SENSORY EVALUATOIN OF THE DIFFERENT LEVEL OF BLACK RICE (Oryza sativa L. indica) IN MINI CAKE PRODUCTION

College of Technology and Allied Sciences
BOHOL ISLAND STATE UNIVERSITY
Zamora, Bilar, Bohol

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A Thesis
Presented to the Faculty of the
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In Partial Fulfillment
Of the Requirements for the
Bachelor of Science in Industrial Technology
major in Food Preparation Service Management

Jemalyn V. Boncales
Regine Etorma
Vanesa Gutang
Markie Fernandez

June 2021

APPROVAL SHEET

This thesis entitled, "**SENSORY EVALUATION OF THE DIFFERENT LEVEL OF BLACK RICE (*Oryza sativa L. indica*) IN MINI CAKE PRODUCTION**", prepared by Jemalyn Boncales, Regine Etorma, Vanesa Gutang and Markie Fernandez, in partial fulfillment of the requirements for the degree of Bachelor of Science In Industrial Technology major in food Preparation Service Management has been examined and recommended for acceptance and approval for oral defense.

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ABSTRACT

The study was conducted at the Bohol Island State University- Bilar campus at Zamora, Bilar, Bohol for the food tasting and answering the question by the selected respondents. The study was conducted to determine the acceptability level of black rice in production of mini cake. Specifically, it sought to find out the demographic profile of the respondents, the acceptability level of black rice in terms of appearance, aroma, texture, and taste. The treatment which had the highest level in terms of its visual quality and the significant difference among the treatments were further evaluated. The research used the questionnaire provided to forty (40) respondents consisting of ten (10) BSIT- FPSM students, ten (10) BSHM students, ten (10) faculty and staff of DHMIT and ten (10) senior high school student who had a background and experience related in cooking and food preparation to rate the sensory attributes using the modified 5-hedonic scale of sensory evaluation. The four (4) treatments were evaluated by the respondents to determine the different attributes of the product. It revealed that the most of the respondents were 18- 28 years old, female and students. With regards to sensory preference of black rice in mini cake production. The result showed that in all treatments, T3 that contained 45g of black rice in the production of mini cake surpassed in terms of appearance, aroma, texture and taste. Moreover, T3 obtained the highest weighted mean of 4. 43 and described as "Liked Extremely". On the other hand, T1 got the highest level in terms of visual quality that composed of 136g of black rice in mini cake production. The analysis of variance showed no significant difference among the treatments. Thus, the null hypothesis was accepted. Furthermore, it is recommended and encouraged to conduct further studies using other methods of processing of black rice to compare results. Product refinement is highly recommended for the next researcher. The black rice mini cakes can be produced as an entrepreneurial product. Farmers may consider producing more black rice to supply adequate production of this type of cereal. Food technology instructors may utilize the techno guide as an additional materials for instruction on food preparation and processing by utilizing black rice based products as a potential ideas on innovation to generate income thus enhance the living condition of the community people.

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THE PROBLEM AND ITS SCOPE

Rationale

Healthier options are effective marketing strategies today. Higher accounts of obesity, increasing cancer mortality rates, and diabetes proliferation continue to alarm people globally. Hence, people are now starting to be more careful with their food intake. The challenge for producers now is to create innovation healthy product, which can satisfy the consumer's appetite. There are many Filipinos who are affected by their high-fat, high salt diet. Some examples of these are high blood pressure, which is related to high salt intake, diabetes, and heart disease, which is related to high dietary energy and fat.

Black rice is a colored rice type. It contains essential amino acids, functional fats, dietary fiber, vitamins, minerals, anthocyanins, phenolic compounds, -oryzanols, tocopherols, tocotrienols, phytosterols, and phytic acid, among other nutrients and bioactive chemicals. Several studies have been conducted on black rice because of its supposed health benefits when ingested regularly. In addition, science and technology enable the creation and development of new products through the use of processing methods that improve quality qualities. Because of its nutritional richness, black rice has the potential to be employed in the creation of healthy foods and goods, such as functional foods and gluten-free cereals, providing additional health benefits to those who consume it. (Food Chem.2019).

Black rice, often known as forbidden rice or "emperor's rice," is well-known for its high antioxidant content and nutritional benefits. Forbidden rice got its name because it was once only available to the Chinese emperor in order to ensure his health and longevity, and it was forbidden to everyone else. Forbidden rice is non-glutinous medium-grain heirloom rice with a deep purple hue and a nutty, slightly sweet flavor. Anti-inflammatory and anti-carcinogenic effects are also found in black rice. Anthocyanin, a potent antioxidant, has been associated to a reduction in the number of cases of cancer. (Whelan, 2019)

Rice-based supplementary foods include cereals, biscuits or cookies, rice tea, rice milk, rice cake, and other snacks prepared from grains. Rice cake is a rice baked products relatively new snack food. It is a disk-shaped puffed product, low in calories. Although rice cakes are a puffed product, they are unique in that no added binder is used to hold the individually puffed rice kernels together. Because of consumer interest in low-calorie and dietary fiber-containing foods, rice cake is rapidly gaining widespread consumer acceptance.

The researchers is encourage to conduct a study on the Acceptability of black rice in mini cakes in Bohol Island State University-Bilar Campus in order to promote solutions to every health problem and healthy diet mention above and to utilized black rice while keeping the nutritional level at a high range.

Literature Background

The following related reading serves as the legal bases of the study.

The 1987 Philippine Constitution, Article XIV Section 10, states that:

> The State shall provide priority to research and development (R&D), invention, innovation and their utilization and to support indigenous, appropriate, and self-reliant scientific and technological capabilities, and their application to the country's productive systems and national life (FFTC Agricultural Policy Platform, 2014)

. In this regard, research and development assistance is provided to indigenous peoples in order for them to innovate and become productive through local innovations and scientific breakthroughs in order to attain national development and exclusive growth.

In legislation of Agricultural and Fisheries Modernization Act of 1997 known as AFMA (R.A 8435):

> An act prescribing urgent related measures to modernize the agriculture and fisheries sectors of the country in order to enhance their profitability, and prepare said sectors for the challenges of globalization through an adequate, focused and rational delivery of necessary support services, appropriating funds therefor and for other purposes.

According to the Presidential Proclamation No. 494, National Year of Rice, with the theme "Sapat na Bigas, Kaya ng Pinas." It's part of the Philippine government's plan to reach rice self-sufficiency by 2013. For greater health and reduced rice waste, this advocacy campaign aims to promote efficient farming and ethical ice consumption. Panatang Makapalay (Panatang Makapalay, 2013)

In accordance with the proclamation, the Department of Agriculture-CAR has asked the Regional Development Council to approve a resolution requiring all government offices and local government units in CAR, including high schools

and elementary schools, to recite the "Panatang Makapalay" (Rice Pledge) during flag-raising ceremonies every Monday. As the primary agency in this celebration, the Department of Agriculture as the main agency in this commemoration, the Department of Defense will provide information through tarpaulin for all government agencies and schools to display. (Panatang Makapalay, 2013)

Black rice is unquestionably one of the most unique rice varieties grown on the planet. It distinctive character provide the near-medicinal values are genuinely incredible, especially with all of today's medical knowledge and technologies. Rice is the type of meal that has the ability to save one's life. Consuming and appreciating this super food might make feel as if people eating something only monarchs eat. (BLACK RICE: THE EMPEROR'S RICE, 201.)

Despite being less popular than brown rice or forbidden rice, is an ancient grain with even more impressive health benefits than most other closely related rice varieties. Not only that this type of rice provide the highest concentration of powerful disease-fighting antioxidants, but it also contains dietary fiber, anti-inflammatory properties, and the ability to help prevent the development of cancer, diabetes, heart disease, and even weight gain are all possibilities. Black rice has been consumed in Asian regions for thousands of years. In fact, it was once reserved for only Chinese royalty (Annie Price, 2019).

Black rice contains more nutrients, such as vitamin E that is beneficial to the eyes, skin, and immune system, fiber, iron, and protein. Back rice is also high

in antioxidants, including anthocyanin, which may help the heart and brain fight cancer. (Staff, 2021). People are looking for better products with nutritional benefits, such as black rice flour, which can be used to make baked dough, pasta, and cookies instead of wheat flour. Paella, rice cakes, fried rice, pancakes, risotto, and porridge can all be made with black rice, (Chemistry F. , Black Rice, 2019).

