DEVELOPMENT OF NAGA HOT 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 Naga Hot Sauce",** submitted by **Tomal Biswas** to the Department of Nutrition and Food Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Nutrition and Food Engineering and approved as to its style and contents.

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DECLARATION

I hereby declare that this project has been done by us under the supervision of **Juwel Rana, Assistant 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.

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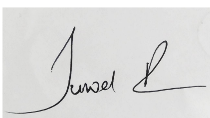

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ABSTRACT

Naga hot sauce emerges as a culinary gem, not only for its ability to captivate taste buds but for its cultural significance and unique experiences it offers. Originating from the enchanting hills of Nagaland in northeastern India and eastern Bangladesh, Naga hot sauce is renowned for its intense heat, derived from the native Naga Chili pepper rich in capsaicin. This sauce is crafted using Naga chili, tomatoes, and a blend of ingredients such as garlic, salt, sugar and food additives. The inclusion of food-grade acids not only enhances flavor but also acts as a preservative, stabilizer, and antioxidant, contributing to an extended shelf life. Naga Sauce serves as a unique selling proposition, offering a distinctive flavor and intense heat that sets it apart in the market. The objective is to develop Naga hot sauce from Capsicum Chinese, providing a memorable culinary experience that combines intense heat with a complex flavor profile. This endeavor not only contributes to the preservation of culinary traditions but also creates economic opportunities for youth through sustainable chili cultivation and small-scale industry. The nutritional composition of this sauce is balanced, with 22% moisture, 6.6% protein, and 0.4% fat. Its carbohydrate content stands at 37.7%, providing a good energy source. It gives a moderate sweetness level with a Brix of 30%. Its flavor character is influenced by its mildly acidic nature, as shown by its pH of 3.1. 3.3% of ash indicates a noteworthy mineral composition. All in all, its composition shows a food product that is well-rounded and has a variety of nutritious qualities.

Keywords: Naga Chili, Tomato, Sauce, Health Benefits.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

In the ever-evolving landscape of global gastronomy, certain culinary treasures stand out, not merely for their ability to tantalize the taste buds, but for their cultural significance and the unique experiences they offer. Among these, Naga hot sauce emerges as a distinctive and intriguing player in the world of fiery condiments. Originating from the rugged and enchanting hills of Nagaland in northeastern India and eastern Bangladesh. Naga Chili pepper contains capsaicin which determines the great smell, flavor and taste. It also provides health benefits such as antioxidants, antimicrobials, body temperature regulation and anticoagulants (Meghvansi, 2010).

Naga hot sauce, well known for its strong flavors and intense heat, has become well-known worldwide and is now a staple in kitchens and dining rooms far beyond its native region. Often made from the native Naga Chili, this hot concoction has enough heat to test even the most daring palates. Making Naga hot sauce requires Naga chili and tomato as raw materials and other ingredients such as garlic, salt, sugar, food additive and food preservative. Food grade acids or acidic ingredients play an essential role in flavor enhancing and act as food preservative, stabilizer and antioxidant. The presence of acids in food inhibits the growth of bacteria, adjusts the pH, reduces the deterioration rate and keeps food fresher for longer period (Theron & Lues, 2011).

Naga Sauce provides a unique selling proposition due to the distinctive flavor and intense heat of Naga chili peppers. This can help a small-scale industry differentiate its product in the market and create employment for the youth. The motivation behind this thesis is to unravel the multifaceted layers that constitute the evolution of Naga hot sauce. Beyond the sensory experience of heat, each drop carries the essence of agricultural practices, local biodiversity, and the culinary creativity embedded in the Naga way of life. From the cultivation of indigenous chili varieties to the artistry of blending flavors, the development of Naga hot sauce reflects the intimate relationship between people, land, and food a synergy that has withstood the test of time.

Through meticulous research and a discerning lens, this thesis seeks to navigate the complexities of Naga hot sauce development, drawing attention to the nuanced processes, cultural significance, and the dynamic interplay between tradition and innovation. By peeling back, the layers of this spicy phenomenon, we endeavor to contribute to a deeper understanding of the culinary heritage that shapes Naga hot sauce, an endeavor that honors the authenticity of a community's gastronomic legacy.

