



**Daffodil**  
*International*  
**University**

**DEVELOPMENT AND QUALITY EVALUATION OF  
QUINOA NUTRI-BAR**

**AN PROJECT REPORT**

**BY**

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Submitted to the Department of Nutrition and Food Engineering

In the fulfilment of B.Sc.in Nutrition and Food Engineering

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**JANUARY 2024**

## **APPROVAL**

This Project titled “**Development and Quality Evaluation of Quinoa Nutri-Bar**” submitted by **Fowzia Angel** to the Department of Nutrition and Food Engineering, Daffodil International University, has been accepted as satisfactory for the fulfilment 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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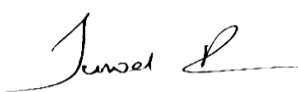
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## DECLARATION

I hereby declare that this project has been done by me under the supervision of **Juwel Rana, Assistant Professor, Department of NFE, Daffodil International University**. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree.

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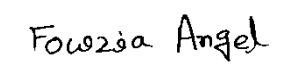
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## ACKNOWLEDGEMENT

First and foremost, I want to thank Almighty Allah for giving me the courage and chance to finish the report on time and effectively. I owe those who have supported me at every stage of my life. My parents are the reason I am here, and for that I am grateful. I would not be able to accomplish my aims and ambitions without my parents' help.

My Supervisor **Jewel Rana, Assistant Professor, Department of NFE, Daffodil International University**, unwavering monitoring during my organizational attachment time has left me incredibly grateful. Without his direction and invaluable assistance, it would have been challenging to produce this report to this calibre. Completion of this assignment was made possible by his constant patience, academic guidance, constant encouragement, continuous and vigorous monitoring, constructive criticism, insightful suggestions, reading several subpar versions and correcting them at every level.

I sincerely thank **Prof. Dr. Md. Bellal Hossain**, the Dean of the Faculty of Allied Health Science, for his kind cooperation and acceptance of the degree. For giving me the opportunity to learn real-world skills, **Dr. Nizam Uddin**, Associate Professor and Head of the Department of Nutrition & Food Engineering at Daffodil International University, has my sincere gratitude.

The whole NFE Department of Daffodil International University is to be commended for setting up this research opportunity and supporting the effort throughout. I express my gratitude to all the other members of the NFE Faculty for their crucial support throughout my time in college. I would want to convey my heartfelt appreciation to NFE Faculty members for their various inspirations and encouragement during student life. I am really grateful to my seniors, juniors, and other students for all of their support, guidance, motivation, and assistance.

## ABSTRACT

The focus of this research was to produce a Bar product using Quinoa Nutri-Bar, a various rice known for its substantial nutritional value and significant possibilities within the industry of confectionery. Quinoa Rice scientifically known as *Chenopodium QuinoaWilld.*, is a tropical rice native to the region of South America, specifically Bolivia, Ecuador, Chile, and Peru. This food item is considered to be a valuable source of Manganese Phosphorus Magnesium, Folate, Thiamine (Vitamin B1). In the present investigation, a confectionery product was produced utilizing Quinoa Nutri-Bar. The confectionery product was produced through a process of puffing Quinoa rice to make it crunchy, then adding sugar and molasses. Subsequently, the mixture was transferred into moulds and allowed to go through the cooling process. The Nutri-Bar produced exhibited a firm texture and possessed a delicate pleasant taste. The confectionery received positive feedback from individuals evaluating its flavour, indicating its ability to serve as an innovative and revolutionary item. The nutritional and sensory characteristics of Quinoa Nutri-Bar have been evaluated in the laboratory of baking confectionery and food processing lab. The Quinoa Nutri-Bar was found to have moisture 4% and ash contents of 1%. The protein was found to be 7.39%, whereas the Fiber was measured at 26.42% and fat is 16.46%. The preparation in concern provides a quick, simple, and the cost-effective method that is high in various nutrients and beneficial chemical substances. Overall, the findings of this study indicate that Quinoa rice possesses the ability to be utilized in the production of a delightful and healthful confectionery.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

One of the most adaptable superfoods that humans can consume is Quinoa, sometimes known as a pseudo-cereal. Super foods are whole, natural foods with lots of nutrients and few calories. They support the body's defences against illness and provide it the resources it needs to live in optimal. It's a wonderful plant-based source of protein. It is also rich in minerals and antioxidants, including iron, zinc, manganese, and folate. Food that is safe, nourishing, and healthful is in more demand than ever. Consuming a balanced diet is the best approach to avoid or treat conditions like obesity, diabetes, malnutrition, cardiovascular disease, and others. Quinoa offers a healthy amount of fatty acids like omega 3, 6, and 9.

The company are produced a sizable of edible goods depend on Quinoa sold across world these days. These consist of beverages, tortillas, chips, soups, puffed Quinoa (Quinoa pop), and flours. Quinoa is flavourful, light, and easily digested. Quinoa Nutri-Bar was prepared in the current study using Product stability was assessed by packing in low density polyethylene and storing at room temperature. The end product had improved physicochemical and sensory quality over the course of the storage period.(PRAVALIKA G., 2022)

Due to its exceptional nutritional and physiological benefits, Quinoa (*Chenopodium Quinoa*), an ancient grain from South America, is becoming a superfood that is in high demand. Quinoa is an appropriate diet to alleviate the widespread protein energy deficiency that occurs worldwide because of its qualitatively and quantitatively better protein. Compared to cereals like wheat, maize, and rice that are often consumed, it has a higher protein content. Because the cereals lack the necessary amino acid lysine, the body cannot use the full protein if it is not supplemented with additional lysine sources. Quinoa has a high lysine content and contains all the other important amino acids, unlike grains. It is gluten free, so those with celiac disease can eat it.

Given that Quinoa protein has a greater protein efficiency ratio than milk protein, it might aid in the formation of stronger muscles. Quinoa's low glycaemic index and the high fiber content make it a preferred option for diabetics. It has been discovered that Quinoa's carbohydrates lower blood levels of free fatty acids and triglycerides. Quinoa's soluble fiber helps improve gastrointestinal health by feeding intestinal microorganisms. With a polyunsaturation index of 3.9–4.7, unsaturated fatty acids, including linoleic acid, oleic acid, and linolenic acid. Quinoa's antioxidant properties against free radical damage to blood cells and cardiovascular system protection are attributed to the presence of vitamin E. 100 grams of Quinoa has enough folic acid and pyridoxine to meet daily requirements, while riboflavin provides 80% of the required amount. The ascorbic acid concentration in 100 gm of Quinoa ranges from 4 to 16.4 mg depending on variation. Quinoa is high in minerals, including phosphorus, iron, magnesium, and calcium. Because of its health-promoting qualities, including its anti-inflammatory, antihypertensive, antioxidant, and

immune-modulating capabilities, it is regarded as a functional food. In order to create grains crispy, porous, aerated, and incredibly appetizing when they're ready to eat, puffing is the technique of heating the grains at a high temperature for a brief period of time.(Deepak Subramani, 2020)

## **1.2 Objectives**

The main purpose of study was:

- ⇒ Analyse the nutritional composition of Quinoa Bar.
- ⇒ Analyse the proximate composition of Quinoa bar.
- ⇒ Evaluate the customer acceptance.