American Health Association, the American Cancer Society and the 2005 Dietary Guidelines for Americans recommended an increase in the consumption of Black rice to prevent heart disease and certain kinds of cancers (USA Rice Federation 2008). Moreover, the US Food and Drug Administration have recognized black rice as a healthy whole grain capable of reducing the risk of certain disease (Kushwaha, 2016)

The origin of black rice created in China about 10,000 years ago is the ancestor of hundreds of types of modern rice. However, it is unique. It purplish black color, result of its high concentration of anthocyanin; this is the same antioxidant responsible for the color of eggplant, blueberries, acaí berries, and concord grapes, as well as purple cauliflower, purple corn, and blood oranges. Most cultivated rice produces white grains, but the color of black rice is caused by a gene mutation. Japanese researchers found that a change in a gene that controls anthocyanin rearranged to create black rice; this mutation occurred in a subspecies of rice. Black rice is cultivated in Southeast Asian countries such as India, Indonesia, Thailand, and China. Owing to its popularity in Western

countries, it is now also grown in small amounts in the Southern United States as well. (Oikawa T, Maeda H, Oguchi T, et al. 2015).

Cake is a type of baked sweet food made from flour, sugar, and other ingredients. Cakes began as a basic adaptation of bread, but now they encompass a vast range of preparations that can be simple or complicated, and that share characteristics with other sweets including pastries, meringues, custards, and pies. On ceremonial events such as weddings, anniversaries, and birthdays, cake is frequently offered as a celebratory food. Cakes are also broadly classified into several categories, primarily based on ingredients and mixing techniques. The term "cake" derives from the Old Norse word "kaka." The term "cake" comes from the Greek word "plakous," which means "flat" (plakoeis). It was made with a flour mixture that included eggs, milk, almonds, and honey (August 2015).

The first cakes made were not at all like the ones we eat today. Interestingly, the ancient Egyptians were the first culture to demonstrate baking skills, and cakes were more bread-like in appearance and sweetened with honey during Ancient Times. The Greeks had an early form of cheesecake, and the Romans created fruitcakes with raisins, nuts, and other fruits. Meanwhile, due to advances in technology and access to ingredients in the mid-17th century Europe, cakes were frequently baked. Modern cakes, which were round and topped with icing, are said to have originated in Europe. Historically, the first icing was a boiled mixture of sugar, egg whites, and flavorings. Many cakes at the time still had dried fruits in them, such as currants and citrons. (Garry's Grill 2018).

In the nineteenth century, cake today gained popularity. However, the treat was regarded as a luxury due to the high cost of sweet ingredients such as sugar and chocolate. Cakes were baked with extra refined white flour and baking powder instead of yeast during this time period. Buttercream frostings have also begun to replace traditional boiled icings. A baker's life has also become much easier as temperature controlled ovens have advanced. The bakers no longer had to constantly monitor and wait for the cake to finish baking. Furthermore, the Industrial Revolution increased the availability of ingredients, which reduced their cost, allowing more people to bake or cook with them or even buy them at the store, (Garry's Grill 2018).

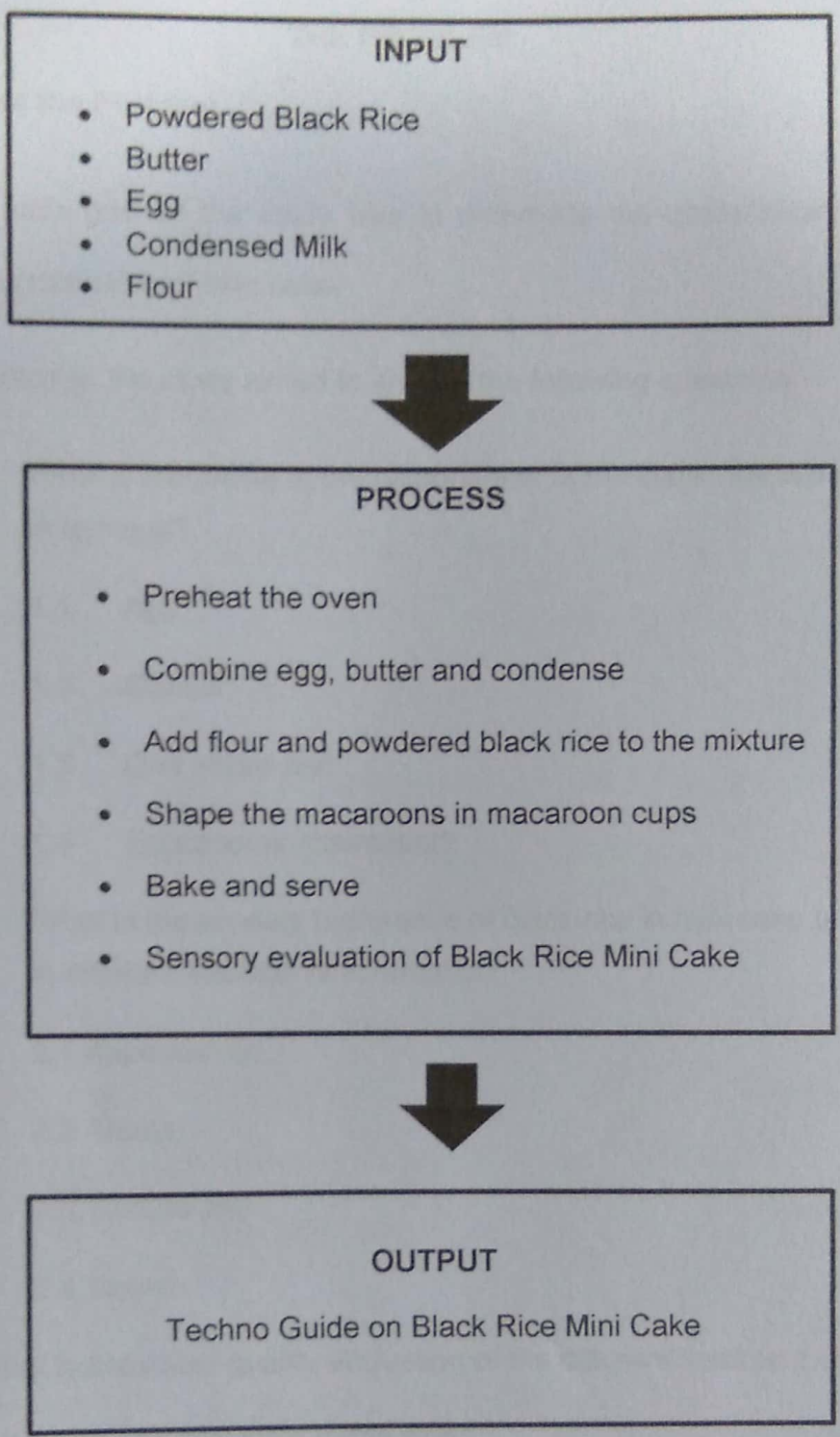

Figure 1 Flow of the Study

THE PROBLEM

Statement of the Problem

The main goal of the study was to determine the acceptability level of black rice in production of mini cake.

Specifically, the study aimed to answer the following questions:

1. What is the profile of the respondents of the black rice in mini cake in terms of?
   - 1.1 Age;
   - 1.2 Gender;
   - 1.3 Civil status and
   - 1.4 Educational attainment?
2. What is the sensory preference of black rice in mini cake production in different treatments in terms of?
   - 2.1 Appearance;
   - 2.2 Aroma;
   - 2.3 Texture and
   - 2.4 Taste?
3. What is the visual quality evaluation of the different treatment of black rice mini cake production?
4. Is there a significant difference among the treatments in terms of aappearance, aroma, texture and taste?

Null Hypothesis

There is no significant difference among the treatments of black rice mini cake in terms of appearance, aroma, texture and taste.

Significance of Study

The result of the study was very useful to the following concerns:

Farmers. The study would open doors for farmers to continue with the production of black rice and to increase income among them. This would also conclude that farmers play a pivotal role in the production of black rice and helping its sustainability for future consumption.

Entrepreneurs. With the less knowledge of people regarding black rice, these undertakings would allow entrepreneur to include in there marketing the benefits of black rice to the consumer.

Parents. The constant health problems that most parents are concerned generated the idea of the researcher to conduct study in the utilization of black rice and provide insights to the parents to serve food with outstanding health benefits that helps in combating disease.

Community. The result of this study is to the community as one of the products produce that might help the economy grow.

