DEVELOPMENT OF READY TO EAT STRAWBERRY BAR

A PROJECT REPORT

BY

MST. SHARMIN AKTER

ID: 193-34-216

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

Supervised By

Professor Dr. Md. Bellal Hossain

Professor

Department of Nutrition and Food Engineering

FACULTY OF HEALTH AND LIFE SCIENCES (FHLS)

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This Project titled **"Development of ready to eat strawberry bar",** submitted by **Mst. Sharmin Akter** 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.

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Dr. Nizam Uddin

Head

Nutrition and Food
Engineering Faculty of
Health and Life Sciences
Daffodil International
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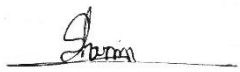
DECLARATION

I hereby declare that this project has been done by us under the supervision of **Dr. Md. Bellal Hossain, professor, Department of Nutrition and Food Engineering,** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

Dr. Md. Bellal Hossain
Professor
Department of Nutrition and Food Engineering
Faculty of Health & Life Sciences (FHLS), DIU.

Submitted by:



Mst. Sharmin Akter
ID: 193-34-216
Department of Nutrition and Food Engineering Daffodil International University

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ABSTRACT

An analytical study was conducted to develop a strawberry bar and analysis of the nutritional quality and storage stability of a newly formulated strawberry bar. In proximate analysis moisture, fat ,protein, ash, Brix, pH, acidity, vitamin C, total phenolic content, (TPC) of strawberry bar, it was found 19%,0.4%, 6.7%,0.72%, 30%the 4.12, 1.10%, 23 mg/100g, 0.15%, Its carbohydrate content stand at 36.8% providing a good energy source. The sensory evaluation of the strawberry bar was conducted based on nine-point hedonic scales. Sample 2 strawberry bar which hasbeen finalized by 9-point hedonic scale. The newly formulated strawberry bar was safe to consume for up to 3 days but not for 6 days.

Keywords

Strawberry Pulp, Strawberry Bar, Antioxidant, Sensory Evaluation.

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CHAPTER 1

INTRODUCTION

Strawberries are highly sought-after globally due to their high market value. There are over six hundred varieties, each with variations in flavor, texture, and size. However, the strawberries we commonly encounter today are scientifically known as Fragaria ananassa. The ancestors of all current strawberry varieties are Fragaria chiloensis and Fragaria virginiana. It is important to consume ripe fruit soon after it ripens, as fruits may deteriorate during distribution before reaching the market. Strawberries can also be used to make wine or liqueur, such as the Italian fragoli. They contain higher quantities of phenols and flavonoids compared to other berries. According to the Food and Agriculture Organization (FAO), global strawberry output has exceeded 4 million tons, with the United States contributing 28 percent. The edible part of a strawberry is the juicy thalamus of the flower, which contains a receptacle with several achenes. Strawberries are not only aesthetically pleasing due to their exquisite flavor and refreshing scent but also have significant nutritional benefits and antioxidant characteristics. This is due to the presence of health-enhancing components in plant-based goods, achieved through multiple complementary pathways that include tannins, flavonoids, and phenolic acids. Strawberries are known for their abundance of polyphenols, particularly Ellagitannins (ETs). The composition and amount of ETs in strawberries have not been extensively studied. Ellagitannins and their metabolites have several health-promoting attributes, such as antiviral, antibacterial, antioxidant, antimutagenic, and anticarcinogenic activities. Polyphenols significantly impact signaling molecules in the activation of signal pathways, which in turn affects cellular function and gene expression. Additionally, they directly influence the digestive system. The *Fragaria ananassa* hybrid cross, dominating strawberry production worldwide, has not gained popularity in Khagrachhari. Aromas possess substantial, robust fruit with exceptional taste, pleasing color, and a vibrant luster. A single portion of strawberries contains roughly 33 kilocalories. They are a rich source of vitamin C, a significant source of manganese, and provide several other vitamins and dietary fiber elements in smaller amounts. Strawberries are a significant fruit crop in the commercial industry and are abundant in nutrients such as antioxidants, vitamins, dietary fiber, and several other nutritive components. They are highly perishable and cannot be preserved for an extended period. A comprehensive examination was conducted to create a strawberry

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bar and evaluate its nutritional quality, texture, sensory qualities, and storage stability.