## CHAPTER 2

### REVIEW LITERATURE

#### 2.1 Quinoa

Quinoa (*Chenopodium QuinoaWilld.*), regarded as a pseudograin or pseudo cereal, has been acknowledged as a complete meal because of its high protein content. Due to its excellent amino acid balance and 15% protein content, it possesses exceptional nutritional qualities. It's also been regarded as an oil crop because of its noteworthy vitamin E concentration and intriguing omega-6 ratio. Quinoa starch has unique functional features that provide new applications due to its physicochemical characteristics (such as viscosity and freeze stability). With its many benefits, Quinoa is a viable substitute crop that has gained popularity as a unique functional meal with a high nutritional content.(James, 2009)

#### 2.2 Nutritional Facts about QuinoaNutri-Bar

Quinoa that has been cooked has 21% carbs, 14.6% protein, and 14.2% fat. Cooked Quinoa has 222 calories per cup (185 grams). 3.5 ounces (100 grams) of cooked Quinoa has the following nutritional information:(Marie Lorraine Johnson MS & Adda Bjarnadottir, 2023)

**Table 2.1: Nutritional Composition of Quinoa Nutri-Bar**

| <b>Nutritional Facts</b> | <b>Amounts in 100 gm</b> |
|--------------------------|--------------------------|
| <b>Calorie</b>           | 120                      |
| <b>Water</b>             | 72%                      |
| <b>Carbohydrate</b>      | 21.3 grams               |
| <b>Protein</b>           | 4.4 grams                |
| <b>Fat</b>               | 1.9 grams                |
| <b>Sugar</b>             | 0.9 grams                |
| <b>Fiber</b>             | 2.8 Grams                |

#### 2.3 Health Benefits of Quinoa Nutri-Bar

Quinoa is a high-fiber, high-protein, gluten-free grain that is rich in vitamins and minerals. Having all nine of the necessary amino acids, it is also a complete protein.

### **2.3.1 Gluten Free Diet for Celiac Patient**

The study involved 19 individuals with celiac disease who followed their regular gluten-free diet for six weeks, consuming 50 grams of Quinoa every day. The results demonstrated a positive trend toward improved histological parameters (serum total cholesterol decreased from 30.3 to 29.7, enterocyte cell height improved from 28.76  $\mu\text{m}$  to 29.77  $\mu\text{m}$ , and the ratio of villus height to crypt depth improved from slightly below normal values 2.8:1 to normal levels 3:1). They found that included Quinoa in their diet was well tolerated and had no negative effects on the way celiac disease presented clinically.

### **2.3.2 Hypocholesterolemic Effect**

The biochemical markers that indicate the risk of cardiovascular illnesses. 22 students, ages 18 to 45, participated in the trial and received daily treatment of Quinoa in the form of cereal bars for 30 days. The findings indicated the lower levels of LDL-c, triglycerides, and total cholesterol. It was shown that include Quinoa in one's diet can help prevent and treat risk factors associated with cardiovascular illnesses. This is because of its high concentration of vitamin E, flavonoids, polyphenols and phytosterols compounds with antioxidant properties that may also be connected to the lower levels of plasma lipids seen in these people.

### **2.3.3 Prevent Type-II Diabetes**

This study looked at the effects of a low-glycaemic-index diet, which included Quinoa, on 210 diabetics over the course of six months. Two groups of patients were created: one for the low-GI diet and the other for the high cereal fiber diet. According to the study, HDL-C rose by 1.7 mg/dl in the low glycaemic index diet group and haemoglobin A1c (HbA1c) decreased more in the low GI diet group (-0.50%). It was shown that eating Quinoa can help avoid type 2 diabetes. (David J. A. Jenkins, Cyril W. C. Kendall, & Gail McKeown-Eyssen, 2008)

### **2.3.4 Reduce Obesity**

Rats were used in a brief experiment by Foucault et al. (2012). Diet-induced obesity in rats induced by Quinoa extract high in 20-hydroxyecdysone. They saw Quinoa extracts' positive effects on fat mass. The findings suggested that extracts function by decreasing adipocyte esterification and fatty acid intake. (Bawachkar RR, 2021)

### **2.3.5 Other Potential Benefits**

- lower levels of oxidative stress
- Lowering cholesterol.
- Helping with weight management.
- Anti-inflammatory properties.
- Providing nutrients like magnesium, potassium, iron, and folate.

## **2.4 Nutritional Evaluation of Quinoa Nutri-Bar**

### **2.4.1 Organoleptic Evaluation**

Selected panel members from the institute used a 5-point hedonic scale to evaluate Quinoa Nutri-Bar organoleptically.

### **2.4.2 Chemical and Nutritional Properties**

Using industry standards, the Quinoa Nutri-Bar's chemical and nutritional characteristics were investigated. AOAC (2005) standard procedures were used to estimate the amount of moisture contained in the food sample.

### **2.4.3 Estimation of Crude Fat**

As per AOAC (2012), the Soxhlet apparatus method was utilized to ascertain the fat content

## CHAPTER 3

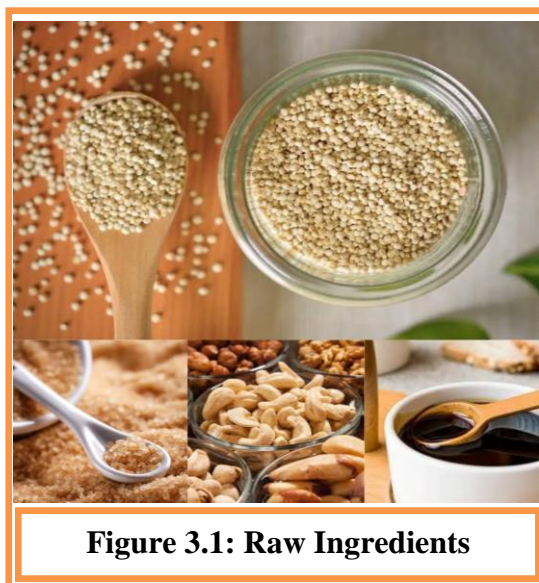
### MATERIALS& METHODS

#### 3.1 Collection of Raw Materials

The Quinoa Rice (Raw) was purchased from the Meena Bazar Jatrabari and all other ingredients of the cake were purchased from the Shawpno (Shonirakhra, Jatrabari, Dhaka). All the Chemicals (analytical grades) required for the assessments were used processing laboratories.