1.2 Objective

- To develop Naga hot sauce from Naga chili (*Capsicum Chinese*).
- To introduce a unique and memorable culinary experience by providing a hot sauce that not only delivers intense heat but also boasts a distinct and complex flavor profile, enhancing a wide range of dishes.
- To create economic opportunities for local farmers and younger youth through sustainable cultivation of Naga chili and small-scale industry.
- To highlight the potential health benefits associated with consuming hot peppers.

CHAPTER 2

LITERATURE REVIEW

Hot sauce has evolved from a simple condiment to a culinary phenomenon, with various regions contributing their unique flavors and heat levels. The Naga hot sauce stands out as a testament to the fusion of tradition and innovation, drawing inspiration from the fiery Naga chili pepper.

One of the hottest chillis in the world is the naga chili, with its fiery temperament and complex flavor profiles, stands as a culinary emblem deeply embedded in the cultural heritage of Northeast India and Eastern Bangladesh**.** In 2006, Naga chili achieved the title of hottest chili worldwide, with a Scoville heat unit (SHU) value of 1,001,304. At the moment, it holds the sixth spot when it comes to the hottest chiles worldwide. Numerous research has been conducted on this crop because of its great potential economic worth.

When the Naga King Chili was first discovered, it was considered to belong to Capsicum frutescens. Baral and Bosland (2007) subsequently determined, using Capsicum descriptors from the International Plant Genetic Resources Institute (1995), that Naga King Chili belongs to the C. Chinese species based on morphological traits.

Historical accounts reveal the early cultivation of indigenous chili varieties, portraying a picture of a community intricately connected to the land. The utilization of chili peppers in Naga cuisine is not merely a recent phenomenon but rather a thread woven into the fabric of Naga history, where these fiery ingredients have been wielded as culinary tools, transforming ordinary meals into sensory experiences. At the forefront of the Naga chili experience is an explosion of flavors that dances on the taste buds. The sauce is a harmonious blend of intense heat, deep umami, and a hint of smokiness, courtesy of the indigenous chili varieties that flourish in the region. Beyond the heat that tantalizes the taste buds, Naga hot sauce carries profound cultural significance within the local community.

The high concentration of capsaicinoids, specifically capsaicin, in Naga chili peppers is responsible for the sauce's unique spiciness and intense heat. Capsaicin has been studied for its potential health benefits, including anti-inflammatory, antioxidant properties, improving metabolism, reducing pain, and maintaining cardiovascular health. To determine the magnitude of these possible health advantages and their applicability in relation to consuming Naga Hot Sauce, it is necessary to critically assess and compile the available studies.

The primary component of Naga hot sauce is Naga chili. To balance and improve the entire flavor profile of Naga hot sauce, enhancing components like garlic, vinegar, sugar, salt, and tomato are used in addition to the Naga chili. These ingredients work together to create a sauce that is rich and deep in flavor along with being quite spicy.

Hot sauce producers started experimenting with various formulas and variants as the demand for Naga hot sauce increased. While some welcomed the intense heat of the Naga chili to appeal to the adventurous taste, others tried to make softer variants to appeal to a wider audience. As a result of this diversity, Naga hot sauces with a range of taste profiles, textures, and uses from marinades to table condiments have emerged.

The cultural impact of Naga Hot Sauce extends beyond its fiery flavor, intertwining with the traditions, rituals, and celebrations of the Naga people. The sauce has become a symbol of cultural identity, representing the rich culinary heritage of the region. In Naga traditions, the preparation and consumption of Naga Hot Sauce are often integral components of various ceremonies, signifying the importance of spice in communal gatherings and cultural expressions.

Naga Hot Sauce's internationalization has allowed it to rise above its regional origins and into the world culinary scene. The fact that the sauce is used in so many different foreign cuisines is a testament to both its flavor profile and its ability to enrich and vary culinary experiences. Chefs and ordinary chefs alike use Naga Hot Sauce in a variety of recipes, showcasing its versatility and assimilation into international culinary trends. The sauce helps tastes spread and cross-cultural culinary experiences develop as it travels across cultural barriers. With fans using naga hot sauce in their cooking all around the world, it has emerged as a major force in the globalization of taste. The powerful and distinctive flavor of Naga Hot Sauce unites people from many ethnic backgrounds, and its presence in a variety of kitchens promotes a sense of connectivity.