Government. The success of this study would suggest that the production of black rice should be given attention to partake in its sustainability for the betterment of the country and its citizen. In making it a success, the government

should utilize the result of this study and other related studies as collaborative efforts to inculcate to people the benefits of black rice to the community. Lastly, this would pave the way for more assistance to farmers in the propagation of black rice in the country to heighten its market and health value.

Future Researcher. The study would be a great help to the future researcher to explore and learn more new product and this would serve as their reference.

RESEARCH METHODOLOGY

Design

The researchers used the experimental research method utilizing the Complete Randomized Design (CRD) in order to determine the sensory preference of Black rice mini cakes in terms of appearance, aroma, texture and taste. The researchers employed the trial and error method to come up with the exact measurements of the ingredients in making black rice mini cakes.

Legend:

T1 = 100g of powdered black rice, 1 pc medium egg, 57grams butter, 240 ml condense milk, 34 grams flour

T2 = 90g of powdered black rice, 1 pc medium egg, 57grams butter, 240 ml condense milk, 34 grams flour

T3 = 60g of powdered black rice, 1 pc medium egg, 57grams butter, 240 ml condense milk, 34 grams flour

T4 = 30g of powdered black rice, 1 pc medium egg, 57grams butter, 240 ml condense milk, 34 grams flour

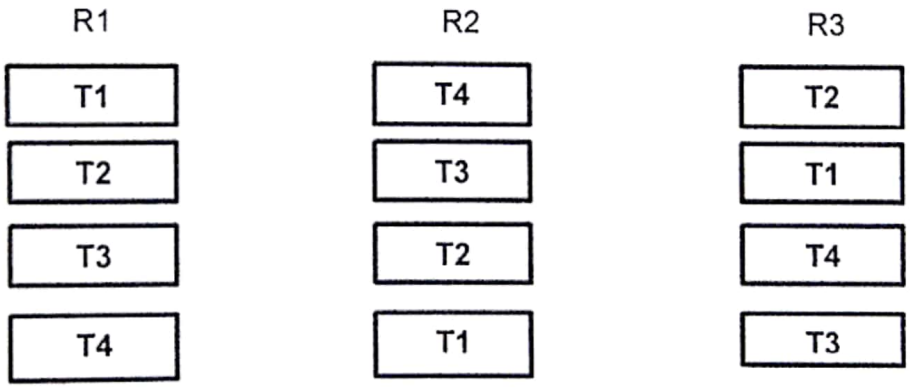

Figure 2 shows the experimental lay-out using CRD.

Environment and Participants

The study was conducted in Bohol Island State University- Bilar Campus, situated in Zamora, Bilar, Bohol. The institution offers Technology courses including Bachelor of Science in Industrial Technology, major in Food Preparation Service Management. The school provides the facilities to the learner to enrich theory learned in classroom learning. The locale of the study was approximately 43 km/s from the city of Tagbilaran. The town was popular of its rice production and in fact known as the rice granary in the province. Additionally, the school has a rice seed bank which was managed by the College of Agriculture and Natural Resources. Further, the town is located strategically at the foot of the renowned Chocolate Hills in Carmen, 20-minute drive to the world's wonder. Bilar town also offers natural scenery to tourist like the "Tarsier" known as the smallest primate in the world, springs, natural landscapes and the breath taking winding road going to the town.

The researchers purposively selected forty (40) respondents, which composed of ten (10) Faculty, ten (10) Bachelor of Science in Hospitality Management (BSHM) students, ten (10) Bachelor of Science in Industrial Technology major in Food Preparation Service Management students (BSIT-FPSM) in Bohol Island State University Bilar-Campus, ten (10) Senior high school students who are major in food preparation and processing.

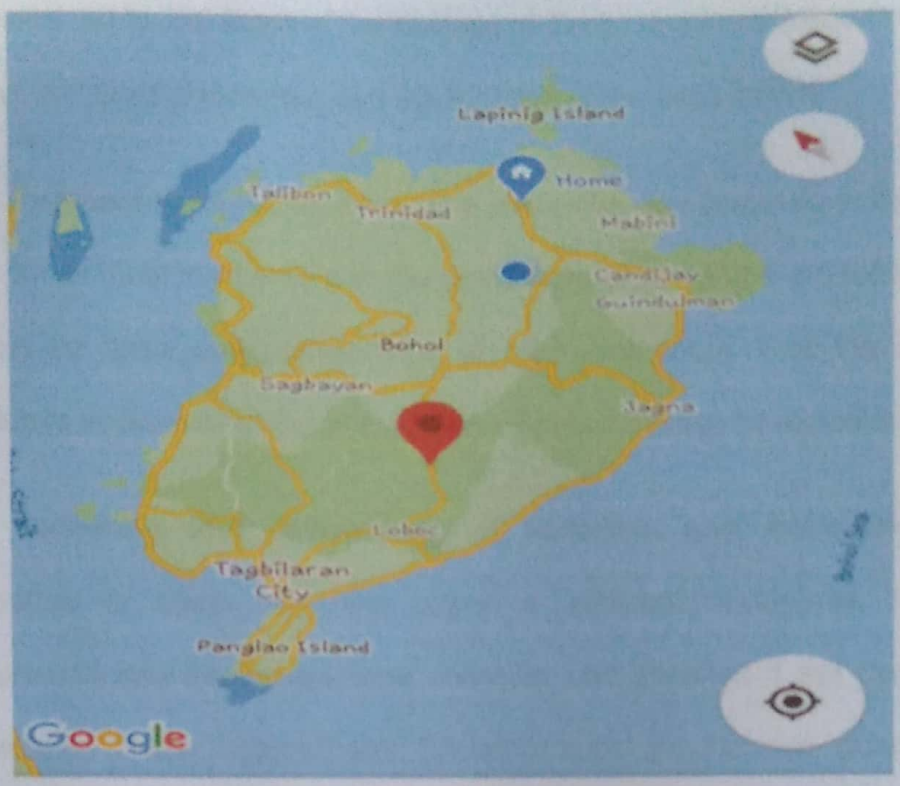

Figure 3. Map of Bohol

Instrument

The researchers used a modified 5-Hedonic scale sensory questionnaire that was adapted from the standardized sensory evaluation questionnaire, the 9-Hedonic scale of sensory evaluation of food in determining the preference or acceptability level of Black rice mini cake in four different treatments (David Peryam).

Procedure

Securing Permit. The researchers asked permission and approval from the Campus Director of the school noted with the Thesis Adviser and

recommended by the Dean of the College of Technology and Allied Sciences to conduct the study and further use the facilities of the department.

Purchasing of Ingredients. The black rice was procured in Bulilis, Ubay, Bohol, since most the farmers in the place were growing and producing this type of grain for ease and convenience of the researchers. And the rest of the ingredients needed were purchased in Bilar public market for expediency.

Gathering and Assembling of Materials and Equipment. In the preparation of black rice mini cakes in different treatments, ingredients, tools/utensils and equipment were collected and checked if still operational or otherwise. These included the following such as the rice grinder, plastic clamshells packaging, oven, mixing bowl, small bowl, wire whisk, hand mixer spreader spatula, measuring cups, cooling rack, macaroon cups, and rubber spatula.

Preparation of Black Rice. The previously milled Black rice placed in a clean big bowl for the grinding process.

Preparation of other ingredients for making black rice mini cake. Measure the condense milk to 240 ml, butter in 57grams, flour in 34 grams, and 1 medium egg.

Baking Black Rice Mini Cake. In baking, preheat the oven first to 150 degree Celsius (302 degree F). In a large bowl, cream butter until light and fluffy, add beaten egg and the milk while continuously stirring the mixture. Then

alternately add the flour mixture and the black rice powder into the mixture until the dry ingredients blended well. Next, place the macaroon cups in the muffin pan and place the mixture and bake in the preheated oven for 30 minutes. Remove from oven and let it stand on the muffin pan for about 1 minute before removing to cool in the wire rack.

Packaging of Black Rice Mini Cake. As soon as the black rice mini cakes were already cool. Transfer the baked product in a plastic clamshell for packaging. And before distributing the Black rice mini cake to the participants for the taste testing.

Testing/ Gathering Data. The researchers prepared the set-up before the testing. The following were secured, questionnaire for the sensory evaluation, the different treatments of black rice mini cake, bottled water, pen or pencil, camera, and other important elements needed for the evaluation of the product.

