A PROJECT WORK REPORT

On

Study on Chemical and Organoleptic Properties of Value-Added Potato Chips

Submitted To

Ms. Fouzia Akhter
Assistant Professor and Head
Department of Nutrition and Food Engineering
Faculty of Allied Health Science

Supervised by

Effat Ara Jahan
Lecturer (Senior Scale)
Department of Nutrition & Food Engineering
Daffodil International University

Submitted By:

Md. Mahmud Hasan
ID: 181-34-729
Department of Nutrition & Food Engineering
Daffodil International University

Date of Submission 20.02.2022

LETTER OF TRANSMITTAL

Date 20.02.2022

To

Ms. Fouzia Akter
Assistant Professor and Head
Department of Nutrition and Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

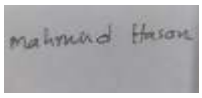
Subject: Submission of Project Report.

Dear Sir,

It is a tremendous pride and honor for me to be able to submit a project report as part of the Nutrition and Food Engineering (NFE) program curriculum. This report has been created based on the taste expertise I gained during my thesis session at our food lab. Working under your active supervision is a big accomplishment. The basis for this report is "Study on Chemical and Organoleptic Properties of Value-Added Potato Chips."

I, therefore, would like to submit this report for your review and feedback. Your thoughtful suggestions will promote greater planning in the future.

Sincerely Yours,



Md. Mahmud Hasan
ID: 181-34-729
Department of Nutrition and Food Engineering
Daffodil International University

LETTER OF AUTHORIZATION

Date 25.02.2022

To
Ms. Fouzia Akter
Assistant Professor and Head
Department of Nutrition and Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

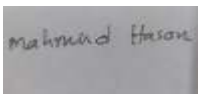
Subject: Declaration regarding the Project Report's authenticity.

Dear Sir,

This is my unequivocal declaration on the "Project Report." I did not create a copy of any past students' thesis reports.

I further express my sincere affirmation in support of the fact that the stated thesis report has never been utilized to meet any other course-related requirements, nor will it be submitted to any other person or authority in the future.

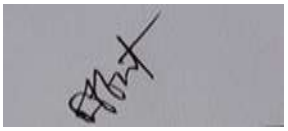
Sincerely Yours,



Md. Mahmud Hasan
ID: 181-34-729
Department of Nutrition and Food Engineering
Daffodil International University

CERTIFICATION OF APPROVAL

I am delighted to verify that Md. Mahmud Hasan's project report, "Study on Chemical and Organoleptic Properties of Value-Added Potato Chips." has been authorized for presentation and defense/viva-voice by the department of Nutrition and Food Engineering. It is my pleasure to certify that the data and findings presented in the report are Md. Mahmud Hasan's original work. For more academic advice and defense/viva-voice, I strongly suggested Md. Mahmud Hasan's report. Md. Mahmud Hasan has a lovely demeanor and a solid moral character. Working with him has been a real pleasure. I wish him the best of luck in life.



Ms. Fouzia Akter
Assistant Professor and Head
Department of Nutrition and Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

Effat Ara Jahan
Lecturer (Senior Scale)
Department of Nutrition & Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

ACKNOWLEDGEMENT

I'd like to acknowledge a number of people for their support and assistance in the development of this report. First and foremost, I'd want to thank Almighty Allah for providing me with the strength and opportunity to successfully complete the report within the allotted timeframe. I'd want to use this opportunity to express my gratitude to everyone who has been a part of my life at any point. I attribute my existence to my parents, without whom I would not be alive. I would not be able to reach my ambitions and goals without the help of my parents. My heartfelt gratitude and deepest appreciation go to Ms. Fouzia Akter, Honorary Head and Assistant Professor, Department of Nutrition and Food Engineering, for her gracious cooperation and acceptance of this Degree. Without her guidance this paper would not been completed. I am grateful to my Supervisor, Lecturer Effat Ara Jahan of the Department of Nutrition and Food Engineering at Daffodil International University, for her unwavering guidance during my organizational attachment time. It would have been extremely impossible to complete this report without their assistance. I'd want to offer my heartfelt gratitude to NFE faculty members for their endless inspiration and encouragement during my time as a student.

ABSTRACT

This study was aim "Chemical and Organoleptic Properties of Value-Added Potato Chips." The ingredients for the final product were gathered from local and online markets, cleaned, chopped into bits, sun dried, and ground then mash the potato, add flour, salt. Make doe perfectly and boils as a roll and cut them into perfect shape. After sun dry frying into boiled vegetable oil. After that add the seasoning which is made with carrot and spinach granular powder, red chili, testing salt, salt, hot spices. Each stage is completed in a safe and sanitary manner. The temperature of the drying process is kept low enough so that the nutritious content of the food is preserved. In this study, it was discovered that s2 (with seasoning) had a higher protein content (16.29%) than s1(without seasoning) (15.167%). Also, s2 (with seasoning) has higher ash content (1.6%) than s1 (without seasoning) that is 1.16%. No microbial growth was seen in both s1 (without seasoning) and s2 (with seasoning). s1 (without seasoning) and s2 (with seasoning) were the two samples. The s1 has no vitamin A content but s2 contain Vitamin A (1372.25µg per 100 gm.). The sensory evaluation of s1 vs. s2 potato chips was performed by 80 panelists of various sensory parameters such as appearance, flavor, taste, texture, and overall acceptability. s2 (with seasoning) performed well in the quality parameter test, and the panelists agreed that it was the best in all sensory attributes. The study also revealed that among the panelists, s2 (with seasoning) was more acceptable than s1 (without seasoning).

Keywords: Potato, Potato Chips, Carrot, Spinach.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Potato (Solanum tuberosum L.) is a key staple crop and the world's fourth largest food crop and yielding more dry matter per hectare than cereal crops. It is rated fourth in the world among other food crops like as wheat, rice, and maize (Mahgoub et al., 2015). With a water content of 75%, it is a tasty, nutritional, and very edible vegetable. A hundred grams of boiled potato has 86 calories, 20 grams of carbohydrate, 1.7 grams of protein, 1.8 grams of fiber, 17 milligrams of vitamin C, 11 milligrams of riboflavin, 1.2 milligrams of niacin, 13 milligrams of calcium, and traces of other minerals and fiber (Fabbri & Crosby, 2016). It is a low-cholesterol, high-potassium diet that contains significant antioxidants, making it capable of protecting humans from cardiovascular disease and cancer (Andre et al., 2009). Aside from table and cooking uses, a variety of processed potato goods such as potato crisp, potato patties, dried potato granules, alcoholic drinks, and flakes are produced. Fried potatoes (French fries), boiled/steamed potatoes, baked potatoes, and mashed potatoes combined with yogurt or milk and butter are all common potato preparations (Tierno et al., 2016). The most significant one, however, is potato chips, which have garnered tremendous commercial significance in the processed food business. Potato also contains a variety of phenolic substances such as flavonols, anthocyanidins, and other phenolic acids. These highly prized chemicals serve a crucial function in protecting cells against degenerative diseases and possible oxidative stress damage (Akyol et al., 2016). Exploiting the naturally existing antioxidants present in potatoes as a functional component would be extremely advantageous in the creation of specialised food products. However, the potato crop is also associated with the presence of preprocessing toxins, such as glycoalkaloids in tubers (Nema et al., 2008), as well as post processing toxins, such as acrylamide in processed food preparations (Stadler et al., 2004), both of which are of serious food safety concern and are linked to their genetic precursor. Greening caused by light exposure (Sengul et al., 2004) and cold sweetening caused by low temperature storage (Blenkinsop et al., 2002) can cause considerable economic losses to the crop. These potatoes are used to manufacture several types of potato chips in addition to being utilized as a normal meal dish. Chips, particularly potato chips, are now a source of curiosity not just for youngsters but also for adults. Through proximate analysis, the paper describes the preparation and added value of potato chips.