1.2 Objective

- To know about Strawberry Bar
- How to make Strawberry Bar and Test it Quality.
- To know about its nutrients.
- To study sensory characteristics of Strawberry Bar.

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CHAPTER 2

LITERATURE REVIEW

Strawberry Bar is a globally renowned delicacy that commands a premium price. More than six hundred varieties exhibit flavor, texture, and size variations. Nevertheless, several strawberries known to us are now classified as Fragaria ananassa. The rapid advancement of technology in controlled environment (CE) plant production has been implemented across various plant species. Strawberries have gained popularity in CE production because of their significant economic and nutritional benefits in recent years. LED technology is widely used in the produce business to influence strawberry growth and development by providing precise light spectra.

Modifying the intensity and content of light may alter the secondary metabolism of strawberries, leading to significant effects on the quality of the fruit and its antioxidant capabilities. Although the effects of visible light on secondary metabolite profiles in other greenhouse crops are well-documented, more understanding is needed about the influence of various light spectra, ranging from UV radiation to the visible light spectrum, on strawberry plants. This will enable cultivators to optimize crop production and quickly adjust to changing customer tastes.

This study is a collection of papers that examine the impact of light qualities on the flavonoids found in strawberry fruit. It also includes a comparative investigation of how different light spectra affect strawberries' photobiology and secondary metabolism. This study examines the impacts of UV radiation and visible light on crops before and after they are harvested. The paper discusses the potential applications and consequences of LED lighting schemes in strawberry fruit production, focusing on future investigations and ramifications for researchers and producers.

Strawberries, in addition to being a delicious treat, are a powerhouse of essential elements such as vitamin C, fiber, potassium, and antioxidants. These nutrients contribute to various health advantages, making strawberries not just a tasty snack, but also a significant part of a healthy diet.

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CHAPTER 3

MATERIALS AND METHODS

3.1 Resources and Study Site

All of the ingredients were bought from neighborhood markets and department stores. The study was executed at Daffodil International University's Food Processing Lab.

3.2 Ingredients

- Strawberry
- Sugar
- Salt
- Pectin
- Cornflour
- Citric Acid
- Sodium Benzoate
- Strawberry essence

3.4 Obtaining raw materials

I purchased the strawberries from a nearby store. The majority of the ingredients and preservatives I have used are readily available in stores.

3.5 Equipment and Apparatus

- Measuring balance
- Blender
- Steel Strainer & Sleeves
- Stove
- Large Pan
- Microwave oven