##### 3.1.1 Raw Ingredients

- QuinoaRice(Raw).
- Brown Sugar.
- Water.
- Dry Fruits(Almond,Cashew,Pistachio,Peanut).
- Molasses.



#### 3.2 Preparation of Quinoa Nutri-Bar

**Table 3.1: The Proportion of Ingredients of Quinoa Nutri-Bar**

| Ingredients                                   | Amount |
|-----------------------------------------------|--------|
| Quinoa                                        | 240 gm |
| Water                                         | 245 ml |
| Molasses                                      | 240 gm |
| Brown Sugar                                   | 200 gm |
| Dry Fruits(Almond, Cashew, Peanut, Pistachio) | 240 gm |

### 3.2.1 Process of Preparing Quinoa Nutri-Bar

At first the raw Quinoa rice washed for remove the dirt. Then the Quinoa rice should be soaked for anhour. Afteranhour,Quinoa rice should be fried like muri. Then cut all the dry fruits like Peanut, Cashew,Pistachio,Almond, Pumpkin Seed.Then make a syrup of sugar and molasses which will be sticky.



**Figure 3.2: Cutting of Quinoa Nutri-Bar**

Then transferred the mould after cool down we have to cut down and give a shape.



**Figure 3.3: Quinoa Nutri-Bar**

### 3.2.2 Flow Chart of the Process of Preparation

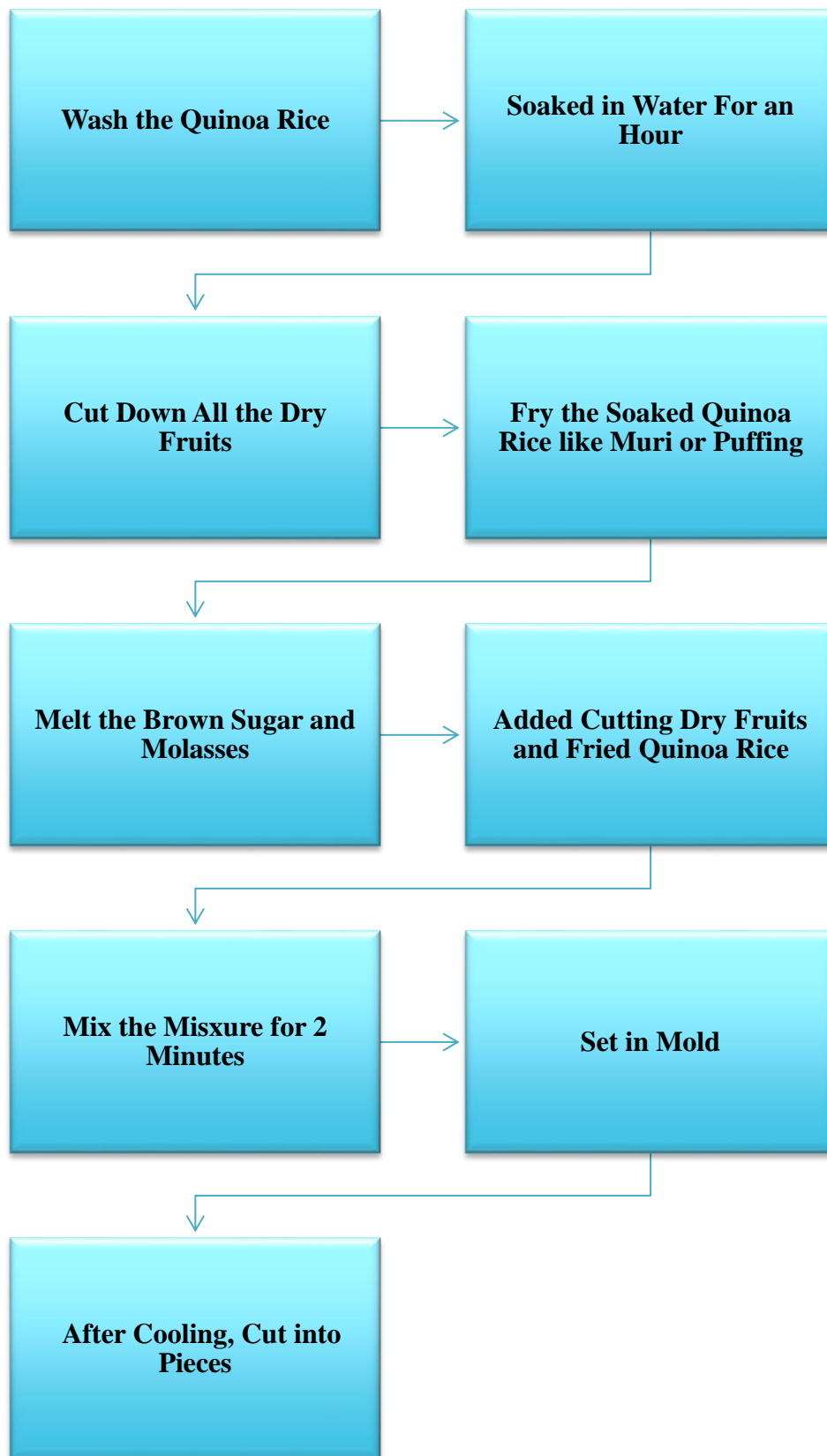


Figure 3.4: Flow Chart of Quinoa Nutri-Bar Preparation



### 3.3 Moisture Content

The measurement of a food's total water content, known as moisture content, is often given as a percentage of the food's overall weight. It's a helpful measurement to know the dry weight of your materials and meals, and it aids in figuring out your yield overall.

#### 3.2.2 Ingredients

- Quinoa Bar.

#### 3.3.2 Apparatus and Equipment

- Pastel mortal.
- Spatula.
- Moisture Analyzer Machine.
- Mortal & Pastel.



#### 3.3.3 Procedure

- ↪ At first use the analyser, just put two grams of each sample into the pan.
- ↪ The temperature of the machine was set at 120°C when it was first started.
- ↪ The analyser beeped to indicate that the sample was ready.
- ↪ The reading was collected subsequent to the beep.
- ↪ Depending on the product, the analyser's processing time may vary; for instance, if the sample contains an excessive quantity of moisture, the beep will sound repeatedly.
- ↪ Then we have to take the weight of drying of sample.
- ↪ Note down all the weights.