1.2 Potatoes in Bangladesh

Since the late 1970s1, the success of the Green Revolution in the rice sector has produced a continual decrease in the real rice price2 and a reduced return on production, pushing farmers to increase the cultivation of non-rice crops in Bangladesh, as it did in India and other South Asian nations.3 Potato has long been regarded as one of these promising crops, and it has grown in popularity, particularly since the introduction of cold storage facilities (hereinafter referred to as "cold storages"), as it can now be consumed almost all year4, whereas most vegetables are only available seasonally due to a lack of preservation and/or processing facilities for such perishables.

Limited-income individuals eat affordable potatoes more than other vegetables (Pitt 1983; Poats 1986), and potato consumption is second only to rice and wheat in Bangladesh. 5 Because there is a substantial seasonal pricing differential between the harvest season and the other seasons in "normal" years, the availability of cold storages encouraged increased potato production and created much more value added than before in the storage and selling process. Propagated through grafting and other vegetative means.

1.3 Types of potatoes in Bangladesh

Several dozens of high yielding varieties (HYV) of potato were imported to Bangladesh and tested experimentally under local circumstances before being recommended for mainstream cultivation throughout the previous few decades. Initially, roughly 16 kinds were chosen in the 1970s, but ten were later deleted. About ten HYV have been released for cultivation in the nation after ongoing evaluation of the traits, varietal performance, and other features. However, the Bangladesh Agricultural Development Corporation (BADC) imports a large quantity of potato seeds each year for distribution to farmers. Bangladesh Agricultural Research Institute (BARI) has also constructed a farm for the production of HYV seed potatoes at Debiganj, Panchagar district.

Among the popular high-yielding cultivars are the following: (a) Cardinal- the most common of the foreign types, with rectangular, reddish tubers, shallow eyes, and smooth skin. The type was brought from Holland and has a potential yield of 20-25 million tons per acre. (b) Diament is another Holland type with oval to rectangular pale-yellow tubers, smooth skin, and shallow eyes. It is extremely disease resistant. The yield per acre ranges between 18 and 24 million tons. (c) Kufri Shindhury - reddish, round tubers with deep eyes and tough skin. This type was brought from India and is less vulnerable to pests and illnesses. It has a potential output of 18 to 22 million tons per acre. Patronis, Alpha, Archa, Multa, and Ukama Hira, Maurin, etc. are some more prominent exotic kinds. (Banglapedia, 2021)

Figure 1.1: Potatoes of different kinds

1.4 Uses of Potatoes

In Bangladesh, potato is mostly utilized as a vegetable, although in many other nations throughout the world it is the staple diet, accounting for more than 90% of the carbohydrate food source. Although potatoes are most commonly used to prepare potato curry with fish, pork, and eggs, there is a wide range of potato consumption in Bangladesh. Boiled potato, fried potato, mashed potato, baked potato, potato chop, potato veggie mix, potato singara, potato chips, French fry, and other potato-based foods are notable. In recent years, bakeries and fast-food restaurants have begun to provide a wide range of potato-based gourmet delights. (The Swazi News 1999)

1.5 Health Benefits of Potatoes

Potatoes are high in fiber, which can aid weight loss by keeping one fuller for longer. By keeping cholesterol and blood sugar levels in balance, fiber can help avoid heart disease. Potatoes are also high in antioxidants, which assist to prevent illnesses, as well as vitamins, which aid in good bodily function. In addition, potatoes can provide other health benefits such as digestive health, disease prevention, lower blood pressure, etc. In case of nutrition one potato, peeled, provides:

- Over 40% of the daily vitamin C
- Requirement around half of the daily vitamin B6 need
- More potassium than just a banana
- Potatoes are high in calcium, magnesium, and folate, among other nutrients.

In case of nutrients per serving, one medium potato contains:

- Calories: 265
- Protein: 6 grams
- Fat: 0 grams
- Carbohydrates: 61 grams
- Fiber: 4 grams
- Sugar: 5 grams

Niacin, choline, and zinc are all found in potatoes. The nutrients provided by various kinds are slightly varied.

Whole, unprocessed potatoes have extremely low sodium content, with just 10 mg per 100 g (3.5 oz), or less than 1% of the daily recommended limit. This isn't the case with processed potato goods like French fries and potato chips. Niacin, choline, and zinc are all found in potatoes. Potatoes also contain a chemical called alpha-lipoic acid (ALA), which aids the body's conversion of glucose to energy. Quercetin, a flavonoid present in potato skin, appears to have an anti-inflammatory and antioxidant impact, preventing free radical damage to the body's cells. Vitamin C, which functions as an antioxidant, is found in potatoes. Antioxidants may aid in the prevention of cell damage and cancer, as well as the promotion of good digestion and cardiovascular health. Potatoes are high in fiber, which helps to maintain a healthy digestive system and circulatory system. (webmd,2020).

1.6 About Potato Chips

A potato chip (also known as a crisp in British and Irish English) is a small slice of potato that has been deep fried or baked until it is crispy. Snacks, side dishes, and appetizers are all typical uses for them. The fundamental chips are fried and salted; other tastes and ingredients, such as herbs, spices, cheeses, spinach and carrot as added value, as well as other natural flavors, artificial flavors, and additives, are used to create more variants.

It is unknown when potato was first brought to the subcontinent. It is thought that Portuguese navigators brought potato to India for the first time in the early 17th century. The first record of potato growing in India may be found in an 1847 edition of The Gardening Monthly, a London-based publication. Potato was first grown in the districts surrounding Calcutta, and from there it expanded to Cherapunjee. Potato farming flourished over various provinces of India, including Bombay, during the governorship of Warren Hastings (1772-1785). (PotatoPro, 2009)

Figure 1.2: Potato Chips

1.7 Objectives:

General Objectives:

To study the Chemical and Organoleptic Properties of Value-Added Potato Chips

Specific objectives:

- To prepare potato chips
- To conduct proximate analysis of value-added potato chips
- Microbial analysis of potato chips.
- Organoleptic analysis of 80 people.