Visual Quality Evaluation. The researchers stored the products in clean area with ambient or room temperature for one month to determine the period of longevity and visual characteristic of the product. The researchers observed changes of the products based on the perceptible attributes such as; appearance, aroma, texture and taste every day for the indicated period. After one month of storing the product the researchers determined the visual quality of the different treatment.

Statistical Treatment

The data gathered was carefully tallied, tabulated, analyzed, computed and interpreted using Complete Randomized Design (CRD) to determine the significant difference among treatments for the purpose of presentation and analysis.

Formulas for the One-Way ANOVA

$$F=\frac{MS_{between}}{MS_{within}}$$

$$MS_{between}=\frac{SS_{between}}{df_{between}} \qquad MS_{within}=\frac{SS_{within}}{df_{within}}$$

$$SS_{between}=\Sigma\frac{(\Sigma x)^2}{n}-\frac{(\Sigma\Sigma x)^2}{n_T} \qquad SS_{within}=\Sigma\Sigma(x^2)-\Sigma\frac{(\Sigma x)^2}{n}$$

$$df_{between}=k-1 \qquad df_{within}=n_T-k$$

One Way ANOVA: The one-way Analysis Of Variance (ANOVA) was used to determine whether there are significant differences between the means of two or more independent (unrelated) groups (although you tend to only see it used when there are a minimum of three, rather than two groups).

The computed weighted mean was described using the following scale:

4.2-5.0 – Liked Extremely
3.4-4.1 – Liked Moderately
2.6-3.3 – Neither Liked Nor Disliked
1.8-2. – Disliked Extremely
1.0-1.7 – Disliked Moderately

OPERATIONAL DEFINITION OF TERMS

The succeeding terms were defined according to how it is use operationally in the context of the study.

Acceptability. It is the degree of acceptance of the appearance, aroma, texture and taste of Black rice mini cakes.

Appearance. It refers to the visual quality of the product as perceived by the naked eye such as color.

Aroma. Refer to pleasant smell obtain from the black rice mini cake.

Black Rice. It is black color and usually turns deep purple when cooked. It is suitable for making porridge, dessert, traditional Chinese black rice cake, bread, and noodles.

Visual Quality. Refers to the time between production and packaging of the product at the point it becomes unacceptable.

Taste. It refers how to describe the flavor of the product.

Texture. It refers to the quality of the black rice macaroons.

5-Hedonic Scale. Instrument used to provide description of the sensory attributes of the Black rice mini cake

Chapter 2

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter deals with the presentation, analysis and interpretation of the gathered data on the acceptability level of black rice in mini cake production in terms of appearance, aroma, texture and taste. The study was conducted in May-June 2021.

Profile of the Respondents

Table 1 presents the demographic profile of the respondents in terms of age, gender, civil status and educational attainment. The result showed that the 85% of the respondents were in the age bracket of 18-28 years old. While the age bracket of 29-39, 40-50, and 51-60 obtained the rating of 5%. In terms of gender, the result displayed that the highest percentage of 57.5% was obtained by females and the remaining 42.5% were male. As to civil status, 82.5% were single and the remaining 17.5% were married. Likewise, 50% of the respondents were college level, followed by senior high school 10 (25%); college graduates 6 (15%) and obtained post graduate studies obtained 4 (10%) respectively.

Table 1
Demographic Profile of the Respondents
n=40

Items	Frequency (F)	Percentage (%)
Age		
18-28	34	85%
29-39	2	5%
40-50	2	5%
51-60	2	5%
Total	40	100%
Gender		
Male	17	42.5%
Female	23	57.5%
Total	40	100%
Civil Status		
Single	33	82.5%
Married	7	17.5%
Total	40	100%
Educational Attainment		
Senior High School	10	25%
College Level	20	50%
College Graduate	6	15%
Obtained Post Graduate Study	4	10%
Total	40	100%

Sensory Evaluation of the Black Rice Mini Cake In Different Attributes

Table 2 presents the data on sensory evaluation on the acceptability level of black rice mini cake in terms of appearance, aroma, texture and taste.

Appearance includes its size, shape, color, structure, transparency or turbidity, dullness or gloss and degree of wholesomeness or damage. It includes

all visible attributes and derives from the interactions between a substance or object and its environment as perceived by the respondents.

The succeeding table 2 showed that T3 got the highest rate of 4.26% and described as "Liked Extremely" followed by both T2 and T4 with a rate of 4.16 % and described as "Liked Moderately" while T1 obtained the lowest weighted mean of 4.05%. This denotes that T3 was the most acceptable by the respondents in terms of appearance. According to Elsevier, (2016) food appearance, which is primarily determined by surface color, is the first sensation that the consumer perceives and uses as a tool to accept or reject food.

With regards to the aroma of the black rice mini cake includes its delicate, delicious, delightful, dewy and freshness characteristics. Table 2 revealed that T3 got the highest rate of 4.48% and described as "Liked Extremely". It was followed by T1 with the weighted mean of 4.34%, then with T4 with the weighted mean of 4.19% and T2 got the lowest weighted mean of 4.06%. All the latter treatments were described as "Liked Moderately". The data further revealed that T3 was the most acceptable in terms of aroma. According to Sharif, Mian & Butt, Masood (2017) aroma is the first cousin of taste; smell evaluates the aroma of food, which is important in the appreciation of flavor. Food tastes better when it smells good. The substance must be gassy in order to produce a smell sensation.

Moreover, texture is defining those properties that are sensed by touch in the mouth and with the hands, also describe the softness or smoothness of the black rice mini cake. Data revealed that T3 got the highest rating of 4.43% and

described as “Liked Extremely” followed by T2 with a weighted mean of 4.06%, then by T4 got the weighted mean of 4.05% and T1 got the lowest weighted mean of 3.92%. T2, T4 and T1 were all also described as "Liked Moderately". According to Tauferova et al., (2015), texture is a multimodal, multisensory food characteristic. It is defined as the functional and sensory manifestation of the surface, mechanical, and structural properties of foods as detected by kinaesthetic, vision, hearing, and touch. This food sensory attribute is conceptualized in a variety of ways, including thickness, creaminess, crunchiness, firmness, and smoothness.

The taste is the term to describe the black rice mini cake that is nutty, buttery and has a sugary flavor that can explode in the mouth. According to the table 2, T3 got the highest weighted mean of 4.43% and was described as "Liked Extremely", along with T3 and obtained the weighted mean of 4.05%, then T2 with the weighted mean 4.03% and T1 with the lowest weighted mean of 3.92% together all were described as "Liked Moderately". It revealed that T3 was the most acceptable treatment in terms of taste. According to Romagny, Ginon, & Salles (2017), taste is a proximal sense that requires direct contact of food with stimuli on the tongue to determine the quality of the food consumed. Umami, sour, sweet, bitter, and salty flavor are important in signalling nutrient-rich foods.

To sum up result in Table 2, it revealed that Black rice mini cake in regards to all sensory attributes T3 obtained the highest average weighted mean.

Thus, manifest T3 was the most acceptable treatment in terms of appearance, aroma, texture and taste.

Table 2
Sensory Evaluation of Black Rice in Mini Cake in Different Attributes
n= 40

Sensory Attributes	T1 (120g)		T2 (90g)		T3 (60g)		T4 (30g)	
	WM	Description	WM	Description	WM	Description	WM	Description
Appearance	4.05	Liked Moderately	4.16	Liked Moderately	4.26	Liked Extremely	4.16	Liked Moderately
Aroma	4.34	Liked Moderately	4.06	Liked Moderately	4.48	Liked Extremely	4.19	Liked Moderately
Texture	3.92	Liked Moderately	4.06	Liked Moderately	4.43	Liked Extremely	4.05	Liked Moderately
Taste	3.92	Liked Moderately	4.03	Liked Moderately	4.43	Liked Extremely	4.05	Liked Moderately
Average Weighted Mean	4.12	Liked Moderately	4.06	Liked Moderately	4.43	Liked Extremely	4.20	Liked Moderately

VISUAL QUALITY EVALUATION OF THE VARIOUS TREATMENTS

Visual quality is one of the most tangible aspects used to evaluate food quality as perceive by the naked eye. These methods of evaluation are highly

subjective but provide a clear understanding of the standards and values of the product. Besides, what is visible can affect the property of the objects either it will give good or bad characteristics of the product. (Cheng-Jin Du, Da-Wen Sun, in Computer Vision Technology for Food Quality Evaluation, 2008).