As we conclude this exploration, the tale of Naga Hot Sauce is still being told, begging for more research into its possible future advancements, environmental initiatives, and economic ramifications. The development of Naga Hot Sauce offers a blueprint for the international sharing of culinary customs, demonstrating how a single condiment may cut across boundaries and unite people via a common appreciation of flavor.

CHAPTER 3

MATERIALS AND METHODS

3.1 Resources and Study Site

All of the ingredients for the Naga hot sauce were bought from neighborhood markets and department stores. The study was carried out at Daffodil International University's Food Processing Lab.

3.2 Ingredients

- Naga Chili
- Tomato
- Garlic
- Sugar
- Salt
- Vinegar
- Sodium Benzoate

3.4 Obtaining raw materials

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

3.5 Equipment and Apparatus

- Blender
- Measuring balance
- Strainer
- Steel Sleeves
- Stove
- Large Pan
- Glass bottle

3.6 Process Diagram

Raw Materials (Naga chili, tomato)

↓

Washing & Shorting

↓

Boiling (3-5 min)

↓

Blending (all ingredients)

↓

Pulp straining

↓

Heating (medium flame,15-20 min)

↓

Addition of (sugar, salt, vinegar, preservative)

↓

Heating (until perfect consistency)

↓

Cooling & storing (sterilized glass jar)

Figure 3.1: Naga Hot Sauce

3.7 Determination of pH

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.

Figure 3.2: pH Meter (hannainst.com)

3.8 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.

Figure 3.3: Digital Moisture Analyzer (atlanticscale.com)

3.9 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.
- Take the readings.
- Lastly, rinse the prism with distilled water in between samples and pat dry with a soft tissue.

Figure 3.4: Refractometer (wonderfulengineering.com)

3.10 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.
- After that, allow the crucible within the desiccator to cool. Weigh the crucible without the sample once it has finished.
- 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)

3.11 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)
- 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. In contrast, a trapping conical flask had 50 mL of clean water and 10 mL of 0.1N HCl. 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 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 %

3.12 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) * 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)

3.13 Total Carbohydrate

A subtract method was used to compute the total amount of carbohydrates.

Fat + Protein + Ash + Moisture - 100 = Percentage of Total Carbohydrate

3.14 Total bacterial count

Apparatus:

- Petrified
- Micropipette
- Nutrient agar
- Incubator
- Autoclave
- Laminar Air Flow

Reagent:

- Nutrient agar
- Sodium chloride

Procedure:

After the preparation phase, the experiment medium is autoclaved for 30 minutes at 121°C to ensure sanitization. Next, add the sample to the Petridis until it reaches the designated level. The medium should be allowed to cool to a temperature of between 37 and 40°C after the autoclave. The medium Petridis is filled with 15 to 20 milliliters, and it is then cautiously assembled both clockwise and counterclockwise before being allowed to settle. After the plate is placed, flip it over and incubate it at 37°C for 24 to 28 hours.

Calculation: CFU (Colony-Forming Unit) = (Colony Number x Dilution Factor) / Sample Volume

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 22%, 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 6.6%, 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 37.7%, 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 3.1 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 3.3%. This provides insights into the food's mineral composition and its potential contribution to overall dietary mineral intake.

Composition	Value
Moisture	22 %
Protein	6.6 %
Fat	0.4 %
Brix	30 %
Carbohydrate	37.7 %
pH	3.1
Ash	3.3 %

Table 4.1: Proximate composition

4.2 Sensory Evaluation

Three types of samples were made for the 9-point Hedonic test with the difference in Naga chili and other ingredients were the same. Sample 1 - 40 gm, Sample 2 - 50 gm, Sample 3 - 60 gm.

