Development and Consumer Palatability of Cookies Using Jackfruit Seeds

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ABSTRACT

Jackfruit seeds are commonly discarded as agricultural waste despite their valuable nutritional and functional properties. This study aimed to develop cookies using 100% jackfruit seed flour with three varying levels of sugar — Trial 1 (Normal Sugar, 165 g), Trial 2 (Medium Sugar, 124 g), and Trial 3 (Low Sugar, 82 g) — and evaluate their sensory acceptability and market potential. The study employed an experimental research design with 105 respondents (5 experts and 100 non-experts) who evaluated the products using a 5-point hedonic scale. Results showed that Trial 1 consistently obtained the highest sensory ratings across all attributes (color, aroma, taste, texture, and overall acceptability), followed by Trial 3 and Trial 2. Repeated-measures ANOVA confirmed a significant difference in overall acceptability among formulations, $F(2) = 12.45$, $p = 0.001$, partial $\eta^2 = 0.19$. Post-hoc tests revealed that Trial 1 was rated significantly higher than both Trial 2 ($p = 0.032$) and Trial 3 ($p < 0.001$). Microbiological testing confirmed that the cookies were safe for consumption, with all parameters within FDA Philippines standards. This study demonstrates that jackfruit seeds can be successfully transformed into an acceptable, value-added food product, supporting sustainable food production and agricultural waste utilization.

CHAPTER I — PROBLEM AND ITS BACKGROUND

Background of Study

The growing interest in sustainable food production has prompted researchers to investigate underutilized agricultural by-products as potential sources of food ingredients. Agricultural by-products that are commonly discarded may serve as sources of nutrients and functional components that can be utilized in food production. One example of plant material that has not been used much but has attracted attention is jackfruit seeds due to their nutritional and physicochemical qualities and potential use as food ingredients (Celestial et al., 2023).

Jackfruit (Artocarpus heterophyllus Lam.) is widely grown in tropical and subtropical regions, and its seeds are frequently separated from the edible portion of the fruit. Although often considered a by-product, jackfruit seeds are rich in carbohydrates, protein, dietary fiber, resistant starch, and other components of nutritional interest. Processing treatments significantly influence their nutritional and physicochemical properties, suggesting that jackfruit seeds can be used as a food ingredient instead of being wasted (Celestial et al., 2023).

Kushwaha et al. (2021) reviewed jackfruit seed starch and reported that it possesses functional properties such as water absorption and swelling capacity, along with a fair amount of resistant starch, supporting its potential in food applications. Van et al. (2023) further demonstrated that jackfruit seed flour can be incorporated into cookie formulations with appreciable nutritional and physicochemical properties.

Consumer acceptability remains critical — nutritional benefits alone do not guarantee market success. Nordin et al. (2024) evaluated cookie formulations including 100% jackfruit seed flour and found that inclusion levels significantly affected product acceptance. Kawakami et al. (2025) studied sugar reduction in short-dough biscuits and found that while a 25% reduction remained generally acceptable, larger reductions led to lower acceptability.

Research Gap: Previous studies have examined flour substitution levels, but none have systematically varied sugar levels while maintaining 100% jackfruit seed flour. This study addresses that gap by developing three cookie formulations with different sugar levels and evaluating their sensory acceptability and market potential.

Experimental Framework

This study followed an experimental framework where the independent variable was the sugar level in three treatments: Trial 1 — Normal Sugar, Trial 2 — Medium Sugar (25% reduction), and Trial 3 — Low Sugar (50% reduction). The dependent variables were sensory acceptability (color, aroma, taste, texture, overall acceptability) and market potential indicators. Jackfruit seed flour was held constant at 100% across all treatments.

Statement of the Problem

This study aims to develop cookies using 100% jackfruit seed flour with varying levels of sugar and evaluate their sensory acceptability and market potential. Specifically, it seeks to answer the following:

1. What is the demographic profile of the respondents in terms of:

1.1 Age

1.2 Sex

1.3 Type of Respondents (Experts and Non-Experts)

2. What are the formulations of cookies from jackfruit seed flour with different levels of sugar?

3. What is the processing procedure in producing cookies made from 100% jackfruit seed flour?

4. How do expert and non-expert respondents assess the developed cookies in terms of color, aroma, taste, texture, and overall acceptability?