Table 3 shows the data that determines the visual quality evaluation of black rice in the production of mini cakes. The product was stored in a clamshell exposed in a room temperature within 30 days. However, all treatment was submitted to visual quality evaluation. It was found out that treatment 1 got the highest visual quality among all treatments since it can last until 26 days, and T4 obtained the shortest visual quality because the product was only good in visual quality on the 16th day and became soft in the following days.

Treatment 1 was still good and can be consumed until 26th day because of the quantity of powdered black rice added to the mixture that affect the texture of the black rice mini cake. Because the more powdered black rice added to the mixture, the more it becomes dry and give a crisp texture that can prevent it from deteriorating quickly.

While treatment 4 deteriorates at the 17th day because of the quantity of the ingredients. Thus, the ratio of the powdered black rice is less than the flour needed in a mixture. That is why the texture is so smooth and so soft that it can affect the visual quality of the product.

Table 3
Visual Quality Evaluation of Black Rice in Mini Cake Production
n=40

No. of Days	T1	T2	T3	T4
1	Pleasant	Pleasant	Pleasant	Pleasant
5	Pleasant	Pleasant	Pleasant	Pleasant
10	Pleasant	Pleasant	Pleasant	Pleasant
15	Pleasant	Pleasant	Pleasant	Pleasant
17	Pleasant	Pleasant	Pleasant	Pleasant but slightly soft
22	Pleasant	Pleasant	Pleasant but slightly soft	Pleasant but slightly soft
26	Pleasant	Pleasant but slightly soft	Soft	Soft
27	Pleasant but slightly soft	Pleasant but slightly soft	Soft	Soft
28	Pleasant but slightly soft	Pleasant but slightly soft	Soft	Soft
29	Pleasant but slightly soft	Pleasant but slightly soft	Soft	Soft
30	Unacceptable	Unacceptable	Unacceptable	Unacceptable

Significant Difference Among Treatment in Terms of the Different Sensory Attributes

In terms of appearance, the computed F-value is 1.587 with df (3) and P-value of 0.19470118 which is not significant at 0.05 level of significance. This means that there is no significant difference in terms of the appearance among the four (4) treatments; therefore the null hypothesis was accepted.

This implies that the quantity of powdered black rice added to each treatment does not affect its appearance.

In terms of aroma, the computed F-value is 7.191 which are significant at 0.05 level of significance with df (3) and P-value of 0.000149156. This means that there is a significant difference in aroma. Therefore, the null hypothesis was rejected.

For the texture, the F-value is 5.676 which is a significant level at 0.05 level of significance with df (3) and P-value of 0.001025879. This means that there is a significant difference in the texture; therefore the null hypothesis is rejected.

Taste, The computed F-value is 5.423, which is significant at 0.05 level of significance with df (3) and P-value of 0.00141935. This means that there is a significant difference in the taste of black rice in the production of macaroons; therefore the null hypothesis is rejected.

This implies that the quantity of the powdered black rice add to each treatment does affect its aroma, texture, and taste.

Table 4
Acceptability Level of Black Rice in Production of Mini Cake in Various Attributes

Sensory Attribute	Degree of Freedom	Sum of Squares	Mean square	Observed F	P-Value	Description	Interpretation
Appearance	3	1.052	0.350	1.587	0.19470118	Insignificant	Accept Ho
Aroma	3	4.063	1.354	7.191	0.000149156	Significant	Reject Ho
Texture	3	5.885	1.961	5.676	0.001025879	Significant	Reject Ho
Taste	3	6.056	2.019	5.423	0.00141935	Significant	Reject Ho

Table 5 revealed the comparison between paired treatments is needed to provide specific information on which means are significantly different from each other. Post hoc analysis in the Analysis of Variance was the test being employed in order to determine honestly significant differences among paired treatments in terms of appearance, aroma, texture and taste. The mean difference is compared to the computed honestly significant differences in order to identify the description that will give us the decision.

Table 5 shows that paired treatments for aroma (T1 vs. T2; T2 vs. T3 and T3 vs. T4), texture (T1 vs. T4; T2 vs. T3 and T3 vs. T4) and taste (T2 vs. T3 and T3 vs. T4) has a significant difference.

The result below implies that the paired treatments mentioned have significant differences in aroma, texture and taste of black rice mini cake because of the four treatments varying consistency due to the different measurement of powdered black rice applied. Meanwhile, in terms of aroma (T1 vs. T3; T1 vs. T4 and T2 vs. T4), texture (T1 vs. T2; T1 vs. T3 and T2 vs. T4), taste (T1 vs. T2; T1 vs. T3; T1 vs. T4 and T2 vs. T4) and all paired treatment of appearance has no significant difference in the respondent's preferences of black rice mini cake.

Table 5
Comparison of Post Hoc Analysis Result in the Acceptability Level of Black Rice in Mini Cake Production in Four Treatments in Terms of Sensory Attributes

Post Hoc Analysis for Appearance

Pairing of Treatments	P-Value	Interpretation	Decision
T1 vs. T2	0.4990406077	Insignificant	Accept Hypothesis
T1 vs. T3	0.0522171	Insignificant	Accept Hypothesis
T1 vs. T4	0.320840073	Insignificant	Accept Hypothesis
T2 vs. T3	0.144170058	Insignificant	Accept Hypothesis
T2 vs. T4	0.7272852	Insignificant	Accept Hypothesis
T3 vs. T4	0.255688027	Insignificant	Accept Hypothesis

Post Hoc Analysis for Aroma

T1 vs. T2	0.006976691	Significant	Reject Hypothesis
T1 vs. T3	0.133984983	Insignificant	Accept Hypothesis
T1 vs. T4	0.080512532	Insignificant	Accept Hypothesis
T2 vs. T3	0.000178609	Significant	Reject Hypothesis
T2 vs. T4	0.188082061	Insignificant	Accept Hypothesis
T3 vs. T4	0.002075787	Significant	Reject Hypothesis

Post Hoc Analysis for Texture

T1 vs. T2	0.410497148	Insignificant	Accept Hypothesis
T1 vs. T3	0.905460925	Insignificant	Accept Hypothesis
T1 vs. T4	0.004697424	Significant	Reject Hypothesis
T2 vs. T3	0.006217184	Significant	Reject Hypothesis
T2 vs. T4	0.309568208	Insignificant	Accept Hypothesis
T3 vs. T4	0.000210844	Significant	Reject Hypothesis

Post Hoc Analysis for Taste

T1 vs. T2	0.376306748	Insignificant	Accept Hypothesis
T1 vs. T3	0.017810786	Insignificant	Accept Hypothesis
T1 vs. T4	0.175038199	Insignificant	Accept Hypothesis
T2 vs. T3	0.00032605	Significant	Reject Hypothesis
T2 vs. T4	0.112922972	Insignificant	Accept Hypothesis
T3 vs. T4	0.003601401	Significant	Reject Hypothesis

Chapter 3

SUMMARY, FINDING, CONLUSIONS AND RECOMMENDATION

In this chapter, the researcher presents the summary of findings, conclusions and recommendations based on the analysis and interpretation of data.

Summary

The aim of the study was to determine the sensory evaluation of Black rice mini cakes in terms of its acceptability level in appearance, aroma, taste and texture and its visual quality. The locale of the study was at Bohol Island State University Bilar-Campus during the academic year of 2021-2022. The study was conducted in May-June 2021 with forty (40) respondents which constituted of ten (10) BSIT-FPSM students, ten (10) BSHM students, ten (10) Senior High School students and ten (10) Faculty of Bohol Island State University-Bilar Campus.

The researchers used the descriptive research design through the help of a questionnaire. The researchers provided a questionnaire as an instrument to rate the respondents' acceptability level based on its sensory attributes of the product. The study used the modified 5-point hedonic scale with the descriptive rating of (5) "Liked Extremely", (4) "Liked Moderately", (3) neither "Neither Liked nor Disliked", (2) "Disliked Moderately" and (1) Disliked Extremely".

The respondents were given ample time to answer the questions. Right after the testing of the product, the questionnaires were retrieved back by the

researchers for the analysis and interpretation of data. The result was tallied, computed and tabulated using the weighted mean to determine the acceptability level of the respondents to the product. The ANOVA, P-test was used in getting the difference between each treatment.

