FORMULATION AND SENSORY ASSESSMENT OF THE BISCUIT PREPARED WITH PUMPKIN SEED AND OATS

A PROJECT REPORT

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 **"Formulation and Sensory Assessment of the Biscuit Prepared with Pumpkin Seed and Oats"** Submitted by **Anjim Aktar Borna** 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.

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DECLARATION

We hereby declare that this project has been done by us under the supervision of **Ms. Munmun Akter, Lecturer, Department of** Nutrition and Food Engineering**,** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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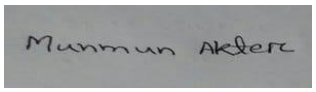

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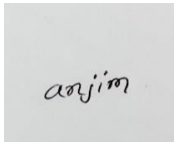

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ABSTRACT

The purpose of the study was to manufacture biscuits that would be high in zinc and conduct a proximate analysis of biscuits using pumpkin seeds, oats, wheat flour, bason, powdered milk, and sugar. Even though pumpkins are grown all over the world for a variety of uses, including baby foods, bakery items, and decoration, pumpkin seeds are still disdainful; primarily a waste product from our agricultural sector. Nutritionally rich oats and pumpkin seeds are also a great source of fiber. In this work, biscuits S-1; containing 12% oats, S-2;12% pumpkin seeds, and S-3;6% oats and 6% pumpkin seeds, were examined. Protein (14.90-10.33%), fat (28.75-10.58%), carbs (60.32-45.88%), fiber (6.7-4.6%), and ash (2.60-1.95%) were identified in the result of proximate analysis. Samples-2 and sample-3, both displayed acceptable results with very little variations. In terms of fiber proportion, nutritional value, fat content, and general acceptability, Sample 2 stood out. However, compared to the second sample, the following sample simply had a higher protein content. Overall, the study showed that biscuits made with oats and pumpkin seeds can be produced commercially and have a 2-2.5-month shelf life when stored in an airtight container.

Keywords: Proximate analysis, Bason, Disdainful, Nutritional value, General acceptability.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Pumpkin seed has always been a delicacy for Bangladeshi people. Among us, who grew up in rural and sub-urban areas are quite familiar with pumpkin seeds. Most people can recall our grandmothers, mothers, or any female individual offering us roasted pumpkin seed on a rainy day; we had to peel the skin to get the nut. Regarding our daily nutritional needs, unconsciously they had fulfilled the need for zinc from a plant source. However, with rapid urbanization usage of pumpkin seeds slacked off. In rural areas, it has limited usage. In contrast, it is discarded in urban areas. As our country is facing a decrease in agricultural land by o.29% each year it has become crucial in terms of using our existing resources rationally (Hossain, et al., 2020).

Being one of the fastest growing economies in the world our domestic biscuit industry has seen expansion in demand towards different packaged snack products. According to Bangladesh Auto Biscuit and Bread Manufacturers Association (BABMA) and Bangladesh Bread, Biscuit O Confectionery Prostutkarok Samity (BBSCP) an alliance of conventional factories, local manufacturers can meet 97-98% of the total domestic demand and other 2-3% is imported from foreign countries. Moreover, demand for biscuits had increased during covid-19 pandemic accounting for per capita consumption of this commodity of 2.8 KG (WARDAD, Dec 18, 2021). Amid this pandemic, local companies have come up with several types of products. For example, cheesy cookies, coconut cookies, low-sugar biscuits, and so on.

1.2 Types of pumpkin seed available in markets

Several forms of seeds are available depending upon hulled or un-hulled, roasted, or unroasted. These kinds of seeds are used in various cuisines around the world. Such as Italy, Mexico, Spain, and the USA.

pumpkin seed: Un-hulled seed available all year round and locally. Pumpkin seed is used widely in Italian and Mexican cuisine. Moreover, oil is made from these kinds of seeds which are associated cold pressing seeds.

Pepitas: hulled pumpkin seeds are known as pepitas. Locally available for consumption. These are dark green and also mistaken as nuts. Health concern individuals consume pepitas.

Roasted pumpkin seed: sun-dried or dehydrated pumpkin seeds, covered in husk, are roasted in a gas stove or oven. Broadly available in foreign markets. The manufacturing process involves shelling, roasting, and salting.

1.3 Pumpkin Seed Usage in Bangladesh

Though pumpkin seed usage in our country is not as widespread as in most other countries there is a growing population conscious of the benefits of this type of seeds. The awareness has retrospectively led to a noticeable usage of it in the diet as it is rich in protein, fiber, and zinc. People have used it not only for diet purposes but also as a substitute for conventional snacks. Availability ranges from supermarkets to street vendors meaning existing consumers include an affluent class and middle-class people.

1.4 Pumpkin seed and oats biscuit

Biscuit made with pepitas and rolled oats has a unique taste. In which wheat flour and oats perform as a base of the recipe. Being familiar with biscuits made with nuts an individual will acknowledge it as a nutty biscuit. Though pumpkin seed has different tests than other nuts it is hard for connoisseurs to distinguish while used in preparing biscuits. The texture of this kind of biscuit is crispy and crumbly. Because of the use of the use of oats.

Pumpkin seed and oats biscuit associates drying of components like wheat flour, gram flour, oats, grinded sugar, and grinded pumpkin seed in case of preparation. These dry ingredients are measured and taken in a bowl for mixing with butter, and milk. The use of rolled oats results in a slightly grainy dough. Then biscuit dough is rolled in the shape of a sheet. Following this step circular shape is given using a cookie cutter. Furthermore, baked in an oven until a white and brownish blended color appears on the surface. Protein, dietary fiber, and zinc are very beneficial to individual health.

1.5 Objectives

1.5.1General objective

- To develop a compatible ratio that is amicable to various age groups.

1.5.2 Specific objectives

- To make a product that can mitigate zinc deficiency among children and pregnant women.
- To formulate a recipe that would have consumer acceptability.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature review

When it comes to fighting diseases like arthritis, inflammation, prostate cancer, and others, pumpkin seeds are considered a nutritional powerhouse because they are a great source of nutrients, mainly zinc, phosphorous, magnesium, potassium, and selenium. Although they were once seen to be a waste, their nutritional value has made them valuable ingredients in cooking. Regular consumption of these won't have any negative consequences on health (Hussain, et al., 2023).