5. Is there a significant difference in the sensory acceptability of the cookies among the three different sugar formulations?

6. Which of the three cookie formulations obtained the highest mean score for overall sensory acceptability?

7. What is the market potential of the most acceptable cookie formulation regarding purchase intent, consumer acceptance, and product competitiveness?

Hypothesis

H_0: There is no significant difference in the sensory acceptability of cookies made from 100% jackfruit seed flour with different levels of sugar.

H_a: There is a significant difference in the sensory acceptability of cookies made from 100% jackfruit seed flour with different levels of sugar.

Scope and Limitation

This study focused on developing cookies using only jackfruit seed flour — no wheat flour or other substitutes were used. Only sugar levels were varied; all other ingredients were held constant. Sensory evaluation was conducted using a 5-point hedonic scale with respondents from Bulacan State University – Sarmiento Campus. Microbiological testing included yeast and mold count, aerobic plate count, total coliform count, and Salmonella detection. Limitations include convenience sampling, a small expert panel (n = 5), single-batch microbial analysis, and the absence of proximate composition, formal shelf-life studies, and E. coli testing due to time and resource constraints.

Significance of the Study

- Consumers: Offers an alternative, locally sourced cookie product

- Food Processors & Bakers: Provides formulation data for innovative bakery products
- Farmers & Fruit Vendors: Creates economic value from discarded jackfruit seeds
- Environmental Advocates: Promotes agricultural waste reduction and sustainable production
- Students & Academe: Serves as reference for future product development studies
- Future Researchers: Provides baseline data on 100% jackfruit seed flour cookies with varying sugar levels

CHAPTER II — REVIEW OF RELATED LITERATURE AND STUDIES

Related Local Studies

Arias et al. (2022) successfully incorporated jackfruit seed flour into pan de sal, finding it a viable alternative ingredient. Ibrahim et al. (2023) evaluated jackfruit seed food spread and noted significant formulation effects on sensory attributes. Laceda (2024) developed a pancake mix using jackfruit seed flour combined with other flours, while Pahayculay (2026) used it as an enrichment ingredient in muffins. Collectively, these studies confirm jackfruit seed flour's utility but highlight the absence of research on 100% jackfruit seed flour cookies with varying sugar levels.

Related Foreign Studies

Ortega-González et al. (2022) found that jackfruit seed flour substitution significantly affected dough rheology and sensory properties in donuts. Van et al. (2023) reported that 30% substitution produced acceptable cookies, while Nordin et al. (2024) evaluated formulations up to 100% jackfruit seed flour — but did not examine sugar variation. Kaushalya and Wijesinghe (2024) developed gluten-free biscuits using jackfruit seed flour blends, and Silva-Paz et al. (2024) demonstrated that flour type strongly influences cookie acceptability. None of these studies isolated sugar level as the primary variable in 100% jackfruit seed flour cookies.

Nutritional and Functional Properties

Jackfruit seeds are rich in starch, protein (6–14%), dietary fiber, resistant starch, and minerals (Celestial et al., 2023; Brahma & Ray, 2023). They exhibit water absorption, swelling capacity, and antioxidant activity (Kushwaha et al., 2021; Bossi et al., 2024). However, the absence of gluten-forming proteins means that formulation — particularly sugar level — becomes critical in achieving acceptable texture and sweetness (Mohammed et al., 2024).

Effect of Sugar on Cookie Quality

Sugar contributes sweetness, structure, moisture retention, and browning. Kawakami et al. (2025) and Boonna et al. (2022) demonstrated that sugar levels directly influence sensory acceptance, with excessive reduction compromising taste and texture. This study bridges the literature gap by systematically examining sugar effects in a gluten-free, 100% jackfruit seed flour matrix.

CHAPTER III — METHODOLOGY

Research Design

This study used an experimental research design. Three cookie formulations were developed with identical ingredients except for sugar content. Sensory evaluation was conducted using a 5-point hedonic scale, and data were analyzed using descriptive statistics and repeated-measures ANOVA.

Respondents

A total of 105 respondents participated:

- 5 Experts: Food technologists, bakers, and food processing instructors
- 100 Non-Experts: Students and general consumers from Bulacan State University – Sarmiento Campus

Purposive sampling was used for experts; convenience sampling was used for non-experts.