CHAPTER 2
MATERIALS AND METHODS

2.1 Materials and Methods

The research was carried out at food processing laboratory, Department of Nutrition and Food Engineering in Daffodil International University Ashulia, Dhaka.

2.2 Collection of Raw Materials

The fresh potatoes (*Solanum tuberosum*) were purchased from a local market. The scientific name is (BARI Alu 7). Collected flour from basundhora company, salt from ACI, other seasoning iteam collected from super shop. Collected carrot and spinach from rural area because of getting the fresh one. Which contain high minerals.

2.3 Potato Chips preparation

Preparation of a dehydrated potato product such as potato flakes or granules, mixing with water and other ingredients to form dough, sheeting the dough, cutting, cooking (frying or baking), sorting, seasoning, and packaging are all common steps in the production of fabricated potato chips and other fabricated potato snacks.

2.4 Methodology

The following components were used in the development of potato chips study.

Sample 1 (Without seasoning)

Ingredients: in 100g

i. Potato 60%
ii. Salt 2.6%
iii. Cooking oil 10.6%
iv. Red Chili 1%
v. Flour 25%
vi. Hot spices .8%

2.5 Method

- Some potatoes were boiled first.
- Then starch was collected from the potatoes.
- Flour, Salt, Chili, hot spices with the starch were added and a dough was made.
- Roll was made as per liking.
- Then the potatoes were put down in boiled water for 10 mins.
- After 10 mins, potatoes were taken out from the boiled water and after 1 hour, they were put into refrigerator for 24 hours.
- After 24 hour the roll was sliced with a slicer and dried well in sun.
- At the end, potatoes were fried with vegetable oil.

2.6 Preparation of making seasoning

- The potatoes were mixed with salt, testing salt, red chili and hot spices.
- At the end the chips were fried and seasonings were added which was ready for eating.

Sample 2 (With seasoning)

Ingredients:

i. Potato 55%
ii. Salt 2.6%
iii. Cooking oil 10.6%
iv. Red Chili 1%
v. Flour 20%
vi. Hot spices .8%
vii. Carrot 7%
viii. Spinach 3%

2.7 Method

- Some potatoes were boiled first.
- Then starch was collected from the potatoes.
- Flour, Salt, Chili, hot spices with the starch were added and a dough was made.
- Roll was made as per liking.
- Then the potatoes were put down in boiled water for 10 mins.
- After 24 hour the roll was sliced with a slicer and dried well in sun.
- At the end, potatoes were fried with vegetable oil.

2.8 Preparation of making seasoning

- The carrots and spinaches were cut properly.
- It was then dried in the sun.
- After drying, it was grinded with hand.
- Then it was mixed with salt, testing salt, red chili and hot spices.

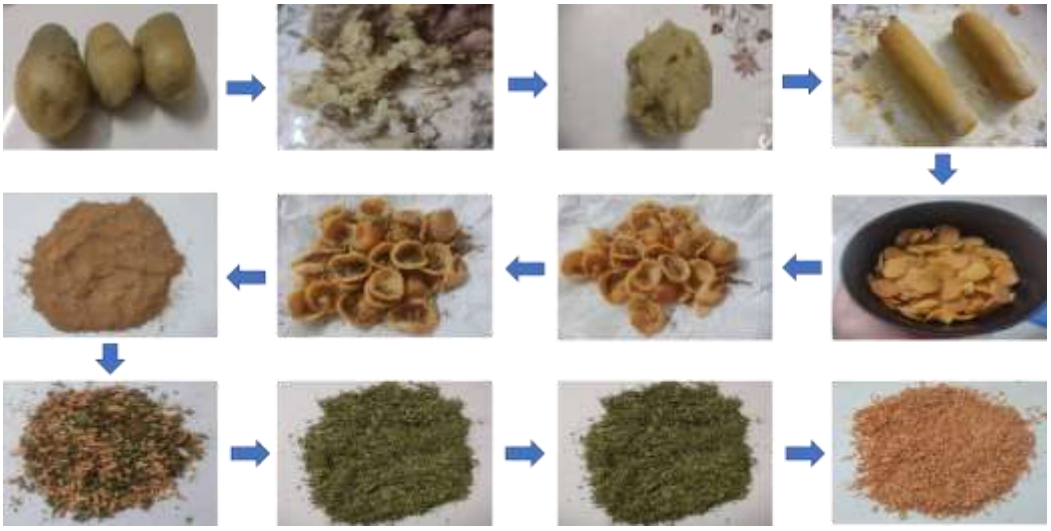


Figure 2.1: Preparation of potato chips

2.9 Flow Chart of preparation method of S1 and S2

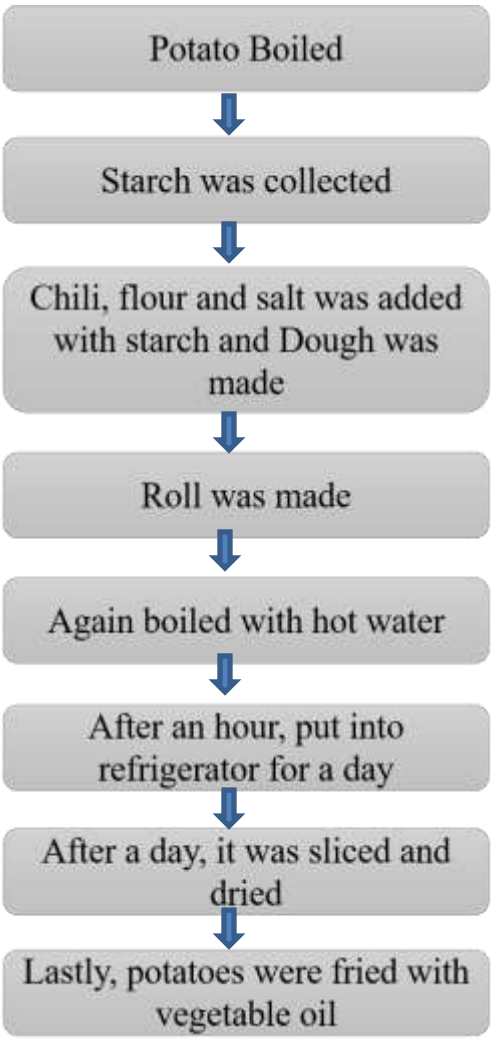


Figure 2.2: Sample 1 (without seasoning)