Findings

After analysing and interpreting the data, the researcher came up with the following findings;

Demographic Profile

The majority of the respondent's ages were 18 to 28 years old were female and single. Most of them were college level with 50% followed by senior high school students, college graduate and lastly the obtained post graduate study with a 25%, 15% and 10% respectively.

Sensory Evaluation of Black Rice Mini Cakes

The following were the findings based on the sensory evaluation of Black rice mini cakes. In terms of appearance, treatment 3 was the most captivating to the eyes of the respondents because T3 got the highest weighted mean of 4.26% and described as "Liked Extremely". In terms of aroma of the product T3 was the most preferred by the respondents because T3 got a 4.48% weighted mean described as "Liked Extremely". In terms of taste of the product, the most palatable for the respondents was the treatment 3 because it got the weighted mean of 4.43% described as "Liked Extremely". In terms of texture of the product

T3 got also the highest weighted mean of 4.43% and described as "Liked Extremely". In view of the fact, treatment 3 was the most preferred and acceptable by the respondents by obtaining the highest average weighted mean of 4.43% described as "Liked Extremely".

Visual Quality Evaluation

The mini cakes were stored in a clam shell plastic container stored exposed to a room temperature within 30 days. It was discovered that T1 has the highest visual quality and can last until 26th day.

Difference in the Sensory Preference of Black Rice Mini Cake

There is no significant difference in the appearance as it revealed that the P-value are greater than 0.05 level of significance, therefore the null hypothesis was accepted. As for the aroma, texture, and taste, the P-values are lesser than the 0.05 level of significance, therefore there is a significant difference and the null hypothesis was rejected.

Conclusion

The sensory evaluation on the acceptability level of black rice mini cakes in terms of appearance, aroma, taste, and texture revealed that T3 was the most acceptable. As to significant, only aroma, texture, and taste have a significant difference at 5% level and rejected the null hypothesis.

Recommendations

Following recommendations:

1. Product refinement is highly recommended for the next researcher.
2. The black rice mini cakes can be proposed as an entrepreneurial product.
3. Food technology instructors may utilized the techno guide as an additional recipe to food instruction and as basis for teaching other black rice based products that can be a potential innovation to many income generating products after the enhancement of its attributes.
4. Farmers may consider producing more black rice to supply production of black rice macaroon.
5. Future researchers are encouraged to conduct further studies using other methods of processing of black rice to compare results.

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APPENDIX A

March 29, 2021

MARIETTA C. MACALOLOT, Ph. D.
College Director
BISU Bilar Campus

Madam:

Greetings!

In partial fulfilment of the requirements of Bachelor of Science and Industrial Technology major in Food Preparation Service Management, we the students in the subject Technology Research 2 in the S.Y. 2020-2021, conducted a research entitled "The Acceptability Level of Black rice *(Oryza sativa L. indica)* in Production of Mini Cake "

In this regards we would like to ask permission through the Dean of the College of Technology and Allied Services to allow us to distribute and to gather the data necessary in this study. We the researcher assures that these undertakings will follow the health protocols set upon the university in the distribution and retrieval of the data for safety purposes for both parties.

We would greatly appreciate your consent about the request.

Very truly yours,
Jemalyn V.Boncales
Markie A. Fernandez
Regine Etorma
Vanessa L. Gutang
The Researchers

Noted:

(sgd)NELIA Q. CATAYAS, Ph. D.
Adviser

Recommending Approval:

(sgd)ARLEN B. GUDMALIN, Ph. D
Dean, CTAS

Approved:

(sgd) MARIETTA C. MACALOLOT, Ph.D.
College Director

APPENDIX B

Republic of the Philippines
BOHOL ISLAND STATE UNIVERSITY
Bilar, Campus
Zamora, Bilar, Bohol

College of Technology and Allied Sciences

Vision: A premier S&T for the formation of a world-class and virtues human resource for sustainable development in Bohol and the country.

Mission: BISU is committed to provide quality higher education in the arts and sciences, as well as in the professional and technological fields; undertake research and development, and extensions services for the sustainable development of Bohol and the country.

Questionnaire on the Modified 5-Hedonic Sensory Evaluation on the Acceptability of Black Rice Mini Cakes

I. Profile of Respondents. Please answer the following questions with sincerity.
Age: _____ Gender: _____ Civil Status: _____
Educational Attainment: _____

II. Sensory Evaluation: Please respond honestly by filling up the check mark (√) on the corresponding table below. Samples with label are provided for evaluation; rinse your mouth with water before and after tasting. Write your responses accordingly.

Sensory Preference	Description / Rating	T4	T3	T2	T1
Appearance	5 Liked Extremely				
	4 Liked Moderately				
	3 Neither Liked nor Disliked				
	2 Disliked Extremely				
	1 Disliked Moderately				
Aroma	5 Liked Extremely				
	4 Liked Moderately				
	3 Neither Liked nor Disliked				
	2 Disliked Extremely				
	1 Disliked Moderately				

Taste	5 Liked Extremely				
	4 Liked Moderately				
	3 Neither Liked nor Disliked				
	2 Disliked Extremely				
	1 Disliked Moderately				
Texture	5 Liked Extremely				
	4 Liked Moderately				
	3 Neither Liked nor Disliked				
	2 Disliked Extremely				
	1 Disliked Moderately				

Legend:

5 = the respondents Liked extremely the product in terms of appearance, aroma, texture and taste.

4 = the respondents Liked moderately the product in terms of appearance, aroma, texture and taste.

3 = the respondents neither Liked nor Disliked the product in terms of appearance, aroma, texture and taste.

2= the respondents Disliked extremely the product in terms of appearance, aroma, texture and taste.

1= the respondents Dislike moderately the product in terms of appearance, aroma, texture and taste.

APPENDIX C

Republic of the Philippines
Bohol Island State University
Bilar-Campus, Zamora, Bilar Bohol

TECHNOLOGY GUIDE

BLACK RICE IN MINI CAKE PRODUCTION

(Oryza sativa L. indica)

APPENDIX D

Raw Data

Appearance

Responden Number	T1				T2				T3				T4			
	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average
1	5	4	5	4.666667	4	4	4	4	5	4	5	4.666667	4	4	4	4
2	4	5	4	4.333333	4	4	4	4	5	5	5	5	3	4	3	3.333333
3	4	3	4	3.666667	2	4	2	2.666667	4	4	4	4	4	4	4	4
4	5	4	5	4.666667	4	4	4	4	5	5	5	5	4	3	4	3.666667
5	5	4	5	4.666667	5	4	5	4.666667	3	5	3	3.666667	5	4	5	4.666667
6	4	4	4	4	5	2	5	4	4	4	4	4	4	4	4	4
7	4	4	4	4	4	3	4	3.666667	4	4	4	4	5	5	5	5
8	4	5	4	4.333333	5	4	5	4.666667	4	5	4	4.333333	4	4	4	4
9	4	4	4	4	3	4	3	3.333333	3	4	3	3.333333	5	3	5	4.333333
10	3	5	3	3.666667	3	5	3	3.666667	5	3	5	4.333333	4	5	4	4.333333
11	5	3	5	4.333333	4	4	4	4	5	3	5	4.333333	5	3	5	4.333333
12	4	4	4	4	4	5	4	4.333333	5	4	5	4.666667	4	4	4	4
13	4	5	4	4.333333	4	5	4	4.333333	3	5	3	3.666667	4	5	4	4.333333
14	5	4	5	4.666667	4	4	4	4	4	4	4	4	3	5	3	3.666667
15	5	5	5	5	5	4	5	4.666667	4	4	4	4	4	5	4	4.333333
16	5	4	5	4.666667	4	5	4	4.333333	4	4	4	4	4	4	4	4
17	2	5	2	3	5	4	5	4.666667	5	5	5	5	5	4	5	4.666667
18	4	4	4	4	5	3	5	4.333333	5	3	5	4.333333	4	5	4	4.333333
19	5	2	5	4	5	4	5	4.666667	5	4	5	4.666667	4	3	4	3.666667
20	4	3	4	3.666667	4	3	4	3.666667	5	5	5	5	5	4	5	4.666667
21	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4.333333
22	3	5	3	3.666667	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333
23	4	4	4	4	4	4	4	4	5	4	5	4.666667	4	4	4	4
24	4	4	4	4	3	4	3	3.333333	4	5	4	4.333333	4	4	4	4
25	4	3	4	3.666667	4	4	4	4	4	4	4	4	3	4	3	3.333333
26	3	4	3	3.333333	4	4	4	4	3	3	3	3	3	4	3	3.333333
27	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667
28	5	5	5	5	4	4	4	4	4	4	4	4	5	3	5	4.333333
29	5	4	5	4.666667	4	4	4	4	5	4	5	4.666667	4	5	4	4.333333
30	2	5	2	3	4	5	4	4.333333	4	4	4	4	3	4	3	3.333333
31	4	4	4	4	4	4	4	4	4	5	4	4.333333	5	4	5	4.666667
32	4	5	4	4.333333	4	4	4	4	4	4	4	4	4	4	4	4
33	3	3	3	3	4	5	4	4.333333	4	3	4	3.666667	4	4	4	4
34	4	2	4	3.333333	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333
35	4	3	4	3.666667	4	4	4	4	4	5	4	4.333333	5	4	5	4.666667
36	4	4	4	4	4	5	4	4.333333	5	5	5	5	4	4	4	4
37	3	4	3	3.333333	5	4	5	4.666667	3	5	3	3.666667	4	4	4	4
38	3	5	3	3.666667	4	5	4	4.333333	5	5	5	5	4	4	4	4
39	4	5	4	4.333333	4	5	4	4.333333	5	4	5	4.666667	4	5	4	4.333333
40	5	4	5	4.666667	5	4	5	4.666667	4	5	4	4.333333	5	5	5	5
	Total Average			4.05	Total Average			4.125	Total Average			4.275	Total Average			4.158333

