study, bakery items meet the required standards for quality. The bread has higher fiber content (9%) compare to any of the traditional bread. It is also contained 10% fat, since flax seeds is a good source of unsaturated so the bread may contained those healthy fat from flax seeds. The sensory acceptance of the newly developed flax seed bread was also auspicious since 49% participants liked it very much. Since the flax seed bread is very uncommon and its texture quite different from traditional bread around 10% participants slightly dislike it. It is important to note that the created bread samples are ideal for persons who follow different low-carb dietary regimes, and the target market will greatly expand due to the absence of gluten, milk, and high sugar. So, further study could be done finely mealing flax seeds.

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