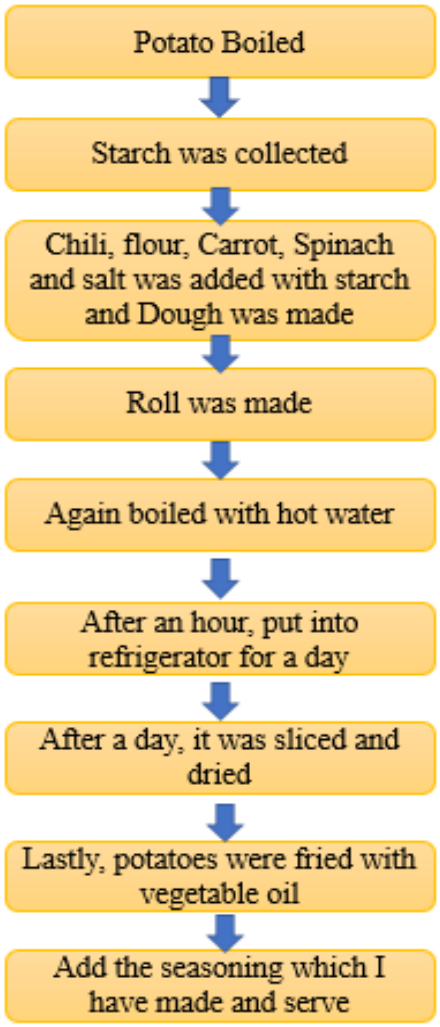


Figure 2.3: Sample 2 (with seasoning)

CHAPTER 3
CHEMICAL ANALYSIS OF POTATO CHIPS

3.1 Chemical Analysis

Moisture, Ash, Fat% of Value-added potato chips were determined by following methods described by; Moisture content by hot oven method at 110°C for 1 hours; Ash content by muffle furnace ignition method at 600°C. Fat determined by hexane treatment. Proteins determined by kjeldahl method are following:

3.2 Sensory Test

Chemicals / Equipment Required:

No chemicals are required.

Procedure:

1. Value added potato chips are tested by physical/sensory method.
2. This is done by using of eye, nose, and tongue.

Result:

If the chips are discolored, the scent does not alter, and the test results do not change, it is not acceptable. However, if it is colorful, well-tested, and crispy, it should be okay.

3.3 Determination of Moisture Content of value-added potato chips:

(Thiex N, Richardson CR)

The hot oven technique was used to determine the moisture content of the samples. Weigh the crucible when it's empty. The sample was then placed in a cleansed and dried crucible dish, weighed, and placed in a Phoenix oven (Preiser model, New York, USA) at 110°C for 1 hour until the weight was constant. The samples were weighed after cooling in a desiccator. The weight loss was determined using the moisture content as the basis:

$$\% \text{ Moisture content} = \frac{W2 - W3 \times 100}{W2 - W1}$$

Here:
W1 = initial weight of empty crucible;
W2 = weight of crucible + sample before drying;
W3 = final weight of crucible + sample after drying

Figure: Moisture determination

Result:

Moisture content is used to calculate the sample's moisture content.

3.4 Determination of Fat Content of value-added potato chips:

Jensen, I. J. (2018).

Materials:

1. Beaker
2. Measuring cylinder
3. Grinder
4. Funnel
5. Filter paper
6. Funnel holder
7. Sprit lamp
8. Measuring balance

Chemical : Hexane

Procedure:

a. Take 10 gram potato chips as sample
b. Grind them well.
c. Add 20 ml Hexane with measuring cylinder and continue grind the chips.
d. Set a filter paper on the funnel and take the hexane from the grind chips.
e. After that add another 20 ml hexane into the chips. And do it similarly.
f. After separate the hexane from chips take it in a beaker
g. Put a sprit lamp under the beaker and start heating.
h. After some time the hexane evaporate and the fat we found at the bottom of the beaker

Result:

The amount of fat is the fat content of the sample.

3.5 Protein Test: (Bess Ruff, MA)

The Kjeldahl method is used to determine the protein content of chips. The chips were digested with a strong acid (H2SO4), releasing nitrogen that could be measured using an appropriate titration approach. The nitrogen concentration was used to determine the amount of protein present. For this application, a conversion ratio of 6.25 (equal to 0.16 g nitrogen per gram of protein) was used. This was only an intermediary number, with each protein having a distinct conversion factor based on its amino acid makeup.

The Kjeldahl technique is easily broken into three phases:

- Digestion
- Neutralization and
- Titration.

Anhydrous sodium sulfate and a catalyst (copper) were added to lower the boiling point of the medium (from 337°C to 373°C). The previously extremely dark-colored liquid had turned clear and colorless, indicating that the chemical breakdown of the sample had been finished.

Result:

The amount of protein in the sample is the result of protein content.

Figure: Protein determination.

3.6 Determination of Ash Content of Value-added potato chips

(AOAC Official Method 2003.05)

The sampling approach for obtaining results is wet ashing. A crucible was heated to 60°C, then cooled in a desiccator before being weighed. Five grams (5 g) of the sample were placed in the crucible and placed in the furnace. After inserting the dish in the furnace, the temperature was allowed to rise to around 600°C. The temperature was kept constant until the water was completely evaporated, showing that all of the biological stuff in the sample had been eliminated (5 hours). The dish was then removed from the furnace, cooled in the desiccator, and weighed again.

Figure: Ash determination

Calculation:

$$\% \text{ Ash content} = \frac{C - A \times 100}{B - A}$$

Here:
A = weight of empty dish
B = weight of empty dish + sample before ashing
C = weight dish + ash

Result:
The Result of Ash content is the amount of Ash in the sample.

3.7 Microbiological Analysis (Total Viable Count of potato chips)

Method: **Pour Plate Count**

Subramanian et al., 2014Robinson, R. K. (2014)

Purpose:

The pour plate technique may be used to calculate the number of microorganisms per milliliter or germs per gram in a specimen**.**

Requirements of Media Preparation:

- Nutrient Agar
- Deionized water.
- Graduate Cylinder.
- Stir bar.
- Analytical Balance.
- Stir plate
- Lab Scoop.
- Aluminum Foil
- Autoclave

Media Preparation

1. A graduating cylinder was filled with 100ml of deionized water.
2. A stir bar was inserted in a 250 ml flask.
3. For analytical balance, a weight boat was placed on the balance.
4. To zero out the weigh boat, use the tare button.
5. 5.2g of Nutrient Agar was added using a lab scoop.
6. Powder was now added to the flask.
7. Deionized water (75ml) was added.
8. A stir plate was placed on top of the flask.
9. After roughly 2 minutes, the remaining 25 ml from the graduate Cylinder was added.
10. The solution was mixed until all visible clumps were broken down.
11. Aluminum foil was used to cover the flask.
12. The medium was then sterilized using an autoclave.
13. Power was applied to the autoclave, the drain valve was closed, and deionized water was added to the level indication line. The culture media flask was placed in a basket. To form an airtight seal, the basket was inserted, the lid was closed, and the handle was cranked.
14. The control panel was used to set the sterilization mode, the temperature to 121 degrees Celsius, and the timer to run for one hour.
15. Once the cycle was completed and the pressure gauge showed 0 PSI, heat proof gloves were used to carefully lift the lid and retrieve the sanitized flask.
16. The flask was put on the stir plate, and the media was stirred.