Cucurbita pepo L. seeds are a nutritious component of the pumpkin family, offering a diverse array of essential nutrients. With a low moisture content of 5.00%, these seeds demonstrate good preservation potential. They contain 5.50% ash, indicating a notable mineral presence. A striking characteristic is their high crude lipid content at 38.00%, which contributes significantly to their energy density. Additionally, the seeds are rich in protein, comprising 27.48%, making them an excellent source of plant-based protein. While the crude fiber content is relatively low at 1.00%, they still provide 28.03% available carbohydrates. This composition results in a substantial energy value of 564 Kcal per 100 grams, highlighting the seeds as a nutrient-dense food option. Overall, Cucurbita pepo L. seeds offer a balanced profile that supports various dietary needs and preferences (M., et al., 2012).

Table 2.1: Mineral composition of *cucurbitapepo L* seeds.

Element	Concentration(mg)
Ca	9.78±0.03
Mg	67.41±0.05
Na	170.35± 0.08
K	237.24±0.09
P	47.68± 0.04
Fe	3.75±0.02
Zn	14.14±0.02
Mn	0.06± 0.01
Co	2.170±.02

Cucurbita pepo L. seeds' mineral composition indicates a wide range of vital elements that support their general health benefits. Important minerals found in significant amounts in the seeds include potassium, which supports muscle function and maintains electrolyte balance. Potassium has the greatest concentration of any mineral in the seeds at 237.24 mg. Furthermore, there are notable concentrations of magnesium (67.41 mg) and sodium (170.35 mg), which support further physiological processes such as nerve impulse transmission and hydration. The nutritional profile of the seeds is improved by additional important minerals like calcium (9.78 mg), phosphorus (47.68 mg), iron (3.75 mg), and zinc (14.14 mg), which support immune system function, bone health, and general metabolic functions. Cucurbita pepo L. seeds provide a source of trace metals such as cobalt (2.17 mg) and manganese (0.06 mg) (M., et al., 2012). Pumpkin seed presented a fairly high value for zinc(14.14±0.02mg/100g). Zinc is known for boosting the health of our hair, it is believed to play a role in the proper functioning of some sense organs such as the ability to taste, sense, and smell (Payne, 1990). Zinc plays a very important role in protein and carbohydrate metabolism and also helps in utilizing vitamin A from its storage site in the liver and facilitates the synthesis of DNA and RNA necessary for cell production (Guthrie, 1989). Over the past few decades, the industrial processing of oats in Bangladesh has accelerated, turning the grain from a specialist product to a staple nutritious diet. Oats were first introduced as a Western dietary trend, but they have since grown in popularity among consumers who are concerned about their health, especially in cities. In line with national health initiatives, oats' nutritional reputation has increased as more people become aware of their health benefits, such as their high fiber content and ability to lower cholesterol. Oats are becoming more and more popular as a flexible component, as evidenced by the creative products made by local businesses that cater to Bangladeshi tastes, such as breakfast cereals and snacks. This change promotes the nation's aim to diversify its agriculture while also highlighting the growing acceptability of oats in the traditional diet. Rolled oats are highly nutritious, offering significant health benefits. Per 100 grams, they contain approximately 382 calories, 13.5 grams of protein, 5.89 grams of fat, and 69.7 grams of carbohydrates, which includes 10.4 grams of dietary fiber. They are rich in essential vitamins and minerals, providing 0.406 mg of the daily value (DV) for thiamin,32 μg for folate,4.34 mg for iron, 126 mg for magnesium, and 2.74 mg for zinc. The soluble fiber in rolled oats, particularly beta-glucan, is known to help lower cholesterol levels and improve heart health, while their high fiber content supports digestive health and aids in weight management. These attributes contribute to the growing recognition of oats as a healthful dietary choice (U.S. DEPARTMENT OF AGRICULTURE, 2022). In addition to offering vital elements like zinc, these ingredients make a tasty and practical snack that both kids and adults may enjoy. This biscuit has the potential to significantly improve general health outcomes by addressing nutritional deficiencies and stunted growth in individuals. Its plant-based makeup also makes it a great option for vegetarian and vegan groups, encouraging inclusivity while meeting dietary requirements. With this creative snack, Bangladeshi youngsters may have a healthier future and be better equipped to succeed.

CHAPTER-3

MATERIALS AND METHOD

3.1 Materials

3.1.1 Raw Materials Collection

Except pumpkin seed all raw ingredients were collected from Digu Babur Bazar which is located in the heart of Narayanganj. However, Pumpkin seeds were collected from the street vendors of Chasara, Narayanganj. Furthermore, preparation and proximate analysis of biscuits was done in the labs of NFE food processing lab and Food chemistry lab of Daffodil International University.

3.1.2 Equipment for Preparation

- Electronic Balance
- Blander
- Bowl
- Spoon
- Sieve
- Cookie roller
- Cookie cutter
- Tray

3.2 Method of preparation

Table 3.1: Ingredients for different concentrations of biscuits.

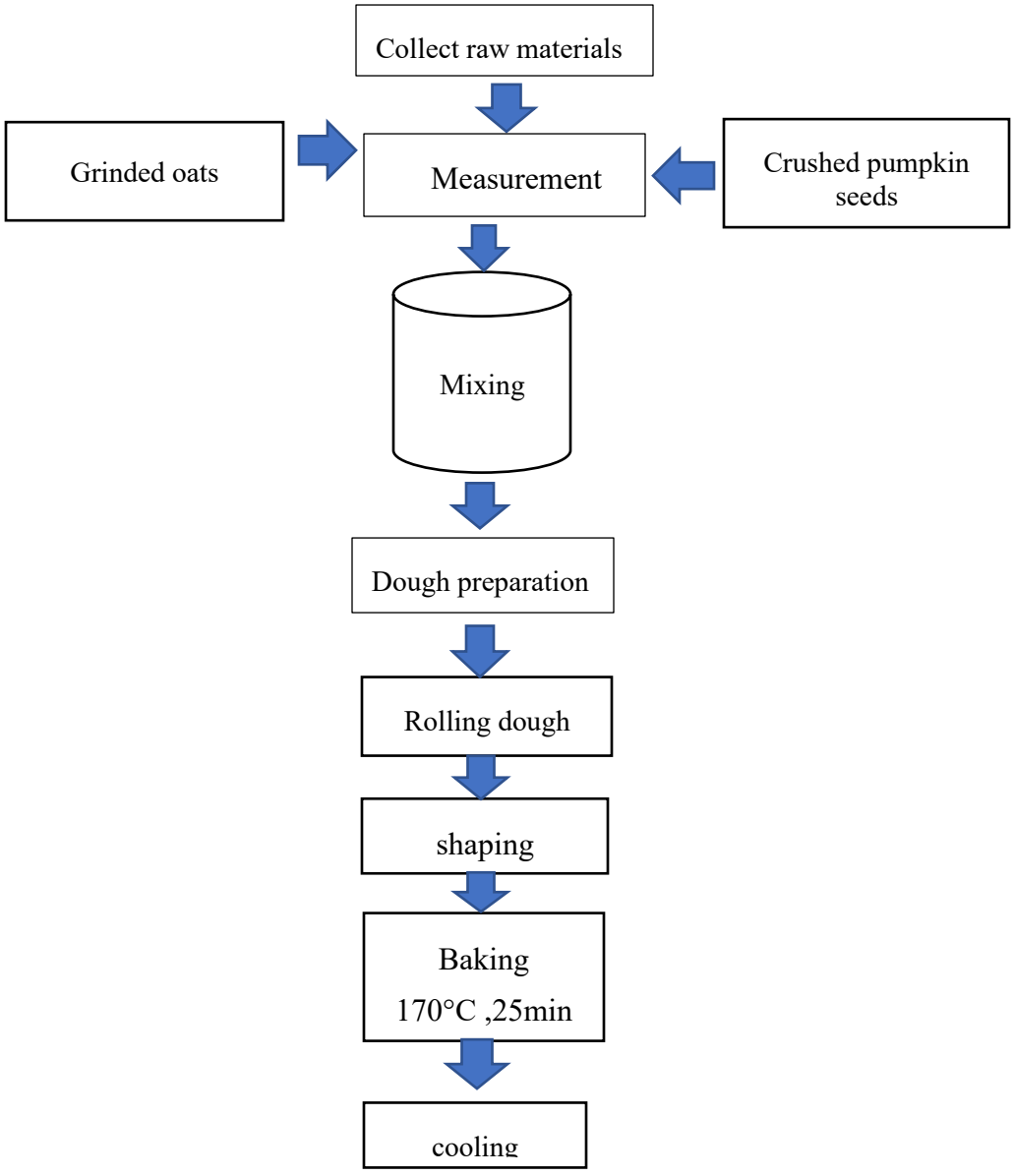
Ingredients	**Amount(g)**		
	S1	**S2**	**S3**
Wheat flour	48	48	48
Gram flour	22	22	22
Grinded sugar	20	20	20
Powder milk	10	10	10
Oil/butter	42	42	42
Baking powder	1	1	1
Oats	20	0	10

