DEVELOPMENT OF CARROT SAUCE

A PROJECT REPORT

BY

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

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APPROVAL

This project titled **"Development of carrot sauce"**, submitted by **Md. Ismail Hossain** 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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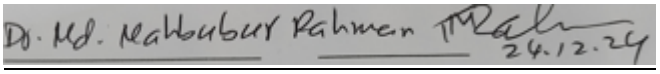
Chairman of the Board 

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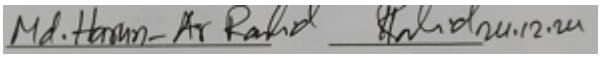
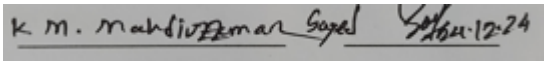
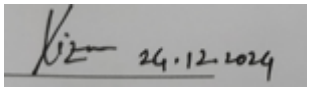
Internal Member-1 

Internal Member-2 



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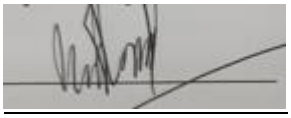
DECLARATION

I hereby declare that this project has been done by us under the supervision of **Dr. Md. Bellal Hossain, Professor & Dean, 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



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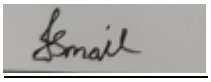

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ABSTRACT

An analytical study was carried out in order to create a new carrot sauce recipe and evaluate its nutritional content and shelf life. In proximate analysis Moisture, Ash, Brix, pH of carrot sauce 75.67±0.27%, 1.52±0.0.047%, 17%, 4.23. The carrot sauce's sensory qualities were evaluated using a nine-point hedonic scale. Based on the nine-point hedonic scale data, sample 1 of carrot sauce was finalized. It was safe to consume the freshly created carrot sauce for up to three days, but not for six.

Keywords

Carrot Pulp, Carrot Sauce, Sensory Evaluation

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties. The consumption of carrot and its products is increasing steadily due to its recognition as an important source of natural antioxidants having anticancer activity.

Carrots contain many nutrients, including beta-carotene and antioxidants, that may support your overall health as part of a nutrient-rich diet. Carrots are rich in beta-carotene, vitamin K1, fiber, potassium, and antioxidants. They also use fewer calories. They also have a lot of health benefits. They have been linked to better eye health and lower cholesterol. The antioxidants in its carotene have also been linked to a decreased risk of cancer.

FIG 1: Carrot

China produces more carrots than any other country in the world, according to FAO (2008). On 22,538 hectares of land, India produces 4.14 lakh tons of carrots annually; the primary producing states are Uttar Pradesh, Assam, Karnataka, Andhra Pradesh, Punjab, and Haryana (Thamburaj and Singh 2005). Carrots and their products have been consumed more frequently in recent years due to their high natural antioxidant content and the anticancer properties of β-carotene, a precursor of vitamin A (Dreosti 1993; Speizer et al. 1999).

A carrot's water content ranges from 86% to 95%. Carrot pulp contained 4-5% protein, 8-9% reducing sugars, and 5-6% minerals. A sauce is a cooking liquid mixture that is applied to another food to add taste. Sauces add taste, moisture, and visual appeal to other dishes; they are usually not eaten by themselves. Sauces play an important role in all cuisines worldwide. A comprehensive examination was conducted to create carrot sauce and evaluate its nutritional quality, texture, sensory qualities and storage ability.

FIG 2: Carrot Sauce

1.2 Objectives of the study

1. To create a sauce that is less expensive than tomato sauce.
2. The sauce's ingredients must be easily accessible locally.
3. To evaluate the created sauce's acceptability to the senses.
4. To look at the chemical composition of the sauce.

CHAPTER 2
LITERATURE REVIEW

Carrot (Daucus carota L.) is a widely cultivated vegetable, known for its high nutritional content, particularly beta-carotene, which is a precursor to vitamin A. Carrots are also rich in dietary fiber, antioxidants, and essential minerals. Carrot-based goods, like carrot sauce, are expanding in popularity in tandem with customer demand for creative and healthful food items. This literature review explores the research on carrot sauce development, focusing on its nutritional value, processing techniques, formulation challenges, and potential applications.