#### 3.3.4 Formula for Calculation

Here,

**W**= Wet Weight of Sample

**D**= Weight After Drying of Sample

Therefore,

$$\text{MOISTURE (\%)} = \frac{W - D}{W} \times 100$$

### 3.4 Ash Content

Ash, which gives an indication of the overall amount of minerals in the food, is the inorganic residue that remains after water and organic matter have been removed by heating in the presence of an oxidizing agent.

#### 3.4.1 Ingredients

- Quinoa Nutri-Bar.

#### 3.4.2 Apparatus and Equipment

- Metal Tong
- Spatula.
- Heat Resistance Gloves.
- Pencil/ Marker.
- Weight Balance.
- Desiccator.
- Crucible.
- Muffle Furnace.
- Mortar & Pestle.

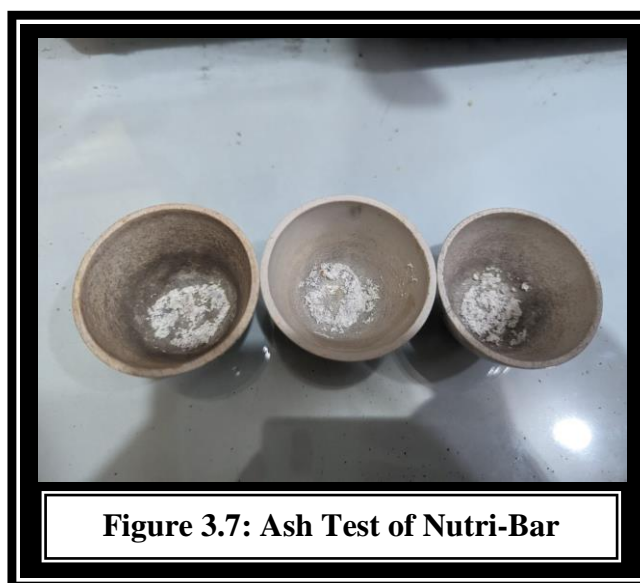
#### 3.4.3 Procedure

##### ➤ Step 1

- ↪ In oven, set crucible and lid for remove moisture.
- ↪ Dry 105°C at least 20 minutes.
- ↪ Place in a desiccator to cool.
- ↪ After cool down we should take blank crucible weight.
- ↪ Then take 2 gm to 6 gm sample in crucible.
- ↪ After taking the sample we have to take crucible weight.
- ↪ Note down all data.



**Figure 3.6: Muffle Furnace**



**Figure 3.7: Ash Test of Nutri-Bar**

## ➤ Step 2

- ↪ At first, we have to on muffle Furnace.
- ↪ Place the sample.
- ↪ Set furnace temperature 700°C.
- ↪ Set the time.
- ↪ When time is over muffle furnace automatic stopped.
- ↪ Ensure that you wear heat proof gloves.
- ↪ The open the muffle furnace and pull out the crucible.
- ↪ Place the crucible in a desiccator to cool.
- ↪ After cooling we see brown ash in the crucible.
- ↪ Then we have to take the weight of the crucible.
- ↪ Note down all the weights.

### 3.4.4 Formula for Calculation

Here,

$W_1$  = Empty Crucible's Weight

$W_2$  = Crucible with Ash's Weight

$W_s$  = Sample's Weight

Therefore,

$$\text{ASH (\%)} = \frac{W_2 - W_1}{W_s} \times 100$$

### 3.5 Crude Fat Content

By using diethyl ether to extract a pulverized feed sample, the crude fat content may be calculated. There may be nutritional benefit to the ether soluble components (ether extract), which can contain fat-soluble vitamins or provitamins like carotenoids, fatty acid esters, compound lipids, and real fats and oils.

#### 3.5.1 Ingredients

- Quinoa Nutri-Bar.

#### 3.5.2 Apparatus and Equipment

- Thimble.
- Cotton.
- Weight Machine.
- Soxhlet Machine.

### 3.5.3 Chemical Solutions

- Petroleum Ether.

### 3.5.4 Procedure

- ↪ At first, take a thimble and boiling flask weight.
- ↪ Then take a sample in thimble.
- ↪ Then take weight the thimble with the sample.
- ↪ In the Soxhlet apparatus, the thimble should be placed and set with the boiling-flask.
- ↪ Then fill the flask with petroleum ether.
- ↪ Then the whole process should then keep 60°C to 70°C at least 6 hours.
- ↪ The petroleum ether evaporated to the top of the apparatus due to heat. Water is kept in the thimble until it cools down to the point of evaporation. When the n-hexane was added to the boiling flask, it released the fat from the sample.
- ↪ The flask is removed after 6-8 hours.
- ↪ Place the flask on heat plate and let petroleum ether evaporated.
- ↪ Then placed the flask in oven remove the petroleum evaporated.
- ↪ Then cool down the flask and weighted.



**Figure 3.8: Crude Fat Content**

### 3.5.5 Formula for Calculation

Here,

$W_1$  = Flask's Weight.

$W_2$  = Flask with Fat's Weight.

$W_s$  = Sample's Weight.

Therefore,

$$\text{Crude Fat (\%)} = \frac{W_2 - W_1}{W_s} \times 100$$

### 3.6 Crude Protein Content

The protein content of a feed is measured as its crude protein content, which is calculated by multiplying the nitrogen content by 6.25. The average number of grams of protein that comprise one gram of nitrogen is 6.25. A common approach for figuring out a feedstock's crude protein concentration is the Kjeldahl method. Using this method, the total nitrogen

content of a sample is measured and then multiplied by 6.25 to obtain the total crude protein value.

### 3.6.1 Ingredients

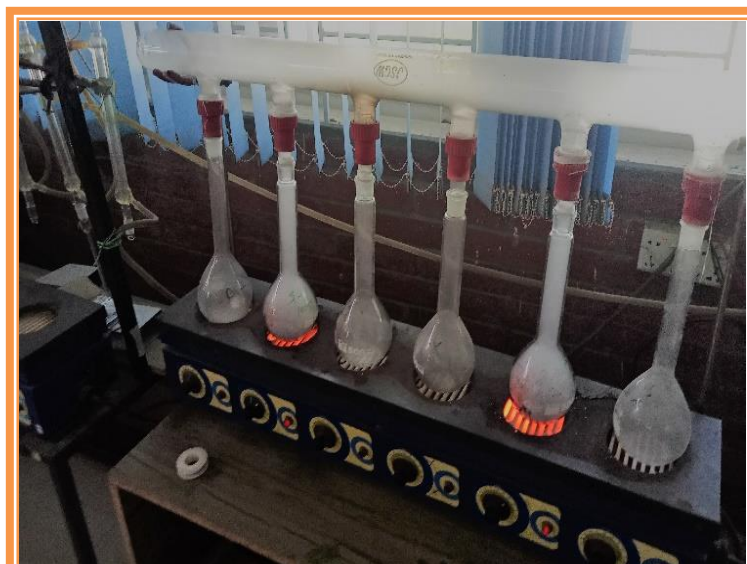
- Quinoa Nutri-Bar.