Pumpkin seed	0	20	10

N.B: S1- Biscuits made with 12% oats; S2-12% pumpkin seeds and S-3; 6% oats and 6% pumpkin seeds.

3.2.1 Preparation of biscuit made with pumpkin seed and oats

Right after collecting ingredients wheat and bason were sieved. Oats and pumpkin seeds were grinded. All the ingredients were dried. Then measured and mixed in a mixing bowl. A well-mixed grainy dough was prepared and was left for one hour or two. Following resting the dough was rolled into a flat sheet and a round shape was given using a cookie cutter. Immediately, these were kept in a baking pan and baked in an oven at a temperature of 170°C for 25 minutes. Biscuits were cooled at room temperature and stored in an air-tight container.



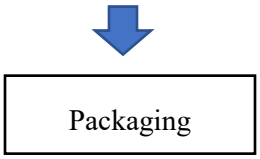


Figure 3.1: Preparation of biscuit made with pumpkin seeds and oats

Sample 1-Biscuits made with 12% oats

Sample 2- Biscuits made with 12% pumpkin seeds

Sample 3- Biscuits made with 6% oats and 6% pumpkin seeds.

Figure 3.2: Photos of different concentrations of biscuit sample

3.2.2 Determination of moisture content

A moisture analyzer is a device that utilizes the principle of loss on drying method to determine the moisture of a sample. It has two units. One is weighting and another is a halogen heating unit. This machine uses a halogen heating unit to dry the sample and the weight of the initial weight of the sample. Start the machine; measure 5 grams of food sample and spread it on the sample pan. Close the lid and press the button 'Start'. The result will be shown on the screen.

Figure 3.3: Moisture Analyzer (MB 65, China)

3.2.3 Determination of Ash content

In food analysis, muffle furnaces are used to measure the total amount of ash in food samples. The amount of inorganic residue (ash) that remains after burning the organic material in a sample can be measured, providing data about the food's mineral content.

Pre-heat the muffle furnace at around 550-600°C. Take clean crucibles to heat at 110ºC for 1 hour to remove any moisture. Take the weight of the crucible and place 2-5 grams of sample in the crucible. Place the crucibles into the muffle furnace and set the temperature at 550-600°C for 4-6 hours. Remove the crucibles from the muffle furnace and place them in a desiccator. Weight the crucible with ash.

$$\text{Ash content (\%)} = \frac{\text{wight of ash}}{\text{weight of sample}} \times 100$$

3.2.4 Determination of protein content

Kjeldahl method was followed while conducting proximate analysis of protein. This technique consists of three parts (Dr. George w. Latimer).

Step 1-Digestion
Step 2-distillation
Step 3-Titration
Step 4-Calculation

During these steps, several chemicals were used. That includes-

- Sulfuric acid (H_2SO_4)
- Catalyst
- 40% Sodium hydroxide (NaOH)
- 4% Boric acid
- O.1 N Hydrochloric acid (HCl)
- Methyl red indicator

Digestion:

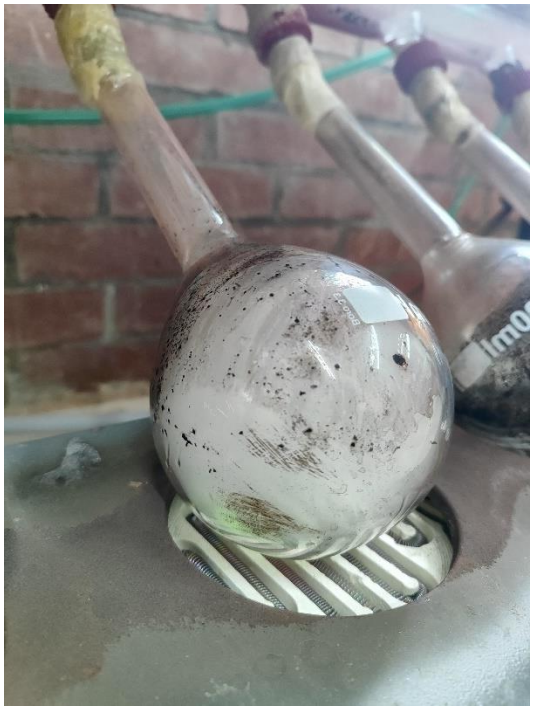


Figure 3.4: Digestion Unit.

Take a Kjeldahl flask and pour 20 ml sulfuric acid and 2 grams of homogenized food sample in that flask. Assemble the flask into a digestion unit and enclose it with foil. Run the digestion at 400°C until digested juice turns greenish. Take off the flask. Pour the digested juice into a volumetric flask; dilute with distilled water to make a volume of 100 ml.