Carrots are recognized for their high beta-carotene content, which imparts their characteristic orange color and offers substantial health benefits, including improved vision, immune support, and antioxidant activity (Chen et al., 2020). Beyond beta-carotene, carrots contain polyphenols, flavonoids, and ascorbic acid, which contribute to their role in reducing oxidative stress and inflammation (Kumar et al., 2019). Utilizing carrots in sauces allows for the preservation and enhancement of these nutrients, potentially addressing micronutrient deficiencies in populations.

Carrot sauce development typically involves processes such as blanching, pureeing, and thermal or non-thermal preservation. Blanching is commonly employed to inactivate enzymes that cause spoilage and to enhance the sauce's texture (Tiwari et al., 2018). Pureeing is essential for achieving a smooth consistency, and advanced methods such as high-pressure processing (HPP) or ultrasonic treatment have been explored to retain the nutritional quality of carrot-based sauces (Rastogi et al., 2020).

Thermal treatments like pasteurization or sterilization are widely used to ensure microbiological safety, although they may degrade sensitive nutrients such as vitamin C. Alternatively, non-thermal methods such as HPP and pulsed electric fields (PEF) have been shown to preserve the bioactive compounds in carrots while ensuring product stability (Zhang et al., 2022).

Developing a carrot sauce that is both palatable and shelf-stable requires balancing nutritional quality, flavor, and texture. Key challenges include: Texture and Consistency, Flavor Enhancement, Shelf Life and Preservation.

Carrot sauce can serve as a base for culinary applications, including pasta, dressings, dips, and baby food. Research indicates that consumer acceptance depends on factors such as color, flavor, and nutritional labeling (Singh et al., 2020). Moreover, the inclusion of carrots in sauces aligns with trends favoring plant-based and functional foods.

Carrot by-products, such as peels or pulp generated during juice production, can be incorporated into sauce formulations, reducing food waste and enhancing dietary fiber content (Ali et al., 2021). This sustainable approach supports the circular economy model in the food industry.

The development of carrot sauce is a promising avenue in functional food innovation, combining nutritional benefits with culinary versatility. Advances in processing technologies and formulation strategies have addressed some of the challenges, ensuring nutrient retention and consumer satisfaction. Future research could focus on optimizing formulations with natural preservatives, improving shelf stability, and enhancing the sauce's sensory attributes.

CHAPTER 3

MATERIALS AND METHOD

3.1 Resources and Study Site

All of the ingredients were purchased from local markets and department stores. The study was conducted at the Food Processing Lab at Daffodil International University.

3.2 Ingredients:

- Carrot
- Sugar
- Salt
- Chili Peppers
- Water

3.3 Obtaining Raw Materials

The carrots were purchased at a nearby market. The majority of the items I used are readily available in supermarkets.

3.4 Equipment and Apparatus:

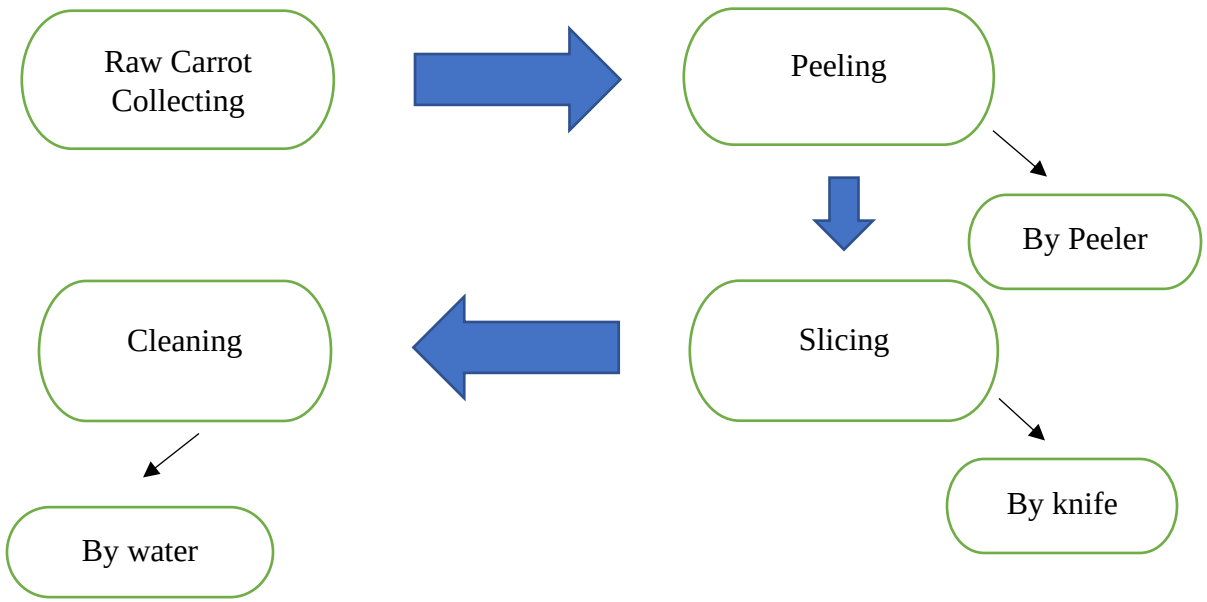
- Measuring Balance
- Dropper
- Spoon
- Blender
- Stove
- Saucepan