### 3.6.2 Apparatus and Equipment

- Electric Heater.
- Condenser.
- Distillation Flask.
- Conical Flask.
- Digestion Flask.
- Burette.

### 3.6.3 Chemical Solution

- Digestion Mixture.  
(2gm  $\text{CuSO}_4$ +98gm  $\text{K}_2\text{SO}_4$ )
- Sulfuric Acid ( $\text{H}_2\text{SO}_4$ ).
- Methyl Red Indicator.
- Distilled Water.
- 0.1N NaOH.
- 40% NaOH.



**Figure 3.9: Crude Protein Content**

### 3.6.4 Procedure

Kjeldahl method was used to determine protein. The Kjeldahl technique has three steps.

#### 3.6.4.1 Digestion of Sample

- ↻ Take 0.4gm of the sample, 10ml of  $\text{H}_2\text{SO}_4$  and 2gm of the digestion mixture.
- ↻ Place the digestion flask on top of it.
- ↻ For this technique, we have to use digestible flask.
- ↻ Heat slowly after that we have expand temperature.
- ↻ At last of the process, there will be no whitish  $\text{H}_2\text{SO}_4$  fumes.
- ↻ Allow it to cool for a while.

#### 3.6.4.2 Distillation

- ↻ Fill a conical flask halfway with distilled water and pour the solution in.
- ↻ Transfer 10 ml of the conical flask's contents.

- ↪ Distilled flask with 120 ml distilled water and 10 ml 40% NaOH.
- ↪ Use same amount of the trapping solution in the trapping conical flask.
- ↪ Then it will change from pink to pale yellow in the end the condenser and turn it on.
- ↪ Run this for 30 minutes.

### 3.6.5 Formula for Calculation

Here,

**B** = Titrate Value.

**S**= Blank Titrate Value.

**N**= Normality of NaOH.

**Ws**=Weight of Sample.

Therefore,

$$\text{Crude Protein (\%)} = \frac{(B - S) \times 1.4 \times 6.25 \times 20N}{Ws}$$

### 3.7 Crude FiberContent

After other ingredients are chemically broken down and dissolved, crude fiber is measured gravimetrically. After fire, the residual weight of the fiber is adjusted for ash content.

#### 3.7.1 Ingredients

- Quinoa Nutri-Bar.

#### 3.7.2 Apparatus and Equipment

- Balance Machine.
- Muffle Furnace.
- Hot Air Oven.
- Hot Plate.
- Beaker.

#### 3.7.3 Chemical Solutions

- 400 ml DistilWater.
- 3.5 ml Sulfuric Acid (H<sub>2</sub>SO<sub>4</sub>) (98%)+Add 100 ml Water.
- 0.313M Sodium Hydroxide (NaOH).

#### 3.7.4 Chemical Reagent Preparation

To finish the test method, two different kinds of chemical reagents are needed. According to the following, they are:

- ⇒ Boiling in Base
- ⇒ Boiling in Acid

### 3.7.5 Procedure

There have 4 stages to complete this test procedure. They are as per following,

- ⇒ Boiled in acid
- ⇒ Boiled in base
- ⇒ Boiled in fiber
- ⇒ Incineration of fiber.

### 3.7.6 Formula for calculation:

Here,

$W_1$  =Weight of Empty Crucible.

$W_2$ =Weight of Crucible with Ash.

$W_s$ =Weight of Sample.

Therefore,

$$\text{Crude Fiber (\%)} = \frac{W_2 - W_1}{W_s} \times 100$$

## 3.8 Sensory Evaluation

The samples were presented in a completely value of rating scale manner, such as a uniform state of Appearance,taste,texture,flavour and overall acceptability. Samples were presented in an anonymous way with a simple coding of four numbers. Nutri-Bar was evaluated for texture, appearance, taste, and flavour. The average value of these sensitive properties was assessed as overall acceptability. Samples were evaluated on a nine-point rating value scale, with 15 representing "moderate preference" and the remaining 20 representing "extremely preferred". Evaluation was done by an untrained panel of 75 students (40 males and 35 females) of Daffodil International University (Dhaka, Bangladesh). Their ages ranged from 22 to 25 years. In order to predict the acceptability of QuinoaNutri-Bar by consumers, QuinoaNutri-Bar was compared with the most eaten bar (Peanut Bar) in Bangladesh.

### 3.8.1 Consumers Acceptance

The amount of nutrients and energy in QuinoaNutri-Bar is much higher than other similar bar in the market. Again, this bar tastes much better than another bar. The sweetness of Nutri-Bar is naturally high which has no effect on our health and is very beneficial. There is no need to add any food-grade colour separately to QuinoaNutri-Bar. The natural colour makes the bar very attractive, which easily makes it attractive to a consumer.

For example, with the Nutri-Bar I made, I did a sensory analysis on 35 participants, ranging in age from 22-25. To anticipate consumer acceptance, the QuinoaNutri-Bar was compared to the most widely eaten bar (Peanut Bar) in Bangladesh. But most of them feel

that my Nutri-Bar is more acceptable and has health benefits than other Nutri-Bars in the market.

### **3.9 Microbial Test(Serial Dilution)**

A procedure known as serial dilution involves repeatedly resuspending an organism in this case, bacteria in predetermined quantities of liquid diluent until its concentration is systematically lowered. For the sample organism to be reduced logarithmically, the diluent's volume is typically a multiple of 10.

#### **3.9.1 Ingredient**

- Quinoa Nutri-Bar.

#### **3.9.2 Apparatus and Equipment**

- Test Tubes.
- 1ml Pipette.
- Distilled Water.
- Measuring Balance.
- Pipette Stand.
- Shaking Machine.

#### **3.9.3 Procedure**

- ↻ Aseptic procedures are used.
- ↻ Use a sterile pipette, filled five test tubes with the 9 ml of distilled water each.
- ↻ 1 gm of date jam is pipetted into a sterile pipette.
- ↻ After that, the sample is added to the first tube, resulting in a total amount of 10ml. It starts with a 10<sup>-1</sup> liquid and is thoroughly blended.
- ↻ And then, the final dilution for the bacterial cells will be 10<sup>-6</sup> due to the use of Six tubes.

### **3.10 Test of Total Bacteria Count**

Pour plate methods can be used to determine how many bacteria per millilitre or germs per gram are present in a sample.