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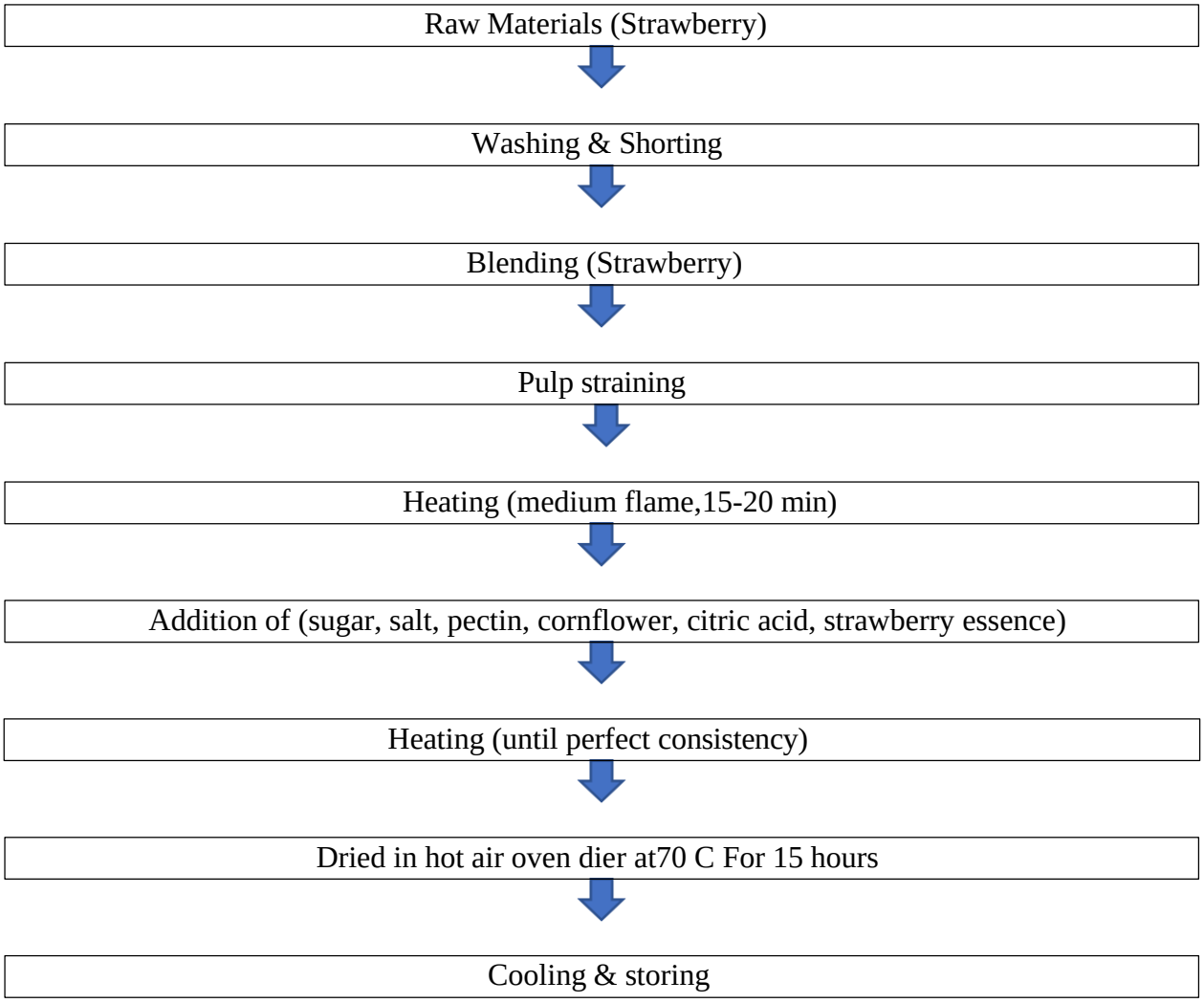
3.6 Formulation of Strawberry Bar

Ingredients	Sample 1	Sample 2
Strawberry pulp	200g	200g
Sugar	40g	40g
Salt	3g	3g
Pectin	6g	5g
Citric Acid	3g	2g
Corn Flour	5g	5g
Strawberry essence	1-2 Drops	1-2 Drops

3.3 Process Diagram:



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3.1: Strawberry Bar

3.4 Determinat

ion of pH

3.5 Apparatus:

- pH meter
- Beaker

Reagent:

- Buffer pH: 1
- Buffer pH: 2

Procedure:

- First, turn on the pH meter. Pour 100 milliliters of the sample into a beaker.
- Ensure that the temperature sensor and pH electrode are dry and clean.
- Use buffers 1 and 2 to calibrate the pH meter.
- Then immerse the electrode in the sample beaker.
- The pH meter's digital screen will show the pH value.

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Figure 3.2: pH Meter (hannainst.com)

3.6 Moisture determination

Apparatus:

- Moisture analyzer
- Aluminum foil
- Weight balance
- Sample

Procedure:

- First, take 2 gm of sample.
- After inserting the sample into the digital moisture analyzer, wait for the device to display the reading.
- Then take the result.

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Figure 3.3: Digital Moisture Analyzer (atlanticscale.com)

3.7 Brix determination

Apparatus:

- Refractometer
- Dropper

Procedure:

- First, take the brix analyzer (refractometer) and use distilled water to clean the prism.
- Next, take a dropper and fill it with the sample.
- Place a drop of sample onto the refractometer's prism.
- Reading were taken and the prism was rinsed with distilled.

Figure 3.4: Refractometer (wonderfulengineering.com)

3.8 Ash determination

Apparatus:

- Porcelain crucible
- Crucible Tong
- Measuring balance
- Muffle furnace
- Desiccators

Procedure:

- Firstly, place a crucible in the muffle furnace and heat it for thirty minutes at 105°C.

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- After that, it was cooled and weigh without sample .
- Next, weigh the crucible and sample together (noting them both) after adding a 2- gram sample to it.
- After that, heat the sample-containing crucible in the muffle furnace for 6 to 8 hours, or until it turns to ash, at 600 to 620°C.
- Finally, determine the percentage of ash content.