Distillation:

Take a 10 ml diluted sample in a distillation flask. Add 50 ml NaOH solution and 50 ml distilled water. Keep 30 ml boric acid solution in a conical flask in a distillate collection tube. Run the distillation unit until the distillate exceeds 100 ml at 200-240°C.

Figure 3.5: Distillation Unit

Titration:

Add a few drops of methyl red in distillate solution. Take 0.1N HCl in a burette; meticulously add HCl solution until the solution changes color from pale yellow to pink.

Calculation:

$$N\% = \frac{V1 \times n1 \times F1 \times MWN}{WS \times 10}$$

$$\text{Protein\%} = N\% \times \text{Factor} \times F2$$

3.2.5 Determination of fat content

Take a filter paper and make a thimble. Weight 4.5 grams of sample and pour the sample into the thimble. Then place a cotton into the thimble in a way that covers the sample. Close the thimble. Put the thimble into a cellulose thimble. Take a clean and dried flat bottom flask of Soxhlet apparatus and weigh it. Set up the Soxhlet extraction unit placing the sample in it. Add

a sufficient amount of N-hexane. Run the Soxhlet apparatus at such a temperature in at a reflux rate of five drops per second for six hours. Take out the thimble and collect the wastage n-Hexane. Rotate the flask to evaporate the excess n-Hexane. Place the flask at 110°C for 30 minutes. Place the flask in a desiccator and weigh it with fat.

$$\text{Fat\%} = \frac{\text{Weight of flask with fat} - \text{weight of flask}}{\text{weight of sample}} \times 100$$

3.2.6 Determination of fiber content

In AOAC 978.10 method (Dr. George w. Latimer) enzymatic digestion is done followed by gravimetric analysis to measure both soluble and insoluble fiber of the food sample. This test procedure consists of 5 steps.

Step 1- Boiling in acid

Step 2- Boiling in base

Step 3-Drying fiber

Step 4-Incineration of fiber

Step 5-Calculation

Reagents:

- 0.128M Sulfuric acid (H_2SO_4)
- 0.313M Sodium Hydroxide ($NaOH$)

Procedure:

Boiling in acid:

Measure 200 ml of sulfuric acid and pour it into a 500ml conical flask. Take approximately 2 grams of sample in that conical flask. Place it on a hot plate and boil for 30 minutes with periodic agitation. Remove the conical flask from the hot plate and filter the boiled sample in a cotton cloth. Wash the residue with warm distilled water to get rid of any acid residue.

Boiling in base:

Take the residue of the boiled sample in a conical flask and add 200 ml of sodium hydroxide.

Place it on a hot plate and boil for 30 minutes with periodic agitation. Remove the conical flask from the hot plate and filter the boiled sample in a cotton cloth. Wash the residue with warm distilled water to get rid of any acid residue.

Drying fiber:

Take the fiber residue in a crucible and heat the crucible in a hot air oven at 130°C for 2 hours. After that specific time cool the crucible in a desiccator.

Incineration of fiber:

Weight the crucible; place it in a muffle furnace. Run the muffle furnace at a temperature of 550°C for 2 hours. Take out the crucible and place it into a desiccator. Weight the final weight of the crucible with fiber.

Calculation:

$$\text{Fiber\%} = \frac{\text{weight of crucible with ash} - \text{weight of crucible with fiber}}{\text{weight of sample}} \times 100$$

3.2.7 Carbohydrate content

By subtracting the total of the measured weight from the total of the measured moisture, ash, protein (derived from the total nitrogen), and fat, the conventional method for determining the amount of carbs in food is "by difference." This process offers a reasonably quick and repeatable method, and the outcomes tend to be sufficiently dependable (SOUTHGATE).

$$\text{Carbohydrate Content (\%)} = 100 - \text{Total Non-Carbohydrate Components}$$

3.3 Sensory evaluation

Biscuits were prepared among students and staff of Daffodil International University's Department of Nutrition and Food Engineering department's a group of 30 panelists were selected instructors, learners, and staff members of Daffodil International for evaluating sensory characteristics. Each sensory quality's importance and the purpose of the sensory evaluation have been described. Each student received a sheet of evaluation along with instructions on how to complete the evaluation process and use the forms. Color, flavor taste, and overall acceptability were told to give points. Before delivering samples, panelists were asked about any allergens to avoid any inconvenience. Following that, codded samples were given to individuals. Strong smells and other distractions were kept out of the vicinity. Students were advised to rinse their palates in between samples to avoid flavor cross-contamination.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Nutritional value

To know and understand information more effectively and easily, People look for food labels. Generally, a nutrition label's information varies with foods and products and also has serving size, calories, and nutrient information. The upper section shows all information except the footnote. On the other hand, the bottom section contains a footnote explaining the %Daily Value. A typical nutritional label can be divided into serving size, calories, nutrients, and a quick guide to percent %Daily Value.

Table 4.1: Physio-chemical analysis of 100 grams of biscuits made with different concentrations of oats and pumpkin seeds.

Sample No.	Carbohydrate	Protein	Fat	Fiber	Moisture	Ash
1	52.42	11.81	23.22	4.6	6	1.95
2	45.88	10.33	28.75	6.7	5.74	2.60
3	60.32	14.90	10.58	6.3	5.59	2.31

N.B: S1- Biscuits made with 12% oats; S2-12% pumpkin seeds and S-3; 6% oats and 6% pumpkin seeds.