Sample 1:

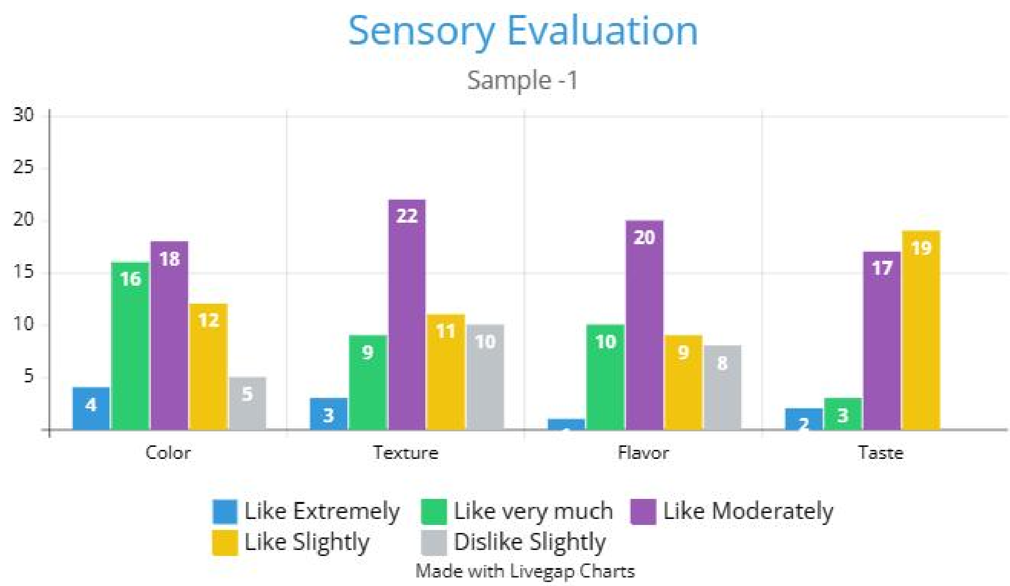

Figure 4.1: This graph demonstrates that, of the 50 respondents, the majority claimed they enjoyed it only passably, with the exception of flavor.

Sample 2:

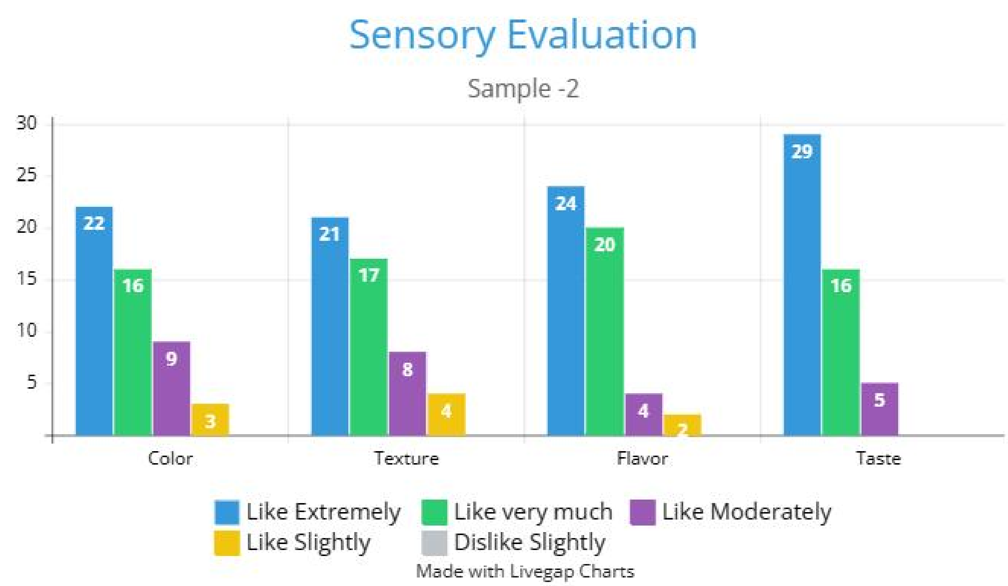

Figure 4.2: This graph indicates that, of the 50 respondents, the vast majority claimed they really enjoyed it, and as there were no negative comments, the product's approval was 100% decided.