#### **3.10.1 Ingredients**

- Quinoa Nutri-Bar.

#### **3.10.2 Apparatus and Equipment**

- Petridis
- Micropipette
- Alcohol
- Laminar Air Flow



- Autoclave
- Incubator
- Plate count Ager (PCA)
- Colony Counter

### 3.10.3 Procedure

- ↪ At first, we have to prepare the media and then sterilize the media for 30 minutes at 14.5 psi in an autoclave at 121°C.
- ↪ Fill Petridis with specified amount of sample.
- ↪ After autoclave, the media should be left to cool at 37°C to 40°C.
- ↪ Approximately 15 ml to 20 ml of the medium is placed in the Petri dish and thoroughly mixed allowing it.
- ↪ After plates solidified, flip it over and incubate it at 37°C for 24-48 hours.
- ↪ Use a colony counter to count the colony once it has been incubated.
- ↪ All processes should be carried out in a laminar airflow environment to maintain aseptic conditions.

### 3.10.4 Formula for Calculation

$$\text{CFU /ml} = \frac{\text{No. of Colonies} \times \text{Total Dilution Factor}}{\text{Volume of Culture Plates in ml}}$$

## CHAPTER 4

### RESULT & DISCUSSION

#### 4.1 Physicochemical Properties of Quinoa Nutri-Bar

Table 4.1: Physicochemical Properties of Quinoa Nutri-Bar

| Product          | Moisture | Ash | Fiber  | Fat    | protein |
|------------------|----------|-----|--------|--------|---------|
| Quinoa Nutri-Bar | 4.75%    | 1%  | 26.42% | 16.46% | 7.39%   |

- ⇒ **Moisture Content:** The moisture content of Quinoa Nutri-Bar is around 4.75%. The moisture content of the available hard candies is approximately 7-8%.
- ⇒ **Ash Content:** The ash content of the Quinoa Nutri-Bar is around 1%.
- ⇒ **Fiber:** The fiber content of Quinoa Nutri bar is around 26.42%.
- ⇒ **Fat:** The fat content of Quinoa Nutri-Bar is around 16.46%.
- ⇒ **Protein:** The protein content of Quinoa Nutri Bar is around 7.39%.

#### 4.2 Microbial Quality

- ⇒ **Microbial Load:** Bacterial count/ml 6000000 CFU/g [D.F-104].

#### 4.3 Sensory Quality

The data are collected from 75 observers who are happily participated and put their opinion through 9-point hedonic scales.

##### 4.3.1 Appearance Preference:

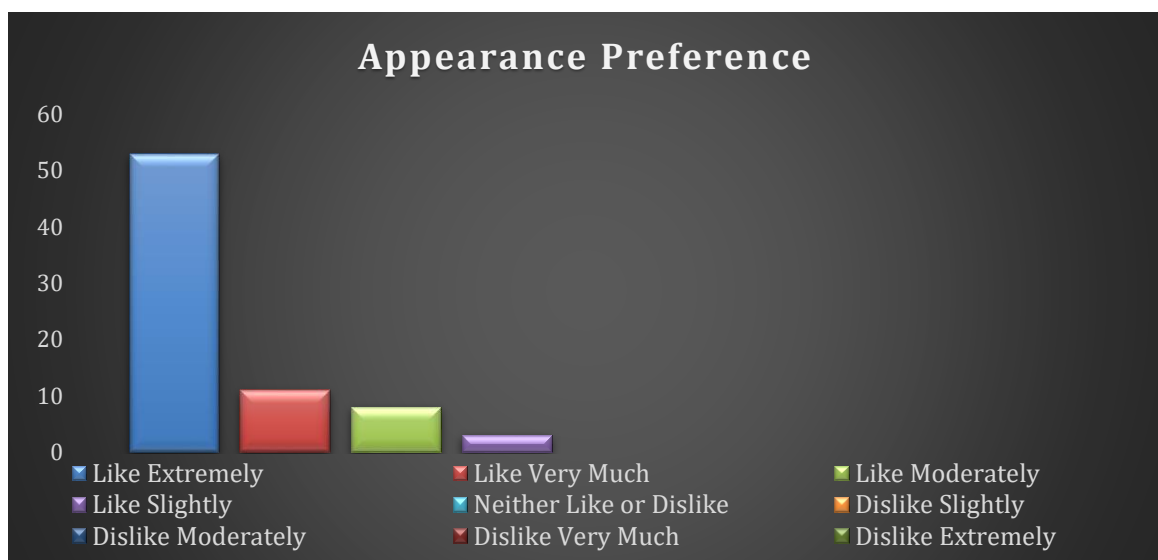


Figure 4.1: Appearance

In Figure 4.1, bar charts are presented, illustrating the Appearance Preference of Quinoa Nutri-Bar. Observers were surveyed to assess their subjective evaluations of Appearance, using a rating scale ranging from "Like Extremely" to "Dislike Extremely". Out of the sample size, 71% liked it extremely. Moreover, 15% of the respondents liked it very much

and 11% liked it moderately. However, only 4% of the observer liked it slightly and remained neutral. Specially, no one dislike the Bar by its appearance.

### 4.3.2 Taste Preference



Figure 4.2: Taste

In Figure 4.2, the Bar Graphical Chart represent the Taste Preference of Quinoa Nutri-Bar. According to the Taste Preference data analysis study, the majority of 77% of observers like the taste of Bar extremely. As well as, 11% and 9% participants were like the taste of the Bar very much and like moderately respectively. Whereas, 3% of the respondents liked the taste slightly. The most significant aspect was that none of them disliked the Bar.

### 4.3.3 Texture Preference



Figure 4.3: Texture

In Quinoa reflects through to the Bar Graphical Chart. Using the Likert scale ranging from "Like Extremely" to "Dislike Extremely", around 39% liked the texture of the Bar extremely and almost nearer 24% liked its texture very much. Moreover, 17% of the

respondents liked the texture moderately and 9% liked it slightly. But the 3% bar kept them neutral for its texture. But no one was disappointed with the texture of the bar.

#### 4.3.4 Flavour Preference



Figure 4.4: Flavour

In Figure 4.4, the bar chart shows the Flavour Preference of Quinoa Nutri-Bar. According to the study data of Flavour Preference, 43% liked the flavour of the Bar extremely. Whereas, 28% liking this and 17% liked medium. However, 9% of the participants liked is slightly and 3% were in neutral. However, none choose the remaining options from the flavour test.