For the sample of Value-Added Potato Chips, the Serial Dilution Method is employed. As a result, the sample concentration is reduced, and the microbiological count is improved.

Serial Dilution Method

Materials Required:

- Test Tube.
- Pipettes.
- Beaker.
- Sample.
- Distilled water.

Procedure

1. A, B, C, and D test tubes were taken.
2. These test tubes were filled with 9 mL of distilled water.
3. 1 mL sample solution was added to test tube A and well mixed.
4. 1ml of the solution from test tube A was put into test tube B and well mixed.
5. After that, 1ml of the solution from test tube B was transferred to test tube C and well mixed.
6. 1 mL of solution from test tube C was transferred to test tube D, mixed well, and repeated until the needed dilution was reached. We're going to make a 10' dilution here.

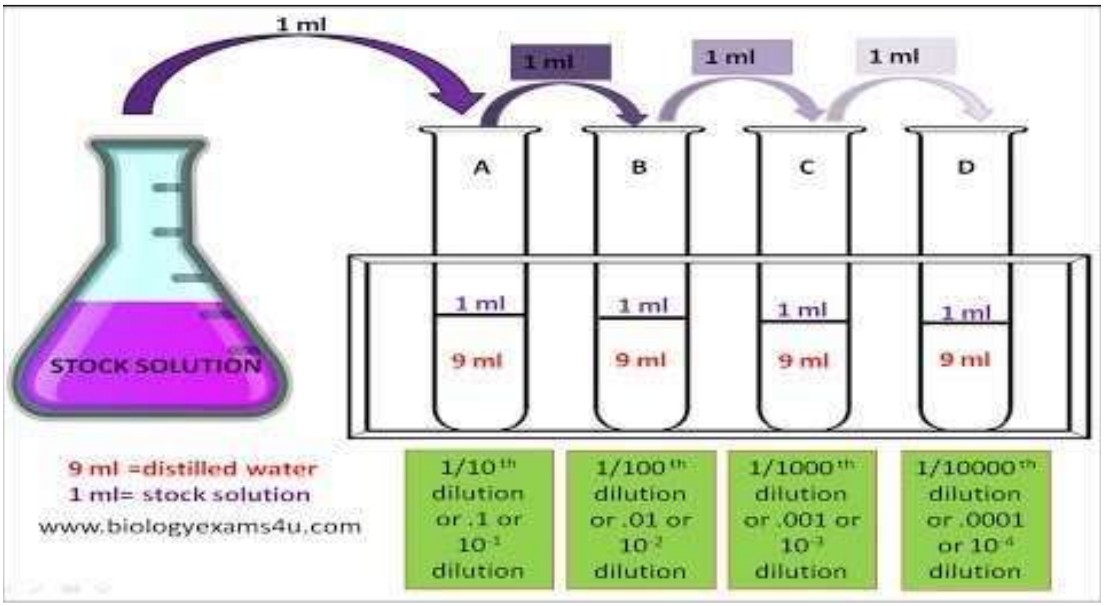


Figure 3.1: Serial Dilution

Inference

Test tube A has 10 times dilution or 1/10 or 10^{-1}
Test tube B has 100 times dilution or 1/100 or 10^{-2}
Test tube C has 1000 times dilution or 1/100 or 10^{-3}
Test tube D has 10000 times dilution or 1/100 or 10^{-4}

Requirements of Total Viable Count:

- Sterile Petridis (90mm)
- Micropipette
- Alcohol (70%)
- Laminar Air Flow
- Autoclave
- Incubator
- Colony Counter
- Water bath
- Orange serum Agar

Procedure

1. Medium was prepared, which has been chilled to 40 degrees Celsius, and perform serial dilution.
2. Petridis was filled with a certain amount of sample.
3. In Petridis, around 15-20ml of medium was poured in and adequately homogenized by clockwise and anticlockwise rotations, allowing solidification.
4. Every petri plate had a 1 mL serial dilution sample.
5. The plate was incubated and inverted at 27°C for 24-48 hours after solidification.
6. After incubation, a colony counter was used to count the colony.
7. To preserve aseptic conditions, all stages were carried out in a laminar air flow.

Calculation:

Colony forming units' formula:

Colonies ÷ Amt plated (mls) X Dilution=CFU/ml

Results: No colonies were created.

3.8 Determination of beta carotene from carrot

(2nd ed. San Diego: Academic Press, 1995:107-153.)

Materials Required:

- Beaker
- Funnel
- Measuring cylinder
- Test tube
- Separating funnel
- Funnel holder
- Measuring balance

Procedure

- Peeled carrots are chopped into little pieces.
- In a measuring balance, around 40g carrot was taken.
- It was a grind well
- In a beaker, 240ml of ethanol was mixed with the carrot.
- The aluminum foil was used to cover the beaker.
- The beaker was placed in a water bath at 70 degrees Celsius for 1 hour.
- A sample of the water bath's content was obtained.
- In the separating funnel, 10 mL of extract was added.
- In the same funnel, 10 mL petroleum ether was added.
- The affinity of beta-carotene with petroleum ether was suitably blended.
- A separating funnel was used to separate two layers.
- The top layer should be separated
- The OD value was obtained using a cuvette.
- a sample was collected
- A blank was filled with the petroleum ether and ethanol solution.
- In the spectrometer, the OD value was measured.

3.9 Determination of beta carotene from spinach

(The Journal of Nutrition, February 1999)

Equipment:

- Chromatography column.
- Erlenmeyer flask 50ml
- Mortar and pestle
- Beaker 100 ml
- Stand
- Funnel
- Pipette 10ml
- Beaker 100 ml
- Clamps, ring
- Suction bulb

Chemical:

- Petroleum ether.

- Dichloride methane CH3 COCH3
- Alumina
- Silica gel 40
- NaCl
- CaCO3
- Na2CO3

Procedure:

A. Separate the beta carotene and chlorophyll from the spinach leaves:

- A sample of 10 g was taken. The stems were plucked, and the soil was cleaned and wiped dry with paper towels before being piled until at least 10 g of leaves were obtained.
- About 20 ml dichloride methane and 20 ml petroleum ether were added to the leaves in a big mortar. For around 5 minutes, the sample was gently mashed with a pestle to remove all organic soluble components.
- Organic solvents were carefully poured into a round bottom flask with a 100- or 50-ml capacity, leaving any water behind.
- The flask was filled with 500 mg of alumina. As specified in the exporting solution, rotovap to dryness.