Sample 3:

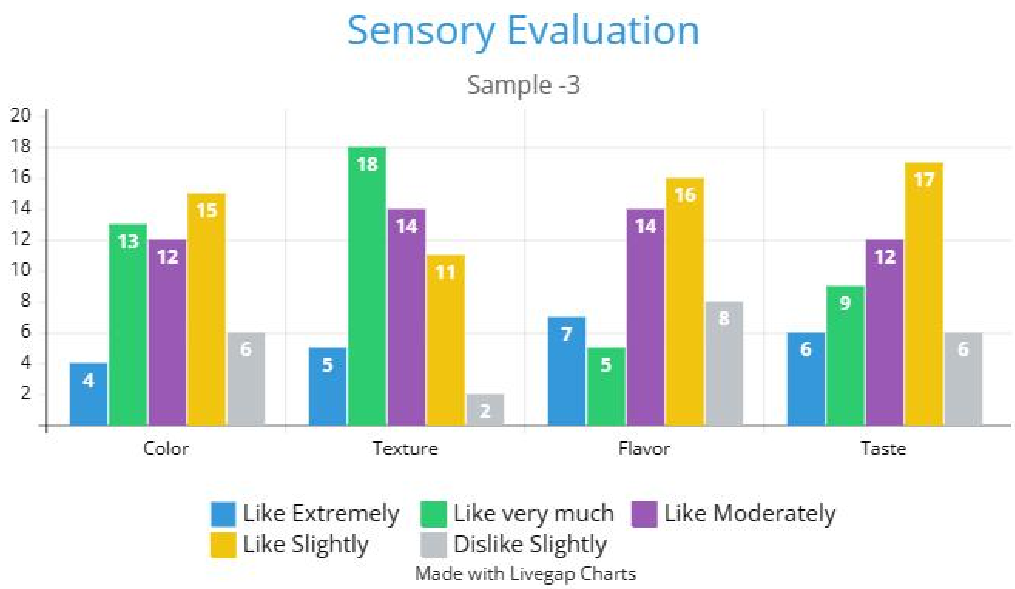

Figure 4.3: This graph indicates that, of the 50 respondents, the majority stated they enjoyed it only a little.

4.3 Overall Acceptability

Sample 2

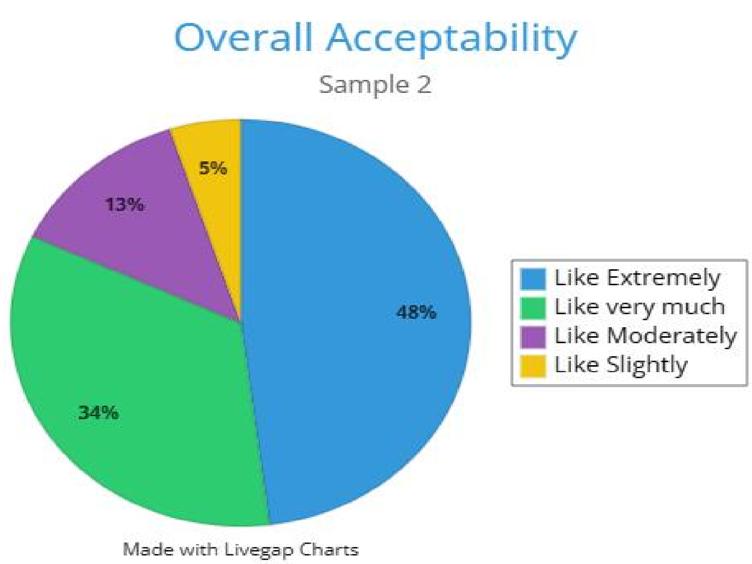

Figure 4.4: Overall acceptability of sample 2 Naga Hot Sauce which has been finalized by 9-point hedonic scale.

CHAPTER 5

CONCLUSION

The development of Naga hot sauce provides proof of the potential for experimentation in the NFE lab and the capacity to turn conventional components into innovative products that are appealing to a broad audience. From the humble origins of Naga Chili, known for their intense heat, to the meticulous crafting of a flavorful and well-balanced hot sauce, this process underscores the dynamic nature of food innovation. The complex history of Naga hot sauce has been examined in this thesis, providing knowledge about a variety of areas including market dynamics and cultural-relevance.

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