Calculation: %Ash = (weight of sample / weight of dry ash) × 100

Figure 3.5: Muffle Furnace (labrotovap.com)

3.9 Protein

determination Kjeldahl methods consist of 4 steps. 1: Digestion

2: Distillation

3: Titration

4: Calculation

Reagent:

- Sulfuric acid (95%–98%) concentration
- 40% solutions of sodium hydroxide
- 0.1N hydrochloric acid
- Catalyst (2g Copper sulphate+98g Potassium sulphate)

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- 4% boric acid
- Methyl red

Digestion: For assistance in the sample's digestion, 4g was put on weighing or foil paper. The substance was added to a flask for digestion. Ten milliliters of H2SO4 were added to the flask after two grams of the digesting mixture had been introduced. To get an average figure, two digestion flasks were utilized. Before being utilized, the flasks were cooked in a kjeldahl digesting chamber. The temperature at which the experiment started was 400 degrees Celsius. The temperature eventually rose to 600 degrees Celsius. It has to remain in the solution for three or four hours for it to become colorless. After allowing the flasks to cool, the experiment was completed by diluting them with 100 mL of distilled water.

Distillation: Ten milliliters of the solution were moved from that flask to the distillation flask. The flask received 150 milliliters of distilled water added to it. The distillation flask was filled with ten milliliters of 40% NaOH. The mixture had no color at all. Three distillation flasks were used in this experiment, one of which had no material at all. There was absolutely no sample in the third distillation flask; all that was in it were the reagents. The trapping conical flask was filled with two drops of methyl red. The answer became rather pink. The identical conical trapping flasks were used in three sets. Using operation, the distillation process was finished in thirty minutes. We titrated the NaOH solution using conical flasks. The burette was loaded with 0.1N NaOH in order to titrate. Conical trapping flasks were used after that.

Figure 3.6: Distillation Unit (labconco.com)

Titration:

Placed under the burette for titration. NaOH was added drop by drop into the burette's trapping conical flask while the flask was gently agitated. After adding NaOH, the

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color altered. Eventually, the color transitioned from pink to a vivid yellow.

Calculation:

(B-S) *1.4*0.1*5.95*10/sample weight = Protein %

3.10 Fat determination Apparatus:

- Weight balance
- Water bath
- Thimble
- n-HEXANE
- Filter Paper
- Soxhlet equipment

Procedure:

- Place a 5g sample in the thimble after it has been ground and dried (moisture removed).
- It is necessary to insert the thimble into the 12 Soxhlet extractor.
- Put 90 milliliters of n-Hexane into a 150 milliliter flask with a round bottom.
- Place the whole apparatus on a heating mantle and bring the n-Hexane to a boil.
- Continue the extraction procedure for over six hours.
- After removing the extraction unit's condensing unit, allow the sample to cool. In the end, all of the fat is eliminated.
- Collect nearly every drop of the solvent after distillation.
- The sample should be placed in the desiccators after being taken out of the oven.
- Determine the weight of the sample.

Calculation:

Total Fat = (W2 – W1 / Ws)

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* 100 Sample weight = Ws

Before extracting fat, thimble = W1

After fat is extracted, thimble with fat = W2

Figure 3.7: Soxhlet Extraction Unit (chemicoscientific.com)

3.11 Total Carbohydrate

A subtract method was used to compute the total amount of carbohydrates.
Fat + Protein + Ash + Moisture - 100 = Percentage of Total Carbohydrate

3.15 Determination of Microbial Contamination

Reagents: To prepare Sodium Chloride Solution, dissolve 2.5 grams of sodium chloride in 200 milliliters of purified water. For Agar Media Preparation, combine 5 grams of agar powder with 200 milliliters of distilled water.

Procedure:

1. Sterilize test tubes, beakers, measuring cylinders, pipettes, micro pipettes, and petri dishes in an autoclave at 121 degrees Celsius for 30 minutes.