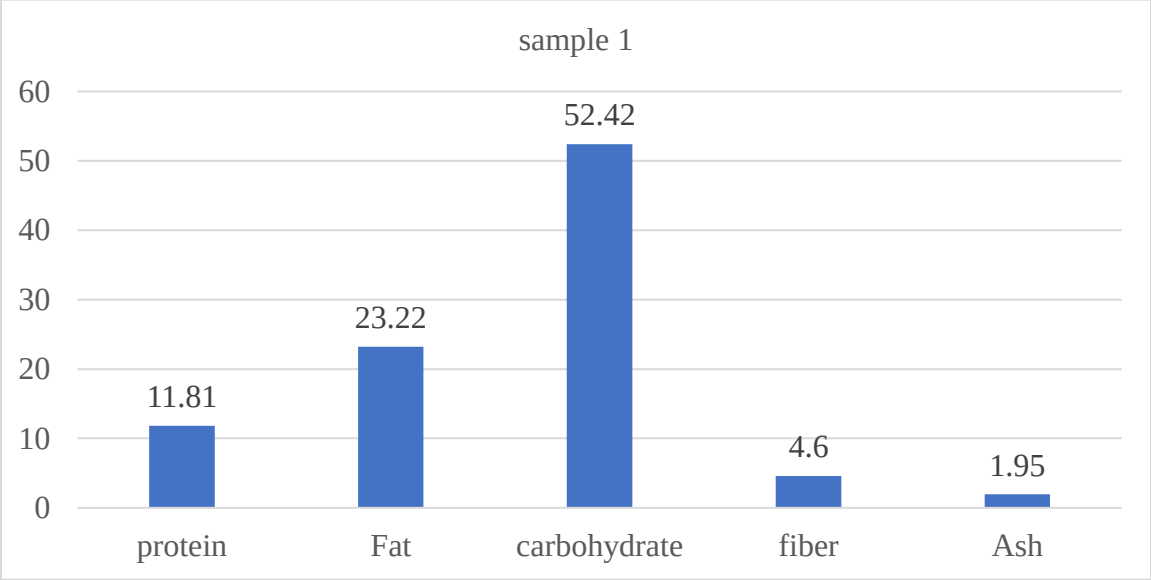


Figure 4.1: Graphical representation of sample-1

Biscuits made with 12% oats and 0% pumpkin seeds had 11.81% protein, 23.22% fat, 52.42% carbohydrates, 4.6 % fiber, and an ash content of 1.95%. The Ash content of 1.95% represents the inorganic residue remaining after the biscuit is burned. This value indicates the presence of minerals, suggesting that the biscuit contains various essential nutrients, albeit in small amounts. This analysis shows that the biscuit is a source of energy, protein, and dietary fiber, but it also has a relatively high-fat content.

Conversely, 100 grams of biscuit made with 12% pumpkin seeds had 10.33% protein, 28.75% fat, 45.88% carbohydrates, 6.7 % fiber, and an ash content of 2.6%. This biscuit analysis highlights a good balance of protein, healthy fats, carbohydrates, and fiber, making it a nutritious option. The presence of pumpkin seeds not only enhances the protein and healthy fat content but also boosts the fiber and mineral profile, making this biscuit a well-rounded choice for those seeking nutritious snack options.

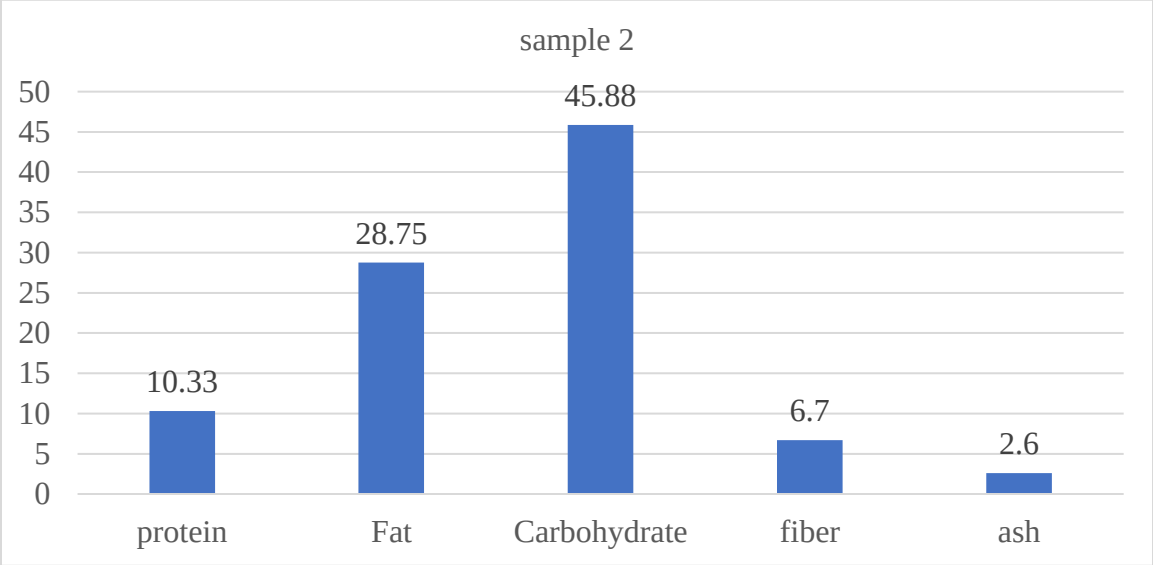


Figure 4.2: Graphical representation of sample-2

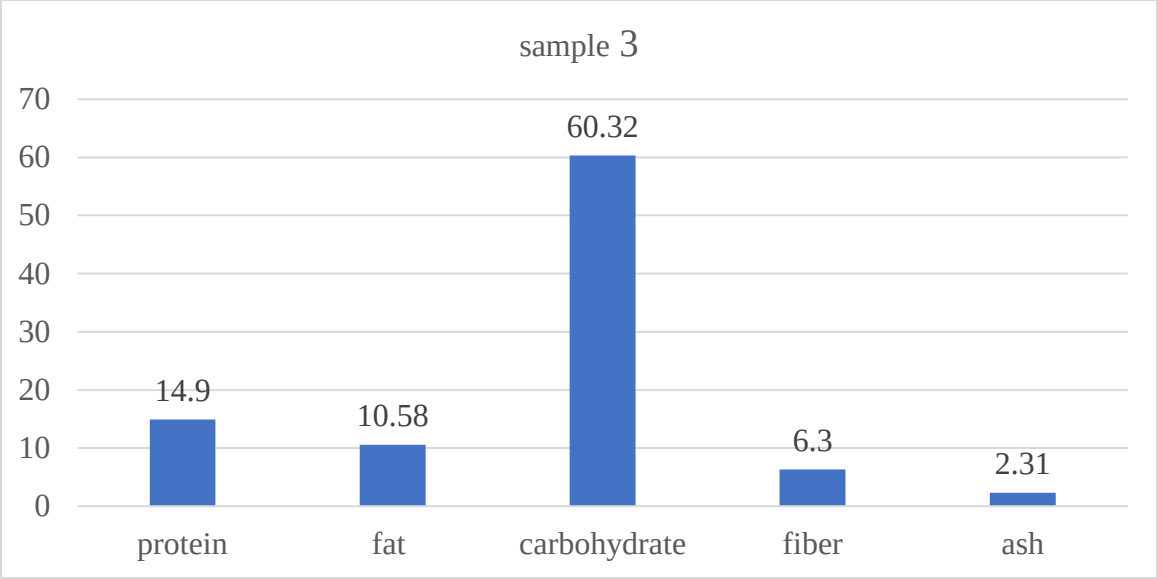


Figure 4.3: Graphical representation of sample-3

14.9% protein, 10.58% fat, 60.32% carbohydrates, 6.3% fiber, and 2.31% ash in a 100-gram biscuit sample showcases a balanced nutritional profile with a notable protein content, moderate fat, and high carbohydrates, complemented by a significant fiber content. The presence of minerals further enhances its nutritional value. This analysis indicates that the biscuit can be a nourishing snack option, particularly for those seeking to incorporate more protein and fiber into their diets.