Aroma

Respondents Number	T1				T2				T3				T4			
	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average
1	5	4	5	4.666667	4	4	4	4	5	5	5	5	4	4	4	4
2	3	5	3	3.666667	5	4	5	4.666667	5	5	5	5	4	4	4	4
3	4	4	4	4	3	3	3	3	4	4	4	4	4	3	4	3.666667
4	5	3	5	4.333333	5	5	5	5	5	5	5	5	5	4	5	4.666667
5	4	4	4	4	3	4	3	3.333333	5	5	5	5	4	4	4	4
6	4	4	4	4	5	3	5	4.333333	4	5	4	4.333333	4	4	4	4
7	4	4	4	4	4	4	4	4	4	5	4	4.333333	5	4	5	4.666667
8	3	5	3	3.666667	4	5	4	4.333333	3	5	3	3.666667	3	5	3	3.666667
9	5	4	5	4.666667	2	4	2	2.666667	4	4	4	4	5	4	5	4.666667
10	5	4	5	4.666667	5	3	5	4.333333	5	5	5	5	5	4	5	4.666667
11	5	4	5	4.666667	4	3	4	3.666667	5	4	5	3.666667	4	4	4	4
12	4	4	4	4	4	5	4	4.333333	4	4	4	4	4	4	4	4
13	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333	4	4	4	4
14	5	4	5	4.666667	3	4	3	3.333333	4	4	4	4	4	5	4	4.333333
15	4	4	4	4	5	4	5	4.666667	4	5	4	4.333333	4	5	4	4.333333
16	5	3	5	4.333333	5	4	5	4.666667	5	3	5	4.333333	5	3	5	4.333333
17	5	5	5	5	5	4	5	4.666667	5	5	5	5	5	4	5	4.666667
18	5	5	5	5	5	2	5	4	5	4	5	4.666667	5	5	5	5
19	5	3	5	4.333333	5	3	5	4.333333	5	3	5	4.333333	5	3	5	4.333333
20	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	4	5	4	4.333333
21	5	4	5	4.666667	4	4	4	4	5	5	5	5	4	4	4	4
22	4	5	4	4.333333	3	4	3	3.333333	4	5	4	4.333333	3	4	3	3.333333
23	4	4	4	4	4	4	4	4	5	4	5	4.666667	5	4	5	4.666667
24	4	4	4	4	4	4	4	4	5	4	5	4.666667	4	4	4	4
25	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
26	4	4	4	4	3	4	3	3.333333	4	4	4	4	4	4	4	4
27	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667	4	4	4	4
28	4	5	4	4.333333	4	3	4	3.666667	5	4	5	4.666667	5	4	5	4.666667
29	5	4	5	4.666667	4	4	4	4	5	4	5	4.666667	4	4	4	4
30	3	4	3	3.333333	3	5	3	3.666667	3	4	3	3.333333	3	4	3	3.333333
31	4	5	4	4.333333	4	3	4	3.666667	5	5	5	5	4	4	4	4
32	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333
33	4	5	4	4.333333	4	4	4	4	4	5	4	4.333333	4	4	4	4
34	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333
35	4	5	4	4.333333	4	5	4	4.333333	4	5	4	4.333333	4	4	4	4
36	5	5	5	5	3	5	3	3.666667	5	5	5	5	4	5	4	4.333333
37	5	4	5	4.666667	4	5	4	4.333333	5	5	5	5	4	5	4	4.333333
38	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4.333333
39	4	5	4	4.333333	4	4	4	4	5	4	5	4.666667	5	4	5	4.666667
40	5	4	5	4.666667	4	4	4	4	4	5	4	4.333333	4	4	4	4

Taste

Respondents Number	T1				T2				T3				T4			
	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average
1	4	3	4	3.666667	4	3	4	3.666667	5	5	5	5	5	3	5	4.333333
2	4	4	4	4	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333
3	4	4	4	4	3	4	3	3.333333	4	4	4	4	4	4	4	4
4	4	4	4	4	3	4	3	3.333333	5	4	5	4.666667	4	4	4	4
5	4	4	4	4	4	4	4	4	5	5	5	5	4	5	4	4.333333
6	5	4	5	4.666667	5	3	5	4.333333	5	4	5	4.666667	5	4	5	4.666667
7	5	3	5	4.333333	5	3	5	4.333333	5	3	5	4.333333	5	5	5	5
8	4	4	4	4	5	3	5	4.333333	5	5	5	5	4	4	4	4
9	5	4	5	4.666667	1	3	1	1.666667	3	5	3	3.666667	5	3	5	4.333333
10	4	4	4	4	4	4	4	4	4	5	4	4.333333	4	4	4	4
11	5	3	5	4.333333	4	3	4	3.666667	5	3	5	4.333333	5	4	5	4.666667
12	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	4	5	4	4.333333
13	4	3	4	3.666667	4	4	4	4	5	5	5	5	4	5	4	4.333333
14	5	5	5	5	5	5	5	5	4	5	4	4.333333	5	5	5	5
15	4	5	4	4.333333	5	5	5	5	4	5	4	4.333333	5	5	5	5
16	5	4	5	4.666667	5	5	5	5	5	5	5	5	5	4	5	4.666667
17	5	5	5	5	5	4	5	4.666667	5	5	5	5	5	4	5	4.666667
18	5	5	5	5	5	1	5	3.666667	5	3	5	4.333333	4	5	4	4.333333
19	5	3	5	4.333333	5	4	5	4.666667	5	4	5	4.666667	4	3	4	3.666667
20	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667	5	5	5	5
21	3	4	3	3.333333	3	4	3	3.333333	5	5	5	5	3	5	3	3.666667
22	4	5	4	4.333333	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333
23	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5
24	3	4	3	3.333333	3	4	3	3.333333	3	5	3	3.666667	5	4	5	4.666667
25	4	3	4	3.666667	3	4	3	3.333333	5	2	5	4	3	2	3	2.666667
26	3	4	3	3.333333	3	4	3	3.333333	3	5	3	3.666667	4	4	4	4
27	3	3	3	3	4	3	4	3.666667	5	3	5	4.333333	5	3	5	4.333333
28	5	5	5	5	5	5	5	5	5	4	5	4.666667	5	5	5	5
29	5	5	5	5	4	4	4	4	5	5	5	5	4	5	4	4.333333
30	3	4	3	3.333333	4	5	4	4.333333	4	4	4	4	3	5	3	3.666667
31	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	5	5	5	5
32	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	5	5	5	5
33	3	3	3	3	4	4	4	4	2	5	2	3	2	5	2	3
34	3	5	3	3.666667	3	5	3	3.666667	3	5	3	3.666667	3	5	3	3.666667
35	5	4	5	4.666667	4	3	4	3.666667	5	5	5	5	5	4	5	4.666667
36	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4.666667
37	3	4	3	3.333333	4	4	4	4	5	5	5	5	5	5	5	5
38	4	5	4	4.333333	3	5	3	3.666667	5	5	5	5	4	4	4	4
39	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	5	5	5	5
40	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Texture