3.5 Formulation of Carrot Sauce

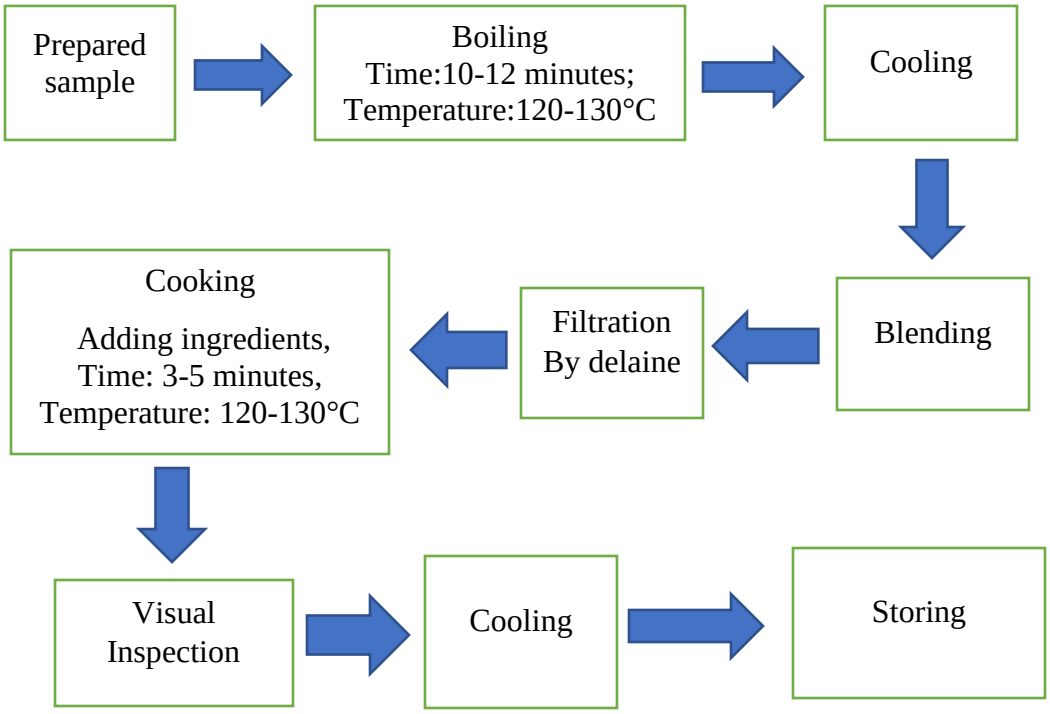
Ingredients	Sample 1	Sample 2	Sample 3
Carrot Pulp	300 gm	300 gm	300 gm
Sugar	17 gm	12.5 gm	17 gm
Salt	2 gm	2 gm	2 gm
Chili Peppers	2 gm	2 gm	1 gm
Vinegar	23 gm	23 gm	23 gm

3.6 Sample Preparation

The carrot was peeled with a peeler once the materials were collected. This was followed by weighing, slicing, and cleaning by water.