2. Perform serial dilution by transferring the sample between test tubes.

3. Distribute the sample into petri dishes with agar, then incubate them at 37 degrees Celsius for 24 hours.

The following was the formula :

Colony - forming Unit (CFU) = (No.of colony x Dilution factor)/volumes of sample

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3.16 Determination of Vitamin C

The amount of vitamin C in each sample was estimated using the standard method . Chemical 2,6-dichlorophenolindophenol is reduced to a colourless form by ascorbic acid. The reaction is specific for ascorbic acid at pH 1 to 3.5. The dye is blue in an alkaline solution and red in acid. 10 ml of standard vitamin C solution is taken in a conical flask and titrated with the dye solution. Four to six grams of tuber dry powder are taken and homogenized well with 3% metaphosphoric acids and filtered through a double layer of muslin cloth. The filter was centrifuged at 3000 rpm for 10 minutes and the supernatant was titrated with 2,6-dichlorophenolindophenol solution. The amount of vitamin C present in the extract was determined by comparing it with the titration result of a standard vitamin C solution.

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CHAPTER 4

RESULTS AND DISCUSSION

4.1 **Proximate composition**

The proximate composition of this sample provides valuable insights into its nutritional content and overall quality. With a moisture content of 19%, this composition indicates a moderate level of water presence, which contributes to the food's texture and mouthfeel. In terms of macro nutrients, the protein content is 6.7%, which is a reasonable protein source. The low fat content of 0.4% indicates a lean profile, making it suitable for those seeking lower-fat dietary options. Carbohydrates make up a significant portion at 36.8%, suggesting a good source of energy. The Brix value of 30% indicates the food's sweetness, as Brix is commonly used to measure sugar concentration. A higher Brix value often correlates with increased sweetness in food products. The pH level of 4.12 implies a slightly acidic nature, contributing to the overall taste profile and potential shelf stability of the product. It's crucial for understanding the sensory characteristics and preservation aspects. The ash content, representing the inorganic mineral content, is at 0.72%. This provides insights into the food's mineral composition and its potential contribution to overall dietary mineral intake.

Table 4.1: Proximate composition

Composition	Value
Moisture	19 %
Protein	6.7 %
Fat	0.4 %
Brix	30 %
Carbohydrate	36.8 %
pH	4.12

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Ash	0.72 %
Fiber	17%
Vitamin - C	23mg / 100 mg
TPC	$3x10^5$ CFU/ml

Microbial quality test for sample 1&2 .Here is we get the result has 3×10^5 CFU/ml &4.4×10^4 CFU /ml

4.1 Sensory Evaluation

Three types of samples were made for the 9-point Hedonic test with the difference in citric acid and other ingredients were the same. Sample 1 - 40 gm, Sample 2 - 50 gm.

Sample 1:

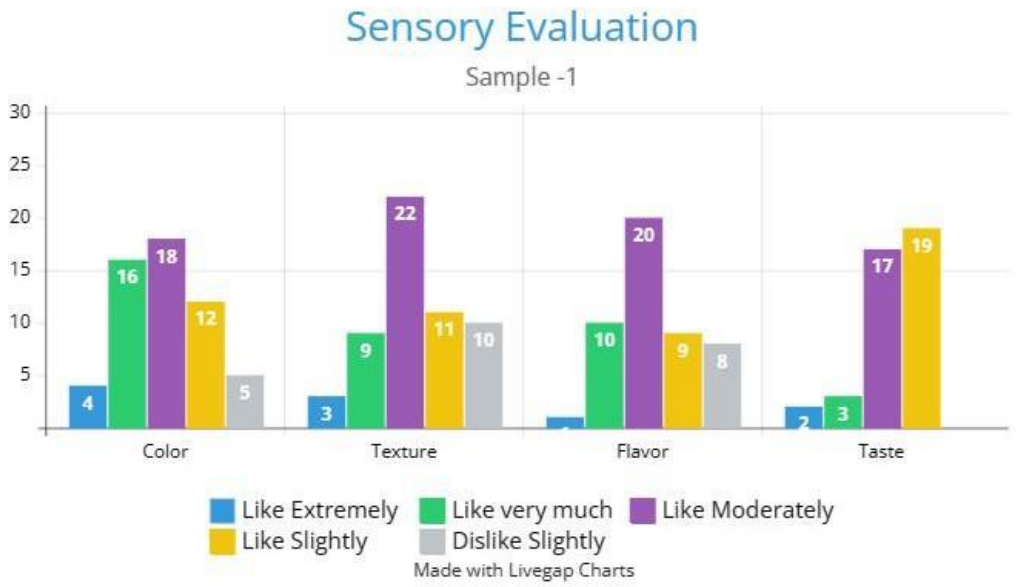

Figure 4.1: This graph demonstrates that, of the 50 respondents, the majority claimed they enjoyed it only passably, with the exception of flavor.