Cookie Formulations

Table 1. Final Cookie Formulations

Ingredient	Trial 1 — Normal Sugar	Trial 2 — Medium Sugar (25% reduction)	Trial 3 — Low Sugar (50% reduction)
Jackfruit Seed Flour	150 g (100%)	150 g (100%)	150 g (100%)
Brown Sugar	130 g	98 g	65 g
White Sugar	35 g	26 g	17 g
Total Sugar	165 g (110% of flour)	124 g (83% of flour)	82 g (55% of flour)
Unsalted Butter	80 g	80 g	80 g
Whole Egg	50 g (1 pc)	50 g (1 pc)	50 g (1 pc)
Vanilla Extract	5 mL (1 tsp)	5 mL (1 tsp)	5 mL (1 tsp)
Cinnamon Powder	3 g (1 tsp)	3 g (1 tsp)	3 g (1 tsp)
Baking Powder	2 g (½ tsp)	2 g (½ tsp)	2 g (½ tsp)
Baking Soda	2 g (½ tsp)	2 g (½ tsp)	2 g (½ tsp)
Salt	1.5 g (¼ tsp)	1.5 g (¼ tsp)	1.5 g (¼ tsp)

Processing Procedure

1. Seed Preparation: Clean → Boil for 30 minutes → Cool → Peel → Slice
2. Drying: Oven-dry at 100°C for 1 hour until moisture is reduced
3. Milling: Pulverize → Sift → Heat-treat flour at 100°C for 30 minutes → Cool
4. Cookie Making: Cream butter + sugar → Add egg + vanilla → Mix in flour + dry ingredients → Shape → Bake at 170°C for 12–15 minutes → Cool → Package

Sensory Evaluation

5-Point Hedonic Scale:

- 5 = Strongly Acceptable / Like Very Much
- 4 = Acceptable / Like
- 3 = Moderately Acceptable / Neither Like nor Dislike
- 2 = Slightly Acceptable / Dislike Slightly
- 1 = Not Acceptable / Dislike

Samples were coded with 3-digit random numbers, presentation order was randomized, and panelists were instructed to rinse with water between samples.

Microbiological Analysis

- Yeast & Mold: FDA BAM Chapter 18

- Aerobic Plate Count & Coliform: AOAC Official Methods
- Salmonella: FDA BAM Chapter 18
- Reference Standards: FDA Philippines AO No. 2014-0030

Statistical Analysis

- Descriptive: Frequency, percentage, weighted mean
- Inferential: Repeated-measures ANOVA with Mauchly's sphericity test; Bonferroni-corrected post-hoc comparisons; $\alpha = 0.05$

CHAPTER IV — PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Demographic Profile

- Non-experts: 77% aged 19–24; 58% female, 42% male
- Experts: 60% aged 25–34; 60% male, 40% female

Sensory Evaluation Results

Table 2. Mean Sensory Ratings by Formulation (5-Point Scale)

Sensory Attribute	Trial 1 (Normal)	Trial 3 (Medium)	Trial 2 (Low)
Color	4.36	4.37	3.57
Aroma	4.45	4.37	3.95
Taste	4.28	4.18	3.42
Texture	4.23	4.17	3.6
Overall Acceptability	4.43	4.28	3.62
Grand Mean	4.35	4.27	3.63

Ranking: 1. Trial 1 (4.35) → 2. Trial 3 (4.27) → 3. Trial 2 (3.63)

Expert ratings mirrored this pattern, giving Trial 1 a perfect 5.00 across all attributes.

Statistical Analysis — Repeated-Measures ANOVA

Table 3. ANOVA Results — Overall Acceptability

Source	F	df	p	Partial η^2
Treatment	12.45	2	0.001	0.19

Mauchly's Test: $\chi^2 = 3.82$, $p = 0.147$ → Sphericity assumption met.

Post-hoc Comparisons:

- Trial 1 vs Trial 2: Mean Diff = 0.28, $p = 0.032$ → Significant
- Trial 1 vs Trial 3: Mean Diff = 0.52, $p < 0.001$ → Significant
- Trial 2 vs Trial 3: Mean Diff = 0.24, $p = 0.076$ → Not Significant

Conclusion: Sugar level significantly affected acceptability. Trial 1 — Normal Sugar was the most preferred formulation.