3.7 Process Flow Diagram



3.8. Determination of Brix

Apparatus:

- Dropper
- Tissue
- Sample

Equipment:

- Hand Refractometer

Procedure:

- To begin, wash the refractometer's prism with water and use a tissue to pat it dry.
- Next, add one or two drops of the sample to the prism.
- Examine the reading after that.
- Finally, take note of the Brix percentage.

Figure 3: Refractometer

3.9 Determination of pH

Apparatus:

- Beaker
- Distilled Water
- Buffer

Equipment:

- Hanna HI 8424 pH meter

Procedure:

- The pH meter was turned on at first.
- It was then calibrated using buffer solutions (4 and 10 pH values).
- The pH meter then gave a reading once the electrode was inserted.
- The reading on the meter's screen remained steady.
- In order to clean the electrode, distilled water was used.

Figure 4: pH Meter

3.10 Determination of Moisture

Apparatus:

- Spatula
- Sample

Equipment:

- Digital Moisture Analyzer

Procedure:

- First, the moisture analyzer was powered on and connected to the power source.
- The temperature was set to 120°C.
- The device was then utilized to weigh the specimen.
- Following that, the analysis was initiated by clicking the "Start" button, and the results were displayed on the screen.
- After the analysis is complete, the device will beep.
- The results should be recorded after observation.

FIGURE 5: Digital Moisture Analyzer

3.11 Determination of Ash

Apparatus:

- Spatula
- Desiccator
- Digital Scale
- Crucibles
- Sample

Equipment:

- Muffle Furnace

Procedure:

- The crucible was cleaned and labeled first.
- After that, the crucible was weighed using a digital balance.
- The crucible was filled with five grams of the substance after the scale was reset to zero.
- The door of the muffle furnace was securely closed once the crucible was placed within.
- The sample spent six hours burning at 700°C in the furnace.
- The furnace was turned off after the burning process and allowed to cool until it reached a minimum temperature of 250°C.
- Using tongs, the crucible was transferred to a desiccator.
- The desiccator was closed and the crucible was covered with a lid.
- After that, the crucible was weighed once more.

Calculation:

$$\%\text{Ash} = \frac{Crucible\ weight\ after\ ashing - Crucible\ wright\ before\ ashing}{\text{Sample weight}} \times 100$$

Figure 6: Muffle Furnace

3.12 Microbial Test

Apparatus:

- Test Sample
- Nutrient Agar
- Sterile Petri Dishes
- Test-Tube
- Pipettes
- Conical Flask
- Distilled Water

Equipment:

- Autoclave
- Incubator

Procedure:

- The first step was to weigh the nutritious agar and prepare the agar medium.
- After that, the medium and all of the equipment were autoclaved for 15 minutes at 121°C to disinfect them.
- Everything was sterilized and then allowed to cool.
- The sample was prepared by repeated dilution in a test tube.
- 0.5 ml of the material was pipetted onto a petri dish after it had been diluted.
- The dish's third was covered with the medium.
- The plate was then gently shaken in clockwise, counterclockwise, and up-and-down directions.
- Following sample-based labeling, the petri dish was placed in an incubator for a full day.
- A 24-hour observation period was followed by a colony census.

Calculation:

$$\text{Price} = \frac{Price\ of\ 1kg\ or\ 1000ml \times Essential\ quantity\ price}{1000}$$

3.13 Sensory Evaluation

The senses—taste, smell, sight, touch, and hearing—react to specific food elements through testing, analysis, and interpretation using a scientific method known as sensory evaluation. Four hours were devoted to preparing thirty students from Daffodil International University for an experiment that involved a sensory analysis of carrot sauce. When participants tasted each of the three distinct samples, they assessed each one based on color, texture, flavor, and taste. They then contrasted the general attractiveness of the samples. Nine points were utilized as the ranking system: Nine of the responses were "like really," eight were "much like," seven were "somewhat moderately," six were "somewhat like," five were "neutral," four were "somewhat dislike," three were "mildly dislike," two were " very distasteful," and one was " detest to the core."