#### 4.3.5 Overall Acceptability

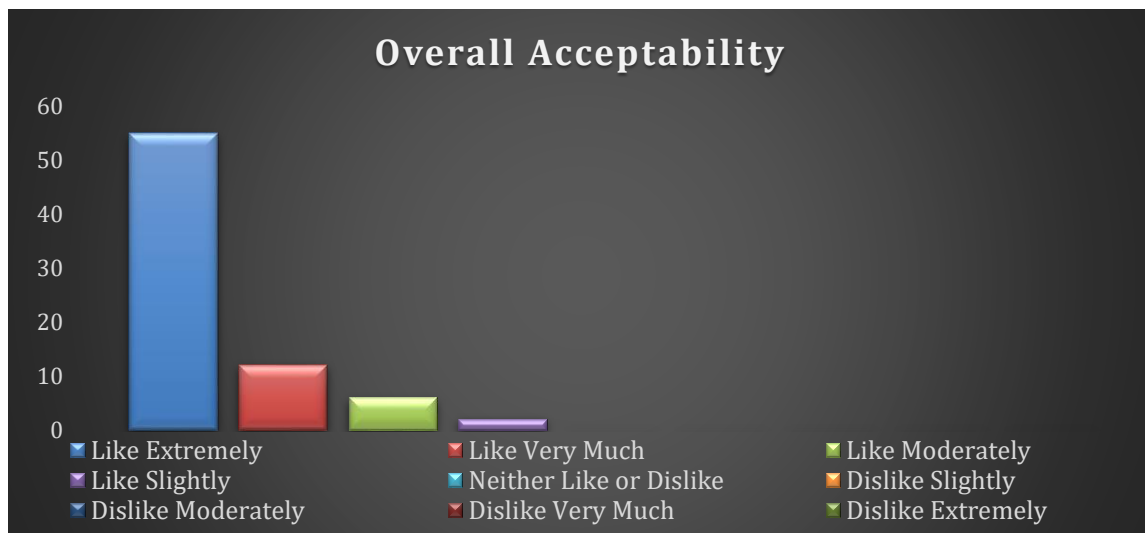
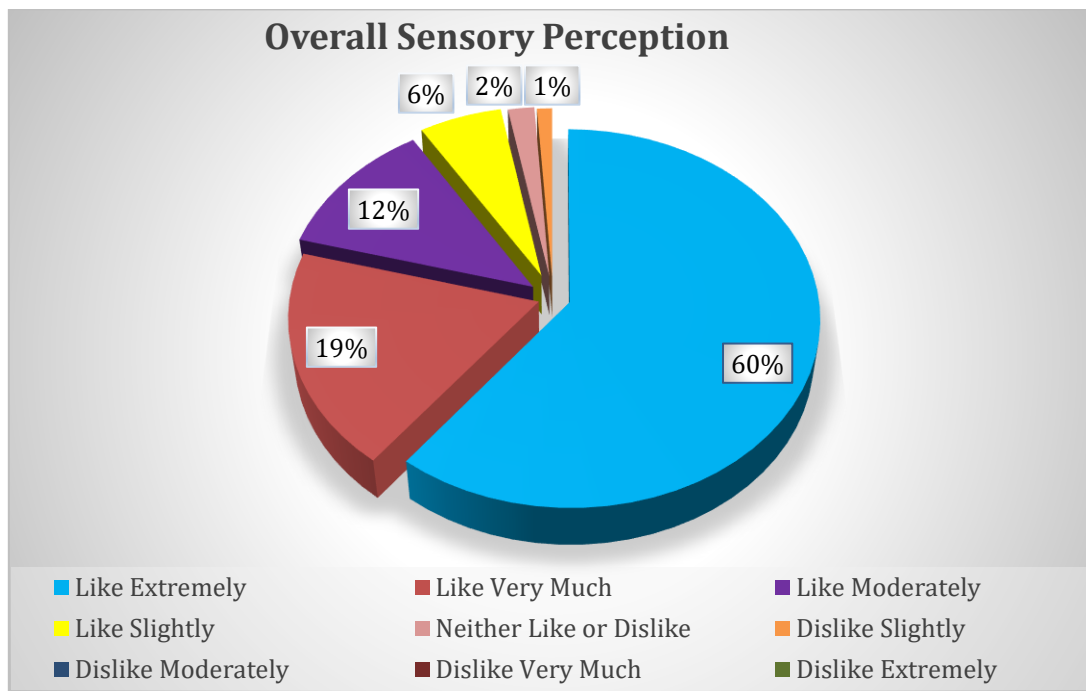


Figure 4.5: Total Acceptability

In Figure 4.5, bar charts are presented, illustrating the Appearance Preference of Quinoa Nutri-Bar. The majority of 73% Accept the Bar extremely considering all the perspectives. However, 16% liked very much through their acceptance. Moreover, 8% liked moderately and 3% liked slightly to accept the Bar as per their taste-bar. But most notably, no one rejects this Quinoa Nutri-Bar from their wish list.

### 4.3.6 Overall Sensory Perception



**Figure 4.6: Overall Sensory Perception**

The total scenario of sensory perception of Quinoa Nutri-Bar is illustrated in this pie chart in figure 4.6 all the consumer, 60% of them tell good it extremely, 19% good it excessively and 12% liked it Medium. In total, among all the criteria, 91% accept it with high preference and participants marked it the most. However, 6% liked it slightly as well as just 2% kept in neutral. Most significantly, just 1% slightly disliked the Quinoa Nutri-Bar.

### 4.4 Discussion

The moisture content of the Quinoa Nutri-Bar moisture content is less than 5%. The standard moisture content of Quinoa Nutri-Bar. (Padmashree, et al., July 2018) It means the Nutri-Bar moisture belongs to the standard level. Low humidity means longer shelf life. (PRAVALIKA G., 2022)

Which state that in sensory evaluation having at least 20 persons are sufficient. And, the combination of fiber and unsaturated fatty acids in this Nutri-Bar is ideal for patients with obesity, overweight and high cholesterol. Here 60% tell its taste very good and Quinoa Nutri bar texture, colour, taste, crunchiness are all good. It has very high fiber and nutritious food. And it can store 1-1.5 month.

## **CHAPTER 5**

### **CONCLUSION**

The study's overall result is that, it is possible to make Nutri-Bar from the Quinoa Rice. The Nutri-Bar received great feedback from the sensory evaluation due to its delicious flavour and consistency, colour and texture. It is low moisture content, Quinoa Nutri-Bar will be possible to keep for a longer period. Of the participants, 61% strongly preferred the Quinoa Nutri-Bar in terms of its organoleptic features. 19% of respondents, nevertheless, felt it was good. Every participant enjoyed the sweets. In the world of food engineering, the development of this confection represents a significant and beneficial breakthrough. The Quinoa Nutri-Bar, which is widely grown in many tropical regions, may now be used in a novel way thanks to this discovery. Nutri-Bar can be viewed as an appropriate and healthy snack choice, in line with customers' rising demand for healthier food options. There are significant limitations associated with this study.