B. Separate Beta Carotene and Chlorophyll from each other:

- A column was made according to the instructions in the article Separating Compounds by Column Chromatography.
- The sample, together with clumia, was placed into the column's top and washed down with a few ml of haxen, which caused it to cling to the edges.
- In hexanes, a solution of 10% ethyl accelate was prepared. The solvent was poured into the column. The stop cock was opened, and the bulb was used to force it through.
- Beta carotene should appear as a yellow band that moves down the column at this point.
- When the yellow band has been completely eluted, squeeze out any surplus solvent in a separate flask as it comes out the bottom.
- A 100 mL solution of 10% methanol in dichloromethane was made.
- The fresh solvent was poured into the column, and a green band traveled down the column as it was pushed through.
- As the band was eluted from the column, it was collected in a separate flask.
- The column's liquid was pushed out and dumped on the desk.

C. Obtain and characteristics the final products:

- 2 flasks with round bottoms were cleaned and weighted.
- On the retovap, yellow and green solutions were added to the flask and evaporated.
- Each compound's look was scrutinized.
- The mass of each chemical was calculated by subtracting the mass of the flask.
- Each was given a percentage recovery rate.

CHAPTER 4
NUTRITIONAL VALUE AND HEALTH BENEFITS

Table No 1: Nutritional value of Potato Chips

Nutritional value per 100 g of Potato Chips (factsecret, 2021)

Property	Amount
Calories	547 kcal
Total Carbohydrate	49.74 g
Protein	6.56 g
Total Fat	37.47 g
Dietary Fiber	4.4 g
Calcium	24 mg
Potassium	1642 mg
Sodium	525 mg
Iron	1.61 mg
Vitamin A	0 mcg
Vitamin C	18.6 mg

Table No: 1 Nutrition value of Potato Chips

4.1 Health Benefits of Potato Chips

- **Bone health:** Potatoes include iron, phosphorus, calcium, magnesium, and zinc, all of which help the body grow and maintain bone structure and strength.
- **Blood pressure:** The fiber, potassium, vitamin C, and vitamin B6 content of potatoes, as well as their absence of cholesterol, all promote heart health.
- **Inflammation:** Choline is a critical and versatile vitamin found in potatoes. It assists in muscular mobility, mood, learning, and memory.
- **Cancer:** Potatoes are high in folate. Folate has a function in DNA synthesis and repair; hence it inhibits the formation of many types of cancer cells caused by DNA mutations.
- **Digestion and regularity:** The fiber content in potatoes helps prevent constipation and promote regularity for a healthy digestive tract.
- **Weight management and satiety:** Dietary fibers are widely acknowledged as key elements in weight management and loss.
- **Metabolism:** Vitamin B6 is abundant in potatoes. This is important in energy metabolism because it breaks down carbs and proteins into glucose and amino acids.
- **Skin:** The skin's support system is made up of collagen. Vitamin C acts as an antioxidant, assisting in the prevention of sun, pollution, and smoke damage. Vitamin C also aids collagen in smoothing wrinkles and improving skin texture.
- **Immunity:** According to research, vitamin C may help lessen the severity and duration of a cold. Potatoes are an excellent source of vitamin C.

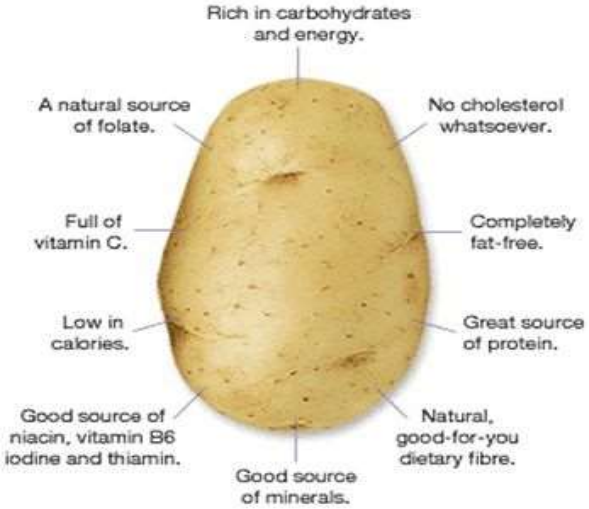


Figure 4.1: Health benefits of Potato Chips (quora, 2022)

CHAPTER 5
RESULT AND DISCUSSION

Table No 2: Chemical Composition of Value-Added Potato Chips:

Sample	Moisture	Protein	Ash	Carbohydrate	Fat	Calories	Vitamin A
S1 (without seasoning)	5.36%	15.167%	1.16%	67.713%	10.6%	426.92%	N/A
S2 (with seasoning)	5.28%	16.29%	1.6%	66.5%	10.33%	424.13%	1372.25µg

s1: Sample 1 (without seasoning)
s2: Sample 2 (without seasoning)

Table No 2: shows the different types of quality parameters for s1 & s2. The moisture content of potato chips was s1 & s2: 5.36% & 5.28%.

The above chemical composition shows the comparison between s1 and s2. From the above table it can be clearly seen that people preferred s2 than s1. Such as the protein content in s2 is higher (16.29%) than s1 (15.167).

Additionally, ash content is also higher in s2 (1.6%) than s1 (1.16%) we know that ash in the main minerals in potato. Which is important for our body. Beside in s2contain vitamin A. In one packet (20gm) s2 vitamin A content is 1372.25 µg.

Table No 3: Total viable count of Value added potato chips:

Sample no	After1day TVC(CFU /ml)	After3 days TVC (CFU/ ml)	After 7 Days TVC (CFU/ml)
S1	0	0	2.7×10^4
S2	0	0	2.3 ×10^4

s1: Sample 1 (without seasoning)
s2: Sample 2 (without seasoning)

Table No 3: Microbial result analysis- TVC (CFU/ml)

Observation: The result of seven days is displayed here in the table. There are no colonies in first 7 days. But after 7 days we found colonies S1 (without seasoning) 2.7×10^4 and in S2 (with seasoning) 2.3×10^4.

5.1 Sensory Evaluation:

I conducted a survey among 80 staff of Daffodil International University. Total data are submitted below.

Name :	Product : Chips
Panelist No :	Date :

Instructions:
Taste the given samples, then place a √ mark on the point in the scale which best describes your feeling.