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Proximate Composition

Data on moisture content, ash content, Brix %, and pH value are all included in the proximate composition of this study. A basic understanding of the sample's chemical or nutritional composition can be gained from these data.

Table 1: Proximate composition

SL NO	Components	Sample 1	Sample 2	Sample 3
01	%Moisture	75.67±0.27	76.27±0.23	76.71±0.29
02	%Ash	1.44±0.016	1.52±0.0.047	1.44±0.021
03	%Brix	17%	15%	17%
04	pH	4.21	4.23	4.17

4.2 Microbial Quality

Microbiological analysis is the study of microorganisms in a sample, including viruses, fungi, and bacteria. It is possible to estimate the number of microorganisms in the sample using this study.

Table 2: Microbial analysis

SL NO	Components	Sample 1	Sample 2	Sample 3
01	Microbial Load (CFU/ml)	3600	2300	2800

4.3 Sensory Evaluation

To determine the degree to which a sample is loved or favored overall, a sensory evaluation method known as the hedonic rating test is employed. Using a scale, panelists assessed the study's samples according to their sensory attributes.

Table 3: Sensory Evaluation

Parameters	**Sample 1**	**Sample 2**	**Sample 3**
Color	7.27±1.13	6.65±1.25	6.94±1.26
Flavor	6.73±0.92	6.69±1.11	6.87±1.23
Taste	7.63±1.17	6.34±1.26	7.3±0.73
Texture	7.22±0.94	6.62±1.08	7.00±0.88
Overall Acceptance	7.43±0.67	6.97±0.56	7.03±0.66

4.4 Discussion

4.4.1 Moisture Content

According to each composition's specifications, the percentage of moisture content varies. The mean value and standard deviation (SD) are shown for each sample after three moisture testing. As shown in Table 1, Sample -1 had the lowest average value among the three sample, with an average of 75.67 and a standard deviation (SD) of 0.27. But as the table demonstrates, the other two sample had higher moisture percentages. Since higher shelf stability is generally linked to lower moisture content, Sample -1's mean result suggests a longer product shelf life out of the three. The somewhat higher mean value for Sample 2 indicated that the product's shelf life would be much shorter. Sample 3, which had the highest mean value among the three, was believed to have the shortest shelf life.

4.4.2 Ash Content

There was a consistent amount of ash under various conditions. Sample 1, 2, and 3 demonstrated mean ash content values of 1.44% with an SD of 0.016, 1.52% with an SD of 0.047, and 1.44% with an SD of 0.021, respectively. The mean ash concentration of Sample-2 was higher than that of the other sample %.

4.4.3 Brix Percentage

The study results, which are shown in Table 1, showed the Brix percentage for each sample. At 15%, Sample 2 had a lower Brix value than Sample 1 and 3, which had the highest Brix levels at roughly 20%.

4.4.4 pH Value

The pH findings from the investigation were displayed in Table 1. The pH values of Sample-1 and 3 were 4.21 and 4.17, respectively, whereas Sample-2 had the highest pH value at 4.23. Because Sample-2 is less acidic, it has the most acceptable pH value according to the pH chart.

4.4.5 Microbial Load

Table 2 of the study shows that the product in this project only contains 2300 to 3600 CFU/mL, which is below the allowed level based on BSTI recommendations.

4.4.6 Sensory Evaluation

The results of an evaluation of various carrot sauce recipes using a hedonic rating test are shown in the data table. The following sensory attributes were evaluated: general acceptability, flavor, texture, color, and aroma. The labels given to the carrot sauce samples are sample 1, 2, and 3. Table 3's results demonstrated how the formulas varied significantly from one another. As for color, flavor, texture, and overall acceptability, Sample 1 received the highest ratings. Sample 3 had the highest mean value for flavor. However, none of the characteristics in sample-2 had the highest average value. Overall acceptability in this trial indicated that Sample-1 was the most widely used formulation.