Respondents Number	T1				T2				T3				T4			
	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average
1	4	4	4	4	5	3	5	4.333333	5	5	5	5	1	4	1	2
2	4	4	4	4	5	5	5	5	5	5	5	5	5	1	5	3.666667
3	4	3	4	3.666667	4	4	4	4	4	3	4	3.666667	4	4	4	4
4	5	4	5	4.666667	5	5	5	5	4	5	4	5	4	5	4	4.333333
5	2	4	2	2.666667	2	4	2	2.666667	5	5	5	5	5	4	5	4.666667
6	4	4	4	4	5	4	5	4.666667	4	4	4	4	5	4	5	4.666667
7	4	4	4	4	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333
8	4	5	4	4.333333	4	5	4	4.333333	5	4	5	4.666667	4	4	4	4
9	5	4	5	4.666667	1	4	1	2	4	4	4	4	5	3	5	4.333333
10	3	2	3	2.666667	3	2	3	2.666667	5	5	5	5	3	5	3	3.666667
11	5	4	5	4.666667	4	3	4	3.666667	5	3	5	4.333333	5	4	5	4.666667
12	4	4	4	4	4	5	4	4.333333	5	4	5	4.666667	4	5	4	4.333333
13	4	5	4	4.333333	4	5	4	4.333333	3	5	3	3.666667	3	5	3	3.666667
14	5	4	5	4.666667	5	4	5	4.666667	4	4	4	4	4	4	4	4
15	4	4	4	4	5	4	5	4.666667	4	4	4	4	4	5	4	4.333333
16	5	3	5	4.333333	5	4	5	4.666667	4	5	4	4.333333	3	4	3	3.333333
17	3	5	3	3.666667	4	4	4	4	5	5	5	5	5	4	5	4.666667
18	4	5	4	4.333333	5	1	5	3.666667	5	4	5	4.666667	4	5	4	4.333333
19	4	1	4	3	5	3	5	4.333333	5	2	5	4	4	2	4	3.333333
20	5	3	5	4.333333	5	3	5	4.333333	5	5	5	5	5	3	5	4.333333
21	4	4	4	4	3	4	3	3.333333	5	5	5	5	4	4	4	4
22	3	5	3	3.666667	4	4	4	4	3	5	3	3.666667	4	5	4	4.333333
23	4	3	4	3.666667	4	2	4	3.333333	5	5	5	5	4	5	4	4.333333
24	4	4	4	4	4	4	4	4	5	5	5	5	5	4	5	4.666667
25	4	3	4	3.666667	4	4	4	4	4	4	4	4	3	4	3	3.333333
26	4	4	4	4	3	4	3	3.333333	3	3	3	3	4	3	4	3.666667
27	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667	5	4	5	4.666667
28	4	5	4	4.333333	4	5	4	4.333333	4	4	4	4	5	4	5	4.666667
29	5	4	5	4.666667	4	4	4	4	5	4	5	4.666667	4	4	4	4
30	1	4	1	2	3	5	3	3.666667	2	4	2	2.666667	2	4	2	2.666667
31	4	3	4	3.666667	3	4	3	3.333333	5	5	5	5	4	4	4	4
32	3	5	3	3.666667	2	5	2	3	5	4	5	4.666667	5	3	5	4.333333
33	3	4	3	3.333333	4	5	4	4.333333	5	3	5	4.333333	4	5	4	4.333333
34	4	3	4	3.666667	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333
35	4	4	4	4	4	5	4	4.333333	4	5	4	4.333333	4	3	4	3.666667
36	3	4	3	3.333333	4	5	4	4.333333	5	5	5	5	4	4	4	4
37	4	4	4	4	5	4	5	4.666667	3	5	3	3.666667	5	4	5	4.666667
38	4	4	4	4	5	5	5	5	5	5	5	5	3	4	3	3.333333
39	4	4	4	4	4	4	4	4	5	5	5	5	4	4	4	4
40	4	5	4	4.333333	4	5	4	4.333333	5	5	5	5	4	5	4	4.333333

APPENDIX F

Computation of One-Way Analysis of Variance

Appearance

Groups	*Count*	*Sum*	*Average*	*Variance*
T1	40	162	4.05	0.288034188
T2	40	165	4.125	0.180555556
T3	40	171	4.275	0.232977208
T4	40	166.3333	4.158333	0.182264957

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.052083333	3	0.350694	1.587154485	0.194701	2.662568549
Within Groups	34.46944444	156	0.220958			
Total	35.52152778	159				

Aroma

Groups	*Count*	*Sum*	*Average*	*Variance*
T1	40	173.6666667	4.341667	0.150925926
T2	40	162.3333333	4.058333	0.267165242
T3	40	179.3333333	4.483333	0.199145299
T4	40	167.6666667	4.191667	0.136111111

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.063194444	3	1.354398	7.191358608	0.000149156	2.662568549
Within Groups	29.38055556	156	0.188337			
Total	33.44375	159				

Texture

Groups	Count	Sum	Average	Variance
T1	40	156.6666667	3.91666667	0.346153846
T2	40	161.3333333	4.03333333	0.449002849
T3	40	177.3333333	4.43333333	0.36011396
T4	40	162	4.05	0.333618234

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6.05555556	3	2.01851852	5.422885572	0.00141935	2.662568549
Within Groups	58.06666667	156	0.37222222			
Total	64.12222222	159				

Taste

Groups	Count	Sum	Average	Variance
T1	40	167	4.175	0.353205128
T2	40	162	4.05	0.436182336
T3	40	182	4.55	0.270940171
T4	40	175.3333333	4.38333333	0.322222222

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5.885416667	3	1.96180556	5.675905414	0.001025879	2.662568549
Within Groups	53.91944444	156	0.34563746			
Total	59.80486111	159				

APPENDIX G

DOCUMENTATION







RESEARCHER'S PROFILE

Name: Jemalyn V. Boncales
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Date of Birth: May 9, 1999
Gender: Female
Civil Status: Single
Citizenship: Filipino
Religion: UCCP

EDUCATIONAL ATTAINMENT

Elementary: Bayongan Elementary School
Bayongan, San Miguel, Bohol
S.Y. 2011-2012

Secondary: San Miguel Technical Vocational School
Poblacion, San Miguel, Bohol
S.Y. 2015-2016

Senior High School: San Miguel Technical Vocational School
Poblacion, San Miguel, Bohol
S.Y. 2017-2018

Tertiary: Bohol Island State University- Bilar Campus
Zamora, Bilar, Bohol
A.Y. 2020-2021

Course: Bachelor of Science and Industrial Technology
Major in Food Preparation Service Management

RESEARCHER'S PROFILE

Name: Regine Etorma

Address: Gov. Boyles, Ubay, Bohol

Date of Birth: February, 1998

Gender: Female

Civil Status: Single

Citizenship: Filipino

Religion: Catholic

EDUCATIONAL ATTAINMENT

Elementary: Gov. Boyles, Elementary School
Gov. Boyles, Ubay, Bohol
S.Y. 2004-2005

Secondary: San Isdro Technical Vocational High School
San Isidro, Pilar, Bohol
S.Y. 2010-2011

Tertiary: Bohol Island State University- Bilar Campus
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Citizenship: Filipino

Religion: Catholic

EDUCATIONAL ATTAINMENT

Elementary: Buenavista Elementary School
Buenavista, Carmen, Bohol
S.Y. 2011-2012

Secondary: Katipunan National High School
Katipunan, Carmen, Bohol
S.Y. 2015-2016

Senior High School: Katipunan National High School
Katipunan, Carmen, Bohol
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Tertiary: Bohol Island State University- Bilar Campus
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Name: Markie A. Fernandez

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Citizenship: Filipino

Religion: Catholic

EDUCATIONAL ATTAINMENT

Elementary: Bulilis, Elementary School
Bulilis, Ubay, Bohol
S.Y. 2008-2009

Secondary: Bulilis National High School
Bulilis, Ubay, Bohol
S.Y. 2014-2015

Senior High School: Bulilis National High School
Bulilis, Ubay, Bohol
S.Y. 2017-2018

Tertiary: Bohol Island State University- Bilar Campus
Zamora, Bilar, Bohol
A.Y. 2020-2021

Course: Bachelor of Science and Industrial Technology
Major in Food Preparation Service Management