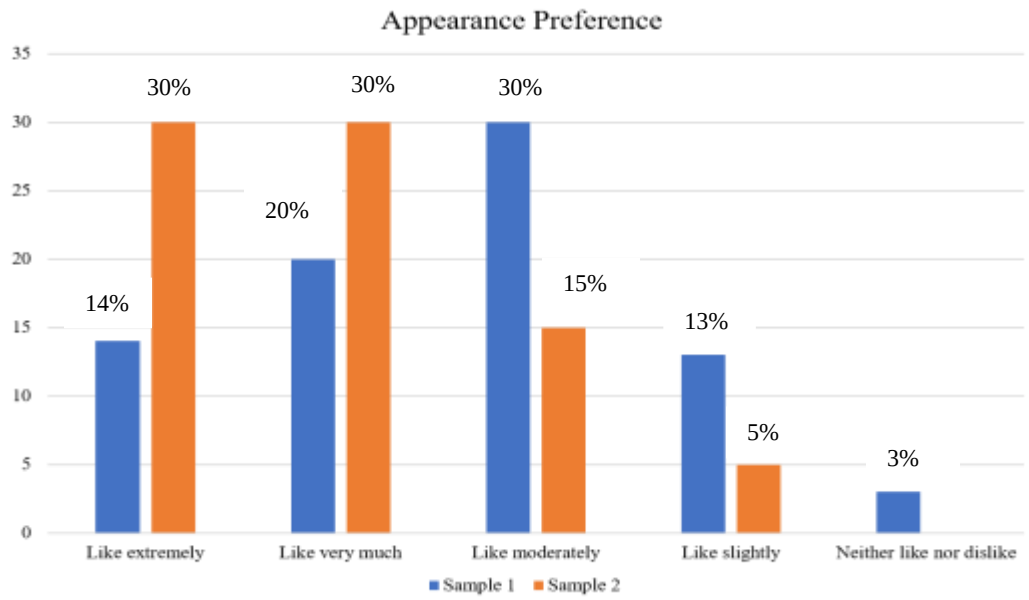
SCORE	SAMPLE CODE									
	Sample 1					Sample 2				
	Appearance	Flavor	color	Firmness	Overall Acceptance	Appearance	Flavor	color	Firmness	Overall Acceptance
(9) Like extremely	14	12	12	11	14	30	37	40	39	35
(8) Like very much	20	30	34	33	25	30	28	28	20	32
(7) Like moderately	30	27	20	24	31	15	15	12	16	12
(6) Like slightly	13	10	14	7	10	5			5	1
(5) Neither like nor dislike	3	1		5						
(4) Dislike slightly										
(3) Dislike moderately										
(2) Dislike very much										
(1) Dislike extremely										

Figure 5.2: Table - Sensory Evaluation

- Sample 1 (s1): without Seasoning
- Sample 2 (s2): With seasoning.

Total Respondent = 80

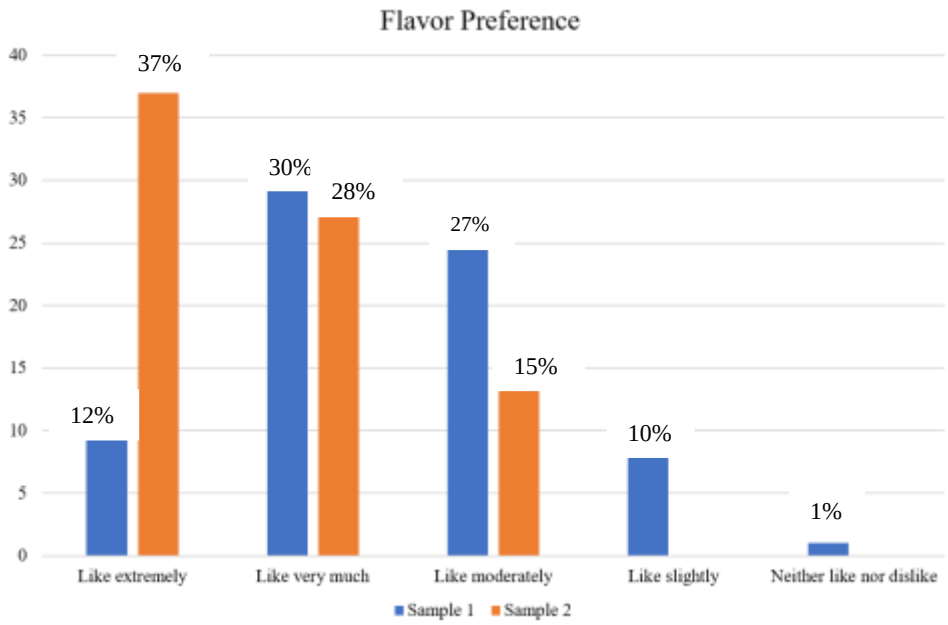
Figure 5.2.1: Comparison between s1 and s2 in Appearance Preference.



- Sample 1 (s1): without Seasoning
- Sample 2 (s2): With seasoning.

In figure 5.2.1 bar charts, the appearance preference of potato chips is displayed. Sample-2 (with seasoning) received the highest score as like extremely with 30% score and Like very much also gain 30% score, sample 1 got highest score in like moderately with 30% and lowest score as neither like or dislike with 3% score according to the bars.

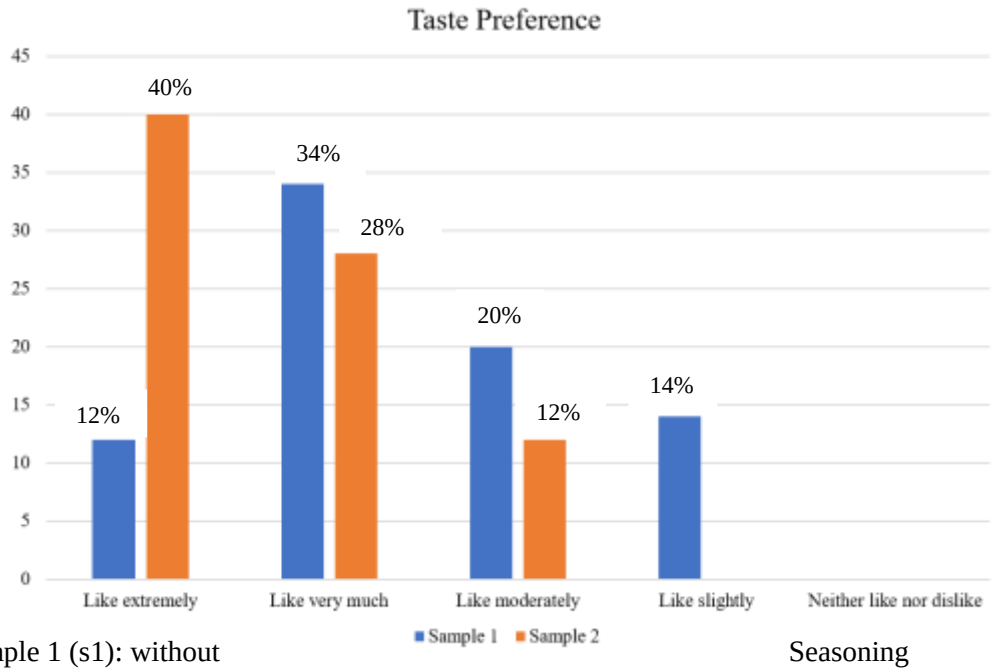
Figure 5.2.2: Comparison between s1 and s2 in Flavor Preference



- Sample 1 (s1): without Seasoning
- Sample 2 (s2): With seasoning.