CHAPTER 5

CONCLUSION

The purpose of this study was to create or development of carrot sauce. Microbiological analysis, sensory evaluation, and proximate composition are among the subjects covered in the comprehensive comparison results provided by the study. The moisture content values in sample 2 and 3 were 76.27±0.23 and 76.71±0.29, respectively, whereas the proximate analysis of sample 1 revealed a value of 75.67±0.27. Of these three, sample 1 is the most widely used due to its lower moisture content, which extends the product's shelf life. For sample 1, 2, and 3, the analysis showed that the percentage of ash content was 1.44±0.016, 1.52±0.047, and 1.44±0.021, respectively. Ash's primary function is to impart a smokey, bitter flavor to food; it should be limited to avoid overpowering more delicate flavors. As a result, the result of sample 1 is preferred. The corresponding Brix percentages for sample 1, 2, and 3 are 17%, 15%, and 17%. Because they contain more sugar, sauces with a higher Brix value are often preferred because the final result is sweeter and more delectable. Therefore, the value of sample 1 is considered ideal. The best pH values for sauces are 4.23 or 4.21 out of the three since a lower pH (indicating increased acidity) is usually preferred to enhance flavor and preserve. Every measurement in the microbiological analysis fell within the range advised by the BSTI. The findings of the sensory assessment demonstrated that sample 1 was the most suitable and preferred by consumers in terms of overall acceptance, color, flavor, taste, and texture scores.

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Synopsis of the Thesis

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1. Project title: A project report on Development of Carrot Sauce

2. Introduction:

Food innovation has become more popular in response to consumers' growing desire for natural, healthier, and nutritionally enhanced products. The vegetable known as carrots (Daucus carota) is renowned for its high nutritional content, which includes important amounts of beta-carotene, dietary fiber, vitamins A, C, and K, as well as essential antioxidants. Because of their versatility in culinary applications, they are positioned as a potential basis for novel food items. Carrot sauce offers an opportunity to create a value-added product that caters to current dietary trends for flavorful and healthful alternatives to traditional sauces.

The formula for carrot sauce is improved to meet consumer needs for nutritional value, flavor, texture, and shelf life. The purpose of this study is to find out how the primary ingredient, carrots, might contribute to the creation of a tasty and nutritious sauce. Such a product might replace traditional sauces, which are often high in sugars, unhealthy fats, and artificial components.

The procedures used to make carrot sauce are examined in this thesis, including the choice of ingredients, processing strategies, preservation techniques, and sensory analysis. It additionally seeks to ascertain the nutritional composition, business potential, and consumer acceptability of the sauce. Utilizing excess or imperfect carrots—which are frequently thrown away while being nutritionally sufficient—this study also targets waste reduction by incorporating sustainable approaches.

This study is particularly significant since it contributes to ongoing efforts in food science to diversify product offerings, promote healthy eating, and decrease food waste. The findings should benefit consumers, food producers, and dietitians by offering a practical blueprint for developing a new sauce that combines taste and health.

3. Materials:

3.1 Ingredients:

- Carrot
- Vinegar
- Water
- Sugar
- Chili Powder

3.2 Instrument:

- Blender machine
- Knife
- Saucepan
- Sieve

4. Method:

4.1 Processing:

A. Selection of fruits: Select carrot having orange color.

B. Preparation of pulp: Take the selected carrot in aluminum or stainless steel vessel and heat until become soft. Do not overcook. After cooking mash the carrot with a wooden spoon and blend the carrot with a blender. Sieve the meshed carrot through a 1 mm meshes.

C. Cooking: Take the meshed carrot into a cooking pot. Add required amount of sugar, vinegar, salt and spices and cook (5 minute) until thick.

D. Judge the endpoint: The endpoint is determined by a hand refractometer. When TSS reaches the desire level; the sauce is considered ready.

4.2 Physicochemical analysis:

Proximate tests along with physicochemical and sensory analysis of the product samples were done by following the methods given in AOAC.

4.3 Determination of total soluble solids (˚Brix):

Total soluble solids of carrot sauce were measured by using a portable refractometer.

4.5 Determination of pH

pH readings of carrot sauce were taken by using a digital pH meter. The pH meter was calibrated by buffer solution of 4, 7 and 9.

4.4 Sensory evaluation:

Sensory evaluation of carrot sauce was conducted by a trained panel, students and staff members. The parameters like color, texture, taste, aroma, mouthfeel and overall acceptability were recorded.