Table 4.2: Nutritional value of biscuits made with 12% pumpkin seeds per serving.

Nutrition Facts 8 servings per container **Serving size**	**1 piece (20-30grams)**
Amount per serving **Calories**	**96KCal**
	%Daily Value*
Total Fat 6g	**7.60%**
Total Carbohydrates 9g	**3.27%**
Dietary Fiber 1.34g Total Sugar 2.5%	**4.79%**

Protein 2g	**4%**
Minerals 0.52g	
%Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet.2000 calories is used for general nutrition advice.	

(U.S. FOOD & DRUG , n.d.)

A typical biscuit weighing around 20-30 grams contains around 96 Kcal. Total fat is noted at 6 grams (7.6% of the daily value), while total carbohydrates are listed as 9 grams (3.27% of the daily value), which includes 1.34 grams of dietary fiber (4.79% of the daily value). The table also specifies total sugars at 2.5 grams, emphasizing the importance of monitoring sugar intake for overall health. Protein content is given as 2 grams (4% of the daily value), highlighting its role in tissue building and repair. Additionally, minerals are noted at 0.52 grams, indicating the presence of essential nutrients.

Table 4.3: Nutritional value of biscuits made with 6% oats and 6% pumpkin seeds per serving.

Nutrition Facts 8 servings per container **Serving size**	**1 piece (20-30grams)**
Amount per serving **Calories**	**79KCal**
	%Daily Value*
Total Fat 2.12g	**3%**
Total Carbohydrates 12g	**4%**
Dietary Fiber 1.26g Total Sugar 2.5%	**5%**
Protein 3g	**6%**
Minerals 0.46g	

%Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet.2000 calories is used for general nutrition advice.

(U.S. FOOD & DRUG , n.d.)

Each serving contains 79 KCal, making it a relatively low-calorie option. The table indicates that total fat is 2.12 grams, which accounts for 3% of the daily value based on a 2,000-calorie diet. Total carbohydrates are reported at 12 grams, contributing 4% to the daily intake, with dietary fiber making up 1.26 grams, or 5% of the daily value, highlighting its role in digestive health. The total sugar content is listed as 2.5%, though this does not have a specified daily value percentage. Additionally, the protein content is 3 grams, which represents 6% of the daily value, emphasizing its importance for muscle maintenance and repair. Lastly, the mineral content is noted at 0.46 grams, suggesting some level of essential nutrients. Overall, this table equips consumers with valuable insights to make informed dietary choices that align with their nutritional goals.

4.2 Sensory Characteristics

Table 4.4: Mean sensory score of different concentrations of oats and pumpkin seeds biscuit.

Sample No.	Color	Flavor	Taste	Overall acceptability
1	3.73±0.27	4.33±0.35	3.77 ±0.31	4.46 ±0.11
2	6.0±0.25	7.37±0.26	7.67± 0.20	8.46± 0.07
3	6.87±0.19	5.87±0.18	5.77 ±0.18	6.67 ±0.06

The sensory evaluation results for three samples reveal distinct differences in consumer preferences across various attributes. Sample 1 received the lowest scores, with color at 3.73, flavor at 4.33, taste at 3.77, and overall acceptability at 4.46, indicating a lack of favorability. In contrast, Sample 2 excelled with significantly higher scores: color at 6.00, flavor at 7.37, taste at 7.67, and an impressive overall acceptability of 8.46, showcasing strong consumer preference. Sample 3 fell in between, with color at 6.87, flavor at 5.87, taste at 5.77, and overall acceptability at 6.67, reflecting moderate appeal. Overall, Sample 2 stands out as the most preferred option, while Sample 1 is the least favored, with Sample 3 occupying a middle position.

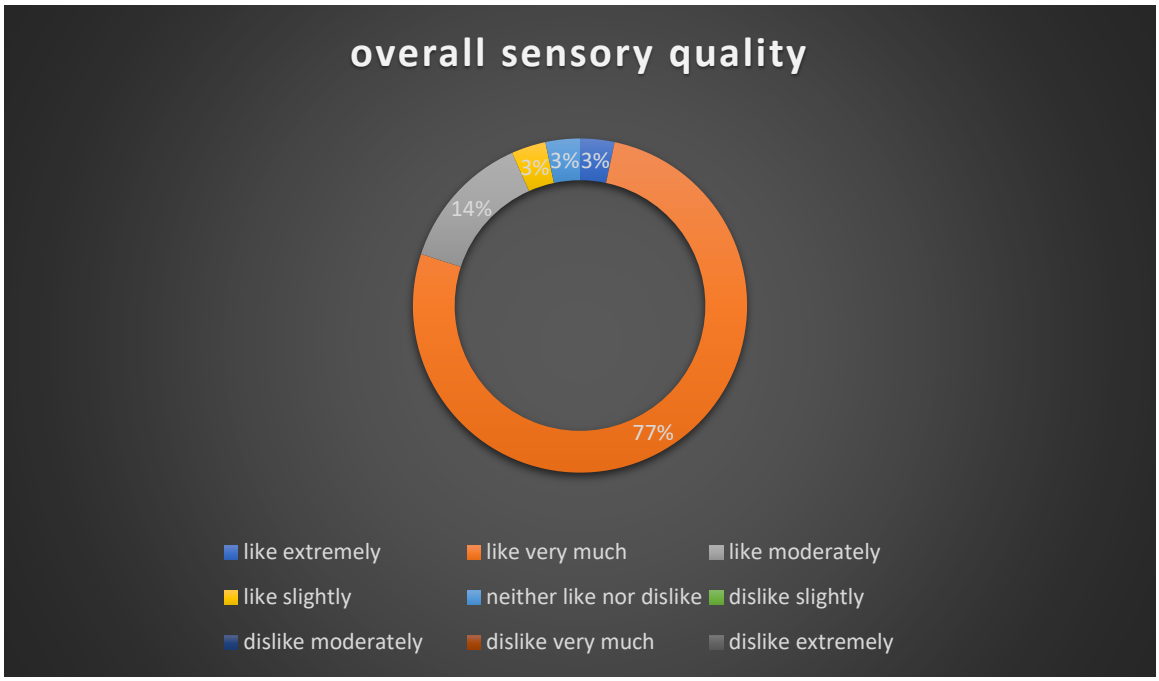


Figure 4.4: Overall sensory quality of sample-2

A big positive response was notable from 30 people sensory panelists, where 77% of people liked sample 2 very much, 14% people liked it moderately, 3% people liked the biscuits slightly, 3% people liked the biscuits extremely and 3% people neither liked nor disliked.