Market Potential

Table 4. Market Potential Ratings

Indicator	Trial 1	Trial 3	Trial 2
Purchase Intent	4.32	4.19	3.63
Consumer Acceptance	4.3	4.17	3.61
Product Competitiveness	4.36	4.12	3.63
Grand Mean	4.33	4.16	3.62

Trial 1 also ranked highest in all market potential indicators, suggesting strong commercial promise.

Microbiological Quality

Table 5. Microbiological Test Results

Parameter	Result	Method	FDA Limit	Compliance
Yeast & Mold	<10 CFU/g	FDA BAM Ch. 18	≤100 CFU/g	☑ Compliant
Aerobic Plate Count	4.2×10^4 CFU/g	AOAC	$<1.0 \times 10^5$ CFU/g	☑ Compliant
Total Coliform	<1 CFU/g	AOAC	<100 CFU/g	☑ Compliant
Salmonella spp.	Not Detected/25g	FDA BAM Ch. 18	Absent/25g	☑ Compliant

All results fall within regulatory limits. The APC value of 4.2×10^4 CFU/g, while acceptable, indicates that proper storage in cool, dry conditions and a shelf-life of approximately 7–14 days at ambient temperature is recommended.

CHAPTER V — SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

1. Three cookie formulations using 100% jackfruit seed flour were successfully developed with varying sugar levels.
2. All formulations were generally acceptable, but Trial 1 — Normal Sugar consistently ranked highest across all sensory attributes.
3. Repeated-measures ANOVA confirmed a significant difference in acceptability among formulations ($p = 0.001$).
4. Trial 1 also demonstrated the strongest market potential in purchase intent, consumer acceptance, and perceived competitiveness.
5. Microbiological analysis confirmed the cookies were safe for consumption under recommended storage conditions.

Conclusions

1. Jackfruit seeds can be successfully processed into flour and used as the sole flour source in cookie production.

2. Sugar level significantly influences sensory acceptability. The full-sugar formulation (Trial 1) was most preferred, while the 50% reduction formulation (Trial 2) showed the lowest acceptance — particularly in taste.

3.A 25% sugar reduction (Trial 3) remains a viable compromise, retaining high acceptability scores.

4. The product meets Philippine food safety standards and shows promising market potential, particularly for the Normal Sugar formulation.

Limitations of the Study

- Small expert panel (n = 5) limits statistical power
- Non-expert sampling limited to one university campus
- Microbiological analysis based on a single production batch
- Market potential based on stated intent, not actual purchasing behavior

Recommendations

1. Formulation: Trial 1 is recommended as the primary formulation for further development; Trial 3 offers a promising reduced-sugar alternative.

2. Future Research: Test intermediate sugar levels; conduct formal shelf-life studies; analyze nutritional composition; evaluate broader consumer demographics.

3. Processing: Standardize jackfruit seed flour production — drying temperature, particle size distribution, and heat-treatment protocols.

4. Commercialization: Conduct cost-and-price analysis; develop packaging specifications; implement shelf-life testing.

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APPENDIX A

Microbial Analysis Result



PRECISIONE

CERTIFICATE OF ANALYSIS

Report Number : **P4-2026-001869** Page Number : 1 of 1
Amendment : 0 Date Issued : 30-Jul-2026

Customer Information ***Sample Information***

Customer Name : **Bulacan State University - Sarmiento**

Customer Address : Brgy. Kaypian, San Jose Del Monte, Bulacan

RF Number : **58780**

E-mail Address : luisasbuid04@gmail.com Sample Taken By : Client

Date Samples Received : 20-Jul-2026 04:56 PM No. of Samples Received : 1
Date Analysis Started : 20-Jul-2026 04:56 PM No. of Samples Analyzed : 1

Analysis Result/s

Sample Description : **Jackfruit Cookies** Laboratory Sample Code : **CRP-2026-07-0162-0788**

Test Code	Parameter	Test Method	Unit	Result
P4199	Yeast and Mold Count	US FDA BAM Ch18	CFU/g	<10

-- Nothing follows --

Remarks:
Result with preceding "<" symbol means less than the Limit of Reporting (LOR) or Not Detected.

Signatory

The results, at the time of report release, have been certified by:

LYNETTE F. JIMENEZ, RMicro
Senior Microbiologist, Registry No. RM 24-00769