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Sample 2:

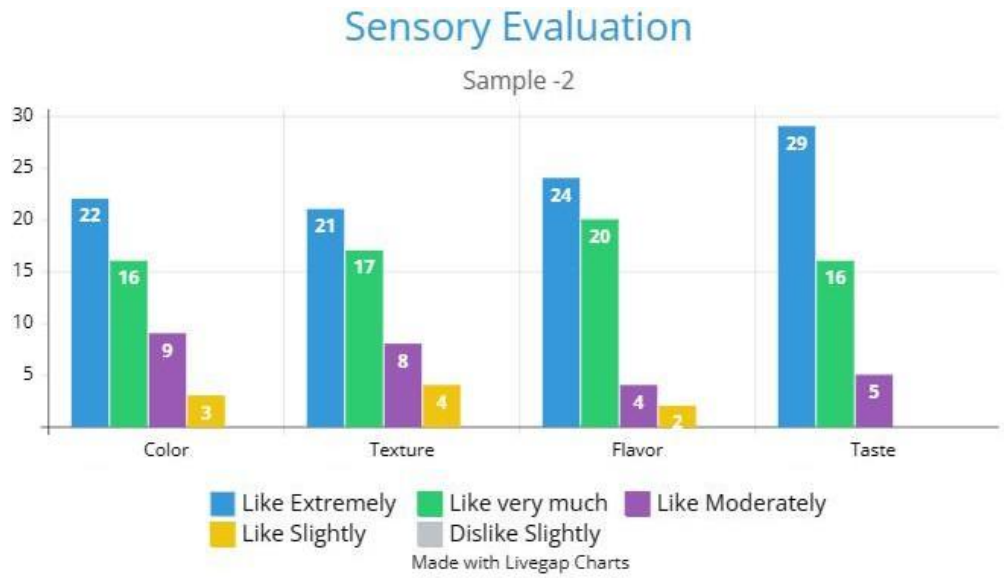

Figure 4.2: This graph indicates that, of the 50 respondents, the vast majority claimed they really enjoyed it, and as there were no negative comments, the product's approval was 100% decided.

Figure 4.3: This graph indicates that, of the 50 respondents, the majority stated they enjoyed it only a little.

Overall Acceptability

Sample 2

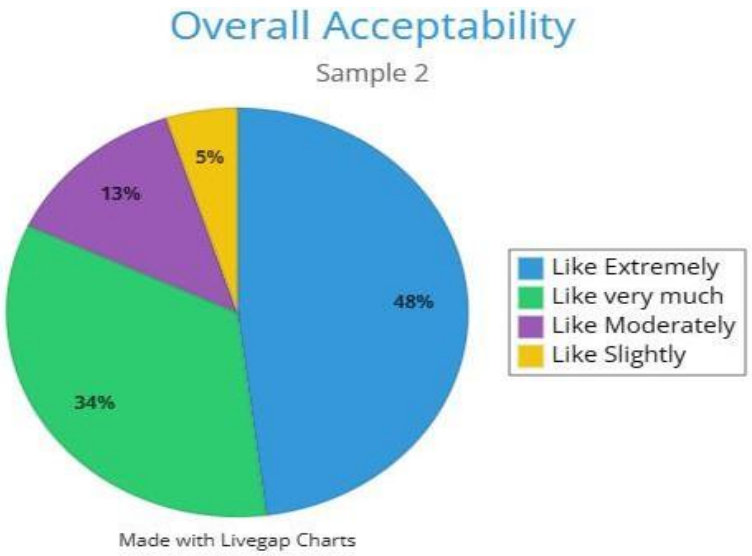

Figure 4.4: Overall acceptability of sample 2 Stawberry Bar which has been finalized by 9- point hedonic scale.

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CHAPTER 5

CONCLUSION

The growing popularity of ready-to-eat fresh fruit can be attributed to their freshness, low calorie content, and their ability to easily fit into a balanced diet that promotes fruits and vegetables as essential components. Fresh strawberries, when held at low temperatures, typically have a shelf life of under 5 days, and this duration is further shortened when the product undergoes minimal processing. Strawberries are a significant fruit crop in the global commercial market and have recently been introduced in Bangladesh. A comprehensive study was conducted to develop a strawberry bar and assess its nutritional quality and storage durability. From a microbiological perspective, the proximate analysis of the moisture, ash, pH, acidity, and vitamin C content of the newly developed strawberry bar indicated that it was safe for consumption for a maximum of three days, but not beyond six days.