5. Conclusion:

Carrot sauce's development demonstrates how carrots may be a key component of a delicious, environmentally friendly, and nutrient-dense food product. Rich in beta-carotene, minerals, and nutritional fiber, the carrot-based sauce offers a healthier alternative to conventional sauces. The study optimized the formulation, processing techniques, and sensory evaluation, resulting in a product with excellent customer acceptability. Using extra or faulty carrots also promotes sustainability by reducing food waste. Future research on vegetable-based sauces that go well with eco-friendly and health-conscious culinary trends is made possible by this study.

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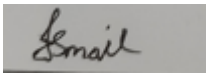
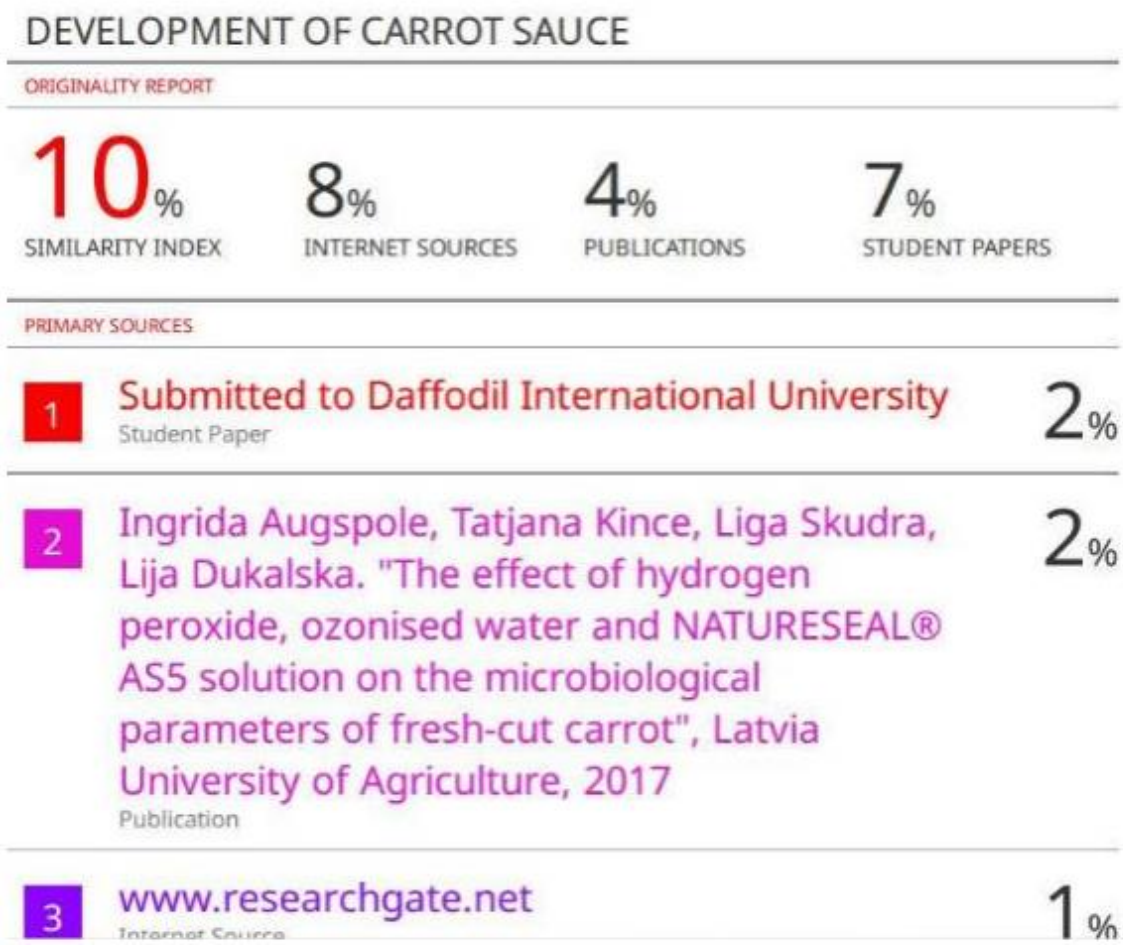


Signature of Student

Signature of Supervisor

APPENDICES



DEVELOPMENT OF CARROT SAUCE

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