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## APPENDICES

### Appendices 1: Sensory Evaluation Data Set

# Sensory Evaluation Form of Quinoa Based Nutri-Bar

Name: ..... ID .....

**Direction:** Please use sensory characteristics to evaluate this Quinoa Bar according to your preference;

**Daffodil International University**

[Check one rating scale for each following attribute of Appearance, Taste, Texture, Flavour and Overall Acceptability by using (√) right sign]

| Attributes<br>Rating Scale | Appearance | Taste | Texture | Flavour | Overall Acceptability |
|----------------------------|------------|-------|---------|---------|-----------------------|
| Like Extremely             |            |       |         |         |                       |
| Like Very Much             |            |       |         |         |                       |
| Like Moderately            |            |       |         |         |                       |
| Like Slightly              |            |       |         |         |                       |
| Neither Like or Dislike    |            |       |         |         |                       |
| Dislike Slightly           |            |       |         |         |                       |
| Dislike Moderately         |            |       |         |         |                       |
| Dislike Very Much          |            |       |         |         |                       |
| Dislike Extremely          |            |       |         |         |                       |

(Values of rating scale: Like Extremely – 9,      Like Very Much – 8,      Like Moderately – 7,  
                                          Like Slightly – 6,      Neither Like or Dislike – 5,      Dislike Slightly – 4,  
                                          Dislike Moderately – 3,      Dislike Very Much – 2,      Dislike Extremely – 1)





## Appendices 2: Synopsis



**Daffodil**  
*International*  
**University**

**Department of Nutrition and Food Engineering (NFE),**

**Faculty of Health and Life Science**

**Daffodil International University**

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

### **Synopsis of Thesis**

**1. Name: Fowzia Angel**

**2. Id: 191-34-836**

**3. Project title: Development and Quality Evaluation of Quinoa Nutri-Bar.**

#### **4. Introduction:**

One of the most flexible super food that humans can take is Quinoa, commonly regarded as a pseudo-cereal. Super foods are whole, organic foods that are low in calories and high in nutrients. They give the body the nutrients it needs to maintain good health and bolster its defences against disease. With all the essential amino acids your body need, it's a fantastic plant-based source of protein. Iron, zinc, manganese, and folate are just a few of the minerals and antioxidants that are abundant in it. There is a greater need than ever for food that is nutritious, safe, and healthy. The best way to prevent or treat illnesses like obesity, diabetes, malnutrition, cardiovascular disease, and others is to consume a balanced diet. Quinoa is a good source of fiber, B2 and mineral.

Nowadays, the food industry has created a significant number of quinoa-based culinary products that are distributed all over the world. These include drinks, flours, tortillas, chips, soups, and puffed quinoa (quinoa pop). Quinoa has a mild flavour and digests quickly. Because quinoa has a high nutritious content, it was included in the present study's Quinoa Nutri-bar together with additional components including flax seeds, chia seeds, dried fruits, almonds, etc. Packing the product in low density polyethylene and keeping it at room temperature allowed us to evaluate its stability. Over the duration of the storage time, the final product's physicochemical and sensory qualities increased. (PRAVALIKA G., 2022)

## **Problem Statement and Justification:**

Stronger muscles may result from quinoa protein since it has a higher protein efficiency ratio than milk protein. Because of its high fiber content and low glycaemic index, quinoa is a recommended food for diabetics. The carbs in quinoa have been shown to reduce triglyceride and free fatty acid levels in the blood. Because it nourishes intestinal microbes, the soluble fiber in quinoa helps to enhance gastrointestinal health. Linoleic acid, oleic acid, and linolenic acid are among the greatest plant-based sources of unsaturated fatty acids, and it has a poly unsaturation index ranging from 3.9 to 4.7. The inclusion of vitamin E in quinoa is thought to contribute to its antioxidant qualities against damage from free radicals to blood cells and protection of the cardiovascular system. Depending on variance, 100 g of quinoa can contain anywhere from 4 to 16.4 mg of ascorbic acid. Minerals such as calcium, magnesium, iron, and phosphorus are abundant in quinoa. It is considered a functional food because of its many health-promoting attributes, including as its anti-inflammatory, antihypertensive, antioxidant, and immune-modulating properties. Puffing is the process of cooking grains at a high temperature for a short while in order to make them crispy, porous, aerated, and extremely tasty when they're ready to eat. (Deepak Subramani, 2020)

## **5. Objectives of the Study:**

- ✓ To developed Nutri-Bar.
- ✓ To achieve knowledge.
- ✓ To see the consumer acceptance.
- ✓ For a thorough understanding of the nutritional value of Quinoa Nutri-bar.

**6. Ingredients:** Quinoa Rice, Molasses, Brown Sugar, Ghee, Dry fruits (Almond, Cashew, Pistachio, Peanut).

**7. Instrument:** Frying Pan, Cooking Spud, Mould, Measuring Cup.

## **8. Method:**

- ✓ Raw Quinoa Rice selection. Soaking rice for 1 hours.
- ✓ Puffing the Quinoa rice by heat. Heat and melt brown sugar and molasses. Cut all dry fruits and mixed all. After mixing place to the mould.
- ✓ After cooling cut down in pieces.

**8. Place of the Study:** Food processing Lab.

**9. Study Period:** My project work began on October 11,2023.

**10. Supervisor:** Juwel Rana, Assistant Professor, Department of NFE.

## **11. Expected Outcome:**

- ✓ Long shelf life, Successful testing.
- ✓ Customer satisfaction.
- ✓ Product quality.
- ✓ Launching new products in the community market.

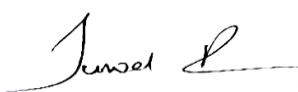
## 12. Conclusion:

The overall finding of the study indicates that quinoa rice may be used to manufacture Nutri-Bars. The Nutri-Bar's excellent flavour, consistency, colour, and texture earned it positive reviews throughout the sensory examination. Due to its low moisture content, Quinoa Nutri-Bar may be stored for an extended amount of time. When it came to the Quinoa Nutri-Bar's organoleptic qualities, 61% of the participants highly agreed. Nevertheless, 19% of those surveyed said it was good. In keeping with consumers' growing desire for better food alternatives, Nutri bars might be seen as a suitable and healthful snack option. This study is accompanied with notable limitations.

## 13. References:

- Bawachkar RR, M. D. (2021). Quinoa bar a novel food: A review. *The Pharma Innovation Journal*, 10(6), 82-86.
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## Supervised by:



**(Juwel Rana)**

Assistant Professor

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