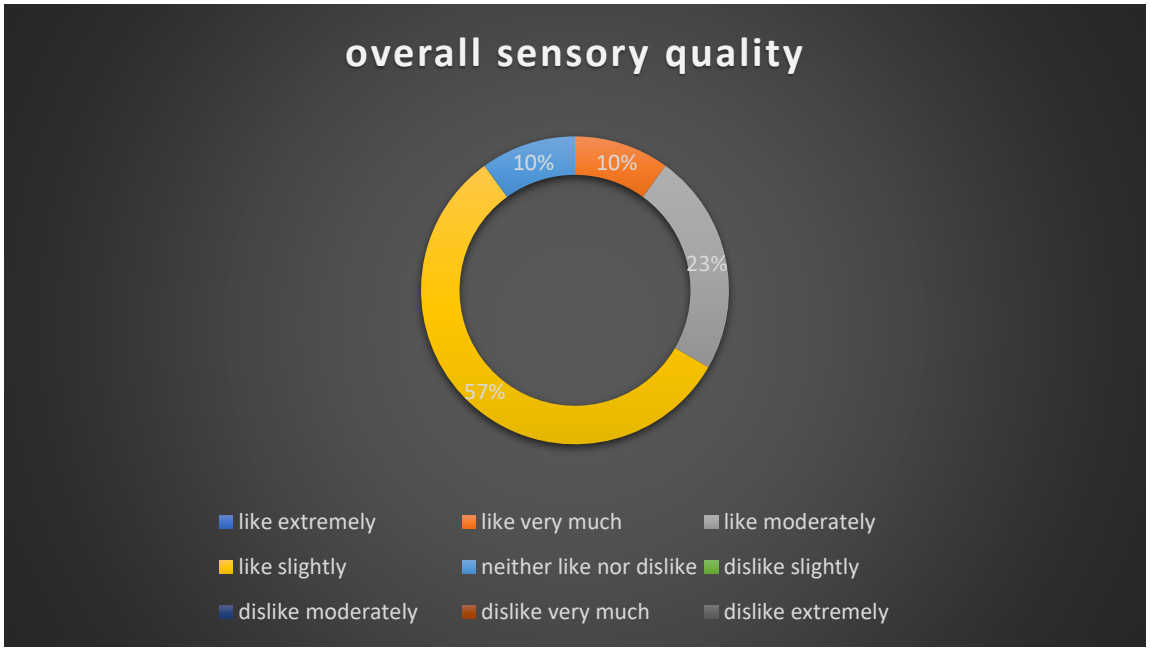


Figure:10 Overall sensory quality of sample-3

A slightly positive response was seen among panelists where 57% of people liked sample 3 slightly and 23% of people liked the sample moderately. 10% of people liked the biscuits very much and the other 10% neither liked nor disliked the sample.

4.3 Discussion

If we compare the Nutritional value of biscuits among all three concentrations, biscuits made with 12% pumpkin seeds and biscuits made with 6% oats and 6% pumpkin seeds, one serving of the first one contributes 96 Kcal and the other one can contribute 79 Kcal on a 2000-calorie diet. A piece of sample-2 biscuit weighing 20-30 grams is estimated to contain 2 grams of protein, 6 grams of fat, 9 grams of carbohydrates, and a generous amount of 3.4 grams of fiber and minerals. Besides, A piece of biscuit made of 6% oats and 6% pumpkin seeds can be predicted to have 3 grams of protein, 2.12 grams of fat, 12 grams of carbohydrates, and a substantial amount of 1.26 grams of fiber and minerals. Taking protein and minerals into account, sample 3 had more protein than other samples. On the other hand, sample 2 had more minerals than other samples.

Both sample 2 and sample 3 are suitable for both personal and public use, based on the proximate analysis of the samples. Nevertheless, sample 2 received a higher grade for acceptability and sensory attributes even though it had less protein than sample 3. However, sample 3 had a somewhat lower outcome than sample 2, even after accounting for protein amount, fat, and fiber. It was perceived that the addition of pumpkin seed and oats flour greatly affected the overall acceptability, color, flavor, texture, and taste. The data indicates that adding oats and pumpkin seeds gave an extravagant golden yellow color to sample 3; whereas, the lowest score for color was sample 1. Sample 1's texture stayed compact, while sample 3’s texture appeared slightly over-compact. However, sample 2 appeared to be of great texture and flavor; standing apart from all samples.

Finally, compared to the other two biscuit samples, the second sample has proven to be fluffier. Last but not least, a biscuit made with oats and pumpkin seed is expected a great way of mitigating Zinc deficiency in our population through snacking. However, no one should be fully dependent on reducing Zinc deficiency based on this type of biscuit rather than modifying their daily diet.

CHAPTER 5

CONCLUSION

To sum up, the oat and pumpkin seed biscuit is a unique and wholesome snack choice that combines the health advantages of both components. Pumpkin seeds, which are high in dietary fiber, provide a boost of vital nutrients such as protein, healthy fats, and minerals like zinc and magnesium. All things taken into account; these types of biscuits are a healthy option for those who have concerns about their health because it not only fulfills cravings but also promote a balanced diet. Snacking on these biscuits can be a fun way to add extra nutrients and fiber to your daily diet. The final product initially has excellent flavor, taste, color, and adequate overall acceptability among people. However, more modification is needed before commercial production and distribution.

Presumably, commercial acceptance can be achieved by comparing the physio-chemical result with the nutritional value of two consecutive oats biscuits in the current market of Bangladesh. This biscuit formula is compatible with as biscuit available and shows nutritional values in a range of 7-9 grams of protein, 19-26 grams of Fat, 50-66 grams of carbohydrates, and 2.7-5 grams of fiber per 100 grams (DAN CAKE, 2018) (big basket , n.d.) Whereas, Samples 2 and 3 had 10.33-14.90 grams of protein, 10.58 – 28.75 grams of fat 45.88- 60.32 grams of carbohydrates, and 6.3-6.7 grams of fiber per 100 grams.

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APPENDIX

Department of Nutrition and Food Engineering (NFE),

Faculty of Health and Life Sciences

Daffodil International University

Daffodil Smart City, Birulia, Savar, Dhaka – 1216, Bangladesh

Synopsis of the thesis

1.Name: Anjim Aktar Borna

2. ID: 201-34-1100

3. Thesis title: Formulation and Sensory Evaluation of the Biscuit prepared with Pumpkin Seed and oats.

4. Introduction:

Biscuits were first introduced by the British in the Indian subcontinent during the British colonial era. People delightedly accepted this food and built a massive economy in Asia.