In figure 5.2.2 bar charts, the flavor preference of potato chips is displayed. Sample-2 (with seasoning) received the highest score as like extremely 37% score and live very much also gain 28% score. Sample 2 gain the highest score in like very much with 30% score the lowest score is gain on neither like nor dislike with 1% score according to the bars.

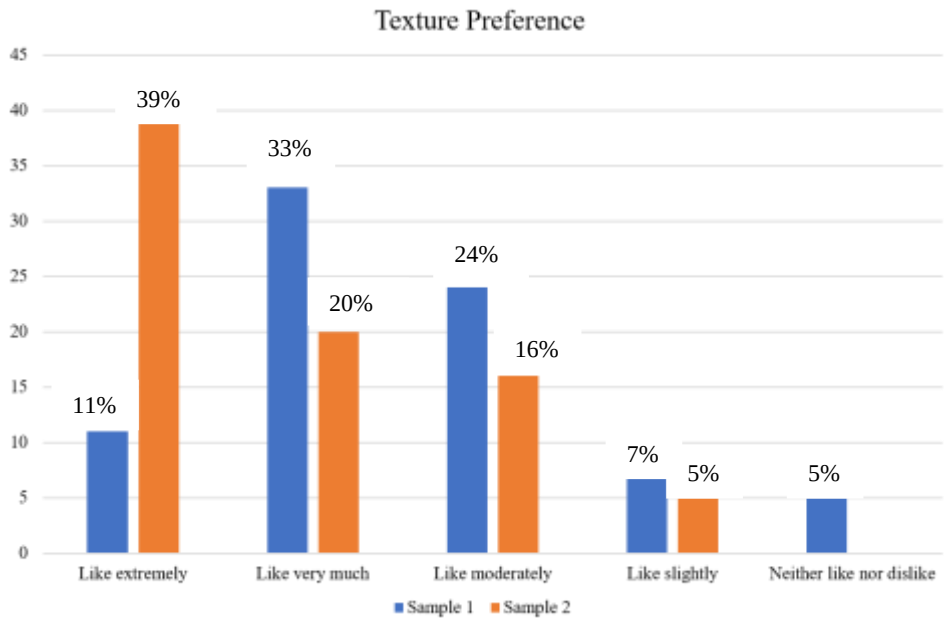
Figure 5.2.3: Comparison between s1 and s2 in -Taste Preference



- Sample 1 (s1): without Seasoning
- Sample 2 (s2): With seasoning.

In figure 5.2.3 bar charts, the taste preference of potato chips is displayed. Sample-2 (with seasoning) received the highest score in Like extremely with 40% score the second highest in like very much with 28% score where the sample 2 gain lowest score in like extremely with 12% score. The second lowest score in like slightly with 14% score as according to the bars.

Figure 5.2.4: Comparison between s1 and s2 in - Texture Preference



- Sample 1 (s1): without Seasoning
- Sample 2 (s2): With seasoning.

In figure 5.2.4 bar charts, the texture preference of potato chips is displayed. Sample-2 received the highest score in Like extremely with 39% score and the second highest is like very much with 20% score. Beside the sample 1 gain only 11% score in like extremely and the lowest score gain both in like slightly and neither like nor dislike with 5% score as according to the bars.

Figure 5.2.5: Comparison between s1 and s2 in – Overall Acceptance

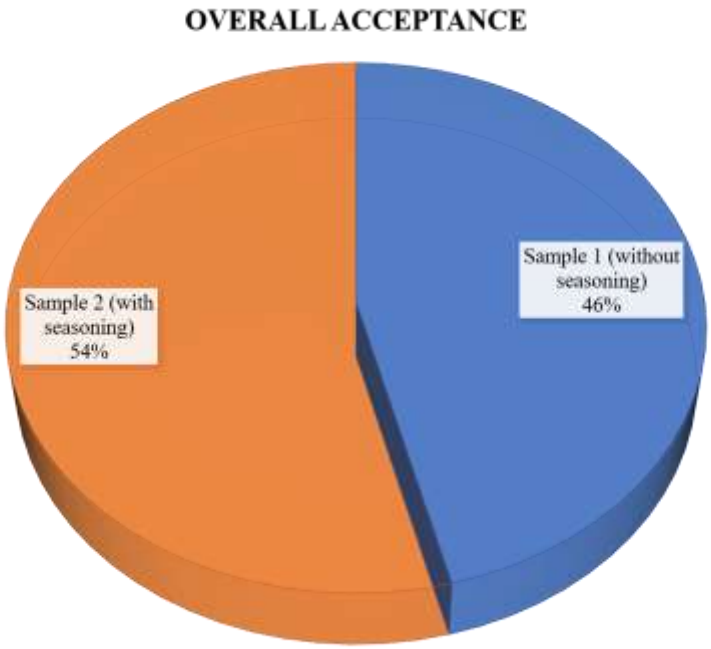


Figure In figure 5.2.5 pie charts, the overall acceptance of potato chips is displayed. Sample-2 received the highest score with 54% score where the sample 1 gain only 46% score according to the bars.

CHAPTER 6

6.1 Conclusions

The result of the study showed that potato chips prepared with sample 2 (s2) showed a positive result and was approved to be the best in all sensory attributes by the panelists. This study also revealed that s2 gain 16.29% protein and s1 gain 15.167% protein. That means s2 has higher protein than s1. Also higher in ash content which for s2 1.6% and s1 1.16%. The calorie percentage is approximately same which is 424.13% and 426.92%. but in s2 it has a high vitamin A percentage which is 1372 µg per 100 g chips. On the other hand s1 has no vitamin A percentage. There were no microbial growth in s1 and s2 after 7 &14 days. The potato is the world's most significant tuber vegetable, playing a crucial but frequently overlooked role in the global food chain. It is a staple meal that meets the energy and nutritional needs of over a billion people throughout the world. Potato production and post-harvest operations provide significant employment and revenue in rural regions, particularly in developing nations. It is used for a variety of purposes, including as a staple food, a cash crop, animal feed, and a source of starch for a variety of industrial applications. The crop is well adapted to areas with little land and abundant labor, which characterizes most of the developing world. Furthermore, potatoes are a very productive crop that yields more food per unit area and time than wheat, rice, and maize. Potatoes are becoming increasingly crucial for Asia and the Pacific area, which, like many other parts of the world, is facing significant issues as food prices rise. If deep analysis of this chips it can get more accurate result and can be increase the nutritional value. But it should be done on a large scale for better result at all with organic materials.

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