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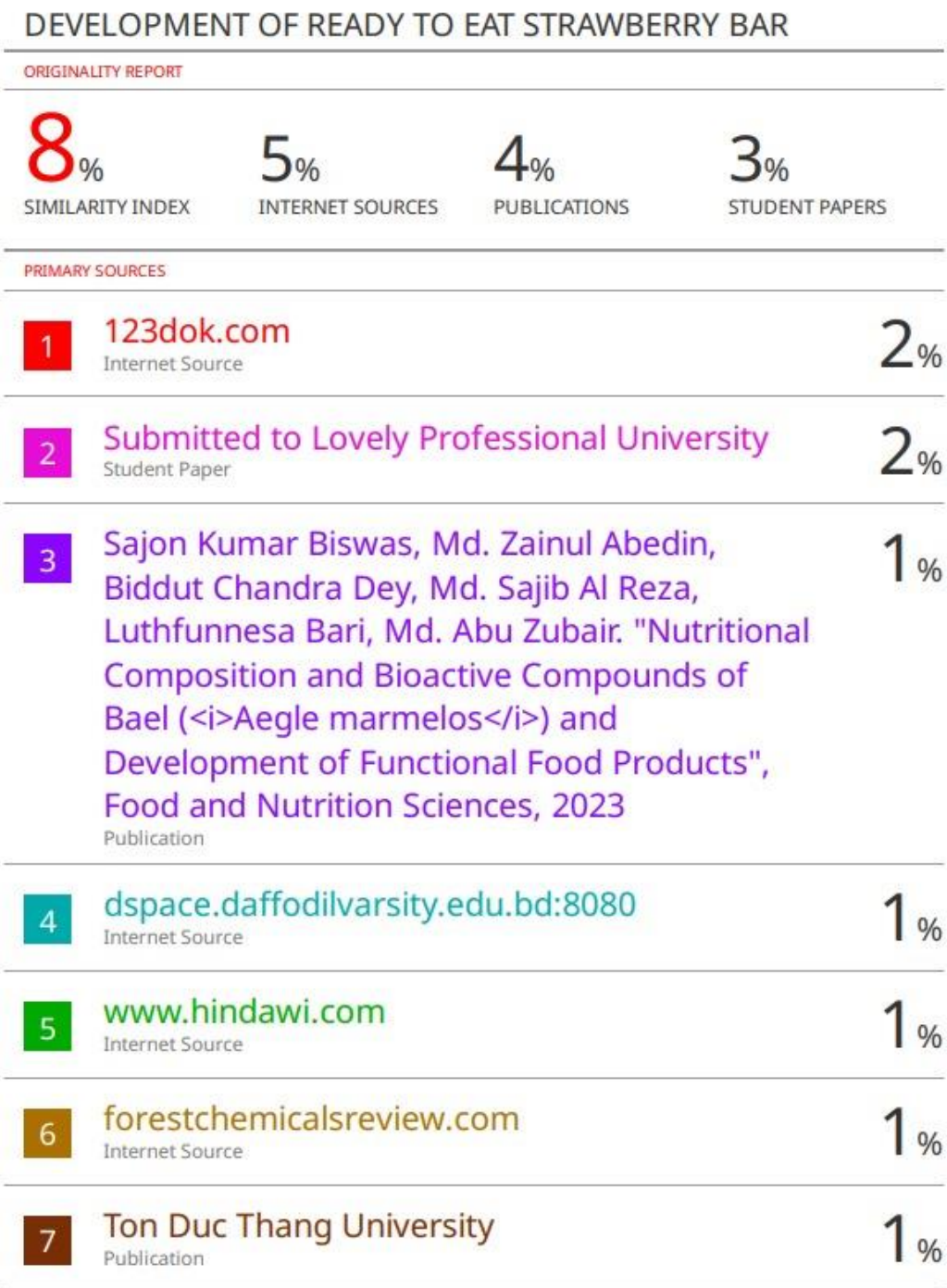
APPENDICES

Appendix 1: Plagiarism report



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