Pumpkin seed contains 7.8mg zinc, 8.8 mg iron, 58 µg folic acid, and 10.71 grams of carbohydrate per 100g. (Qamar Abbas Syed, 2019).The national prevalence of Zn deficiency in preschool children was 44.6%. It was 29.5, 48.6 and 51.7%, respectively, in the urban, rural and slum strata (Rahman, et al., 2016). Also, serum iron level estimation in school-going children is below 50µg/dl which is less than the normal level (Swapan kumar Chowdhury, 2019).

According to WHO," Undernutrition costs Bangladesh more than 7000 crore taka (1 billion US) in lost productivity every year, and even more, in nutrition are effective now will lead to economic gains through increased productivity exceeding 70000 crore takas (10 billion) by 2021. This study aims to formulate a biscuit recipe that will be rich in iron, zinc, and folate and improve the nutritional status of Bangladesh.

5. Objective:

A. To develop a product that can mitigate zinc and folate deficiency in Bangladesh.

B. To formulate a recipe using oats and pumpkin seeds that will have consumer acceptability.

6. Ingredients:

- Wheat flour
- Gram flour
- Oats
- Pumpkin seed

- Sugar
- Baking powder
- Butter/vegetable oil
- Powder milk

7. Method:

A. Prepare the dough:

- All ingredients will be dried in a thermostatic oven.
- All raw materials will be mixed in a bowl.

B. Molding:

- Dough will be rolled using a rolling pin and cut the sheet using a cookie cutter.

C. Baking:

- Biscuits will be baked for 25 minutes at a temperature of 170ºC.

D. Storage:

- The biscuits are expected to have a shelf life of 2-3 months and will be stored in an air-tight container at room temperature.

8. Place of the study:

Food Processing Lab, Department of Nutrition and Food Engineering, Daffodil International University.

9. schedule of activities:

Task	Activities by Months or Days (Start to End)						
	May	June	July	Aug	Sep	Oct	Nov
Literature research	↔						
Formulation of the recipe		↔	↔				
Sensory characteristics data collection				↔			
Physio-chemical analysis					↔		
Data analysis and report writing						↔	
Report writing and article publication							↔

10. Supervisors:

Ms. Munmun Akter, Lecturer, Department of Nutrition and Food Engineering.

11. Expected outcomes:

- Zinc-rich nutritional composition
- Consumer acceptability

- Market alike sensory attribute
- High quality

12. Conclusion:

This research will have a prevalence in improving our nation's nutritional status. In recent years, zinc deficiency has been a concerning issue in the context of Bangladesh. As zinc deficiency results in stunting. Stunting and impaired height for age development have long-term adverse effects on human health. i.e. poor cognitive development and low educational performance in children, LBW (low birth weight) because of zinc deficiency during pregnancy, and loss of productivity potential worldwide. Moreover, this developed delicious product may take part in reducing zinc deficiency percentage both in children and pregnant women.

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3. Swapan Kumar Chowdhury, Shafi Ahmed, Ishrat Ara Hossain, Rabeya Yasmin, 2019, Status of Iron Deficiency Anemia among Bangladeshi Children: Urban and Rural Settings.

14. Signature:

Signature of the Supervisor	Signature of the student

Department of Nutrition and Food Engineering (NFE),

Faculty of Health and Life Sciences

Daffodil International University

Daffodil Smart City, Birulia, Savar, Dhaka – 1216, Bangladesh

Thesis title: Formulation and Sensory Assessment of the Biscuit Prepared with Pumpkin Seed and Oats.

Sensory Evaluation

Name: **Date:**

Age: **Sample code:344,443,343**

Parameter	9-Liked 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
Color									
Flavor									
Taste									
Overall acceptability									

Signature

Sensory characteristics of biscuits made with 12% oats.

panelist	color	flavor	taste	overall acceptability
1	3	7	2	4.5
2	5	6	3	4.96
3	4	2	6	4.68
4	2	4	4	4.33
5	5	3	5	4.02
6	5	2	2	4.29
7	4	4	3	5.83
8	2	7	4	5.5
9	5	5	5	4.25
10	4	6	2	4.32
11	3	4	3	3.86
12	3	5	4	4.75
13	3	9	3	4.34
14	1	4	5	4.57
15	4	6	2	3.95
16	5	2	4	3.79
17	3	4	3	3
18	5	2	5	3.9
19	2	4	2	4.2
20	5	5	7	7
21	5	6	6	6.7

22	3	3	5	2.86
23	6	4	2	3.83
24	2	2	4	4.25
25	6	6	3	5.01
26	2	1	2	6.11
27	1	1	5	4.75
28	1	4	4	4.41
29	3	3	3	4.48
30	3	5	2	4.07

Sensory characteristics of biscuits made with 12% pumpkin seed.

panelist	color	flavor	taste	overall acceptability
1	7	5	7	8.33
2	4	7	7	8
3	7	7	8	8
4	5	9	9	8.67
5	9	8	8	8.9
6	8	5	9	8.67
7	8	9	8	8.67
8	8	9	8	8.46
9	8	7	9	8.67
10	5	8	7	7.33

11	6	9	9	8.67
12	7	8	9	7.33
13	6	7	8	8
14	6	9	5	8
15	9	8	7	8
16	8	8	7	8.67
17	6	8	9	8.33
18	7	7	8	8
19	5	9	7	8.67
20	8	9	6	8.35
21	5	8	7	8.67
22	4	7	6	8.34
23	6	9	8	8.23
24	8	8	9	8.22
25	7	9	8	7
26	9	7	9	9
27	5	7	7	5
28	5	9	7	6.5
29	4	7	8	8
30	8	6	9	7

Sensory characteristics of biscuits made with 6% oats and 6% pumpkin seed.

panelist	color	flavor	taste	overall acceptability
1	9	6	6	7
2	6	6	5	6.67
3	7	5	5	6.69
4	6	7	6	6.58
5	8	6	6	6.29
6	7	5	8	7
7	6	4	6	6
8	7	6	5	6.63
9	5	5	6	7.33
10	7	7	9	8.67
11	6	6	7	6
12	8	8	6	6.32
13	9	8	7	7.31
14	9	7	5	6
15	6	6	4	6.12
16	7	6	7	6.8
17	5	5	6	7.31
18	7	8	8	6.33
19	6	6	5	6
20	8	5	6	6.67
21	7	7	4	5.96

22	9	7	4	5.33
23	6	5	4	6
24	5	5	6	6.37
25	8	6	7	7.67
26	8	5	6	6.67
27	6	7	5	5.5
28	8	7	7	8
29	7	6	6	7
30	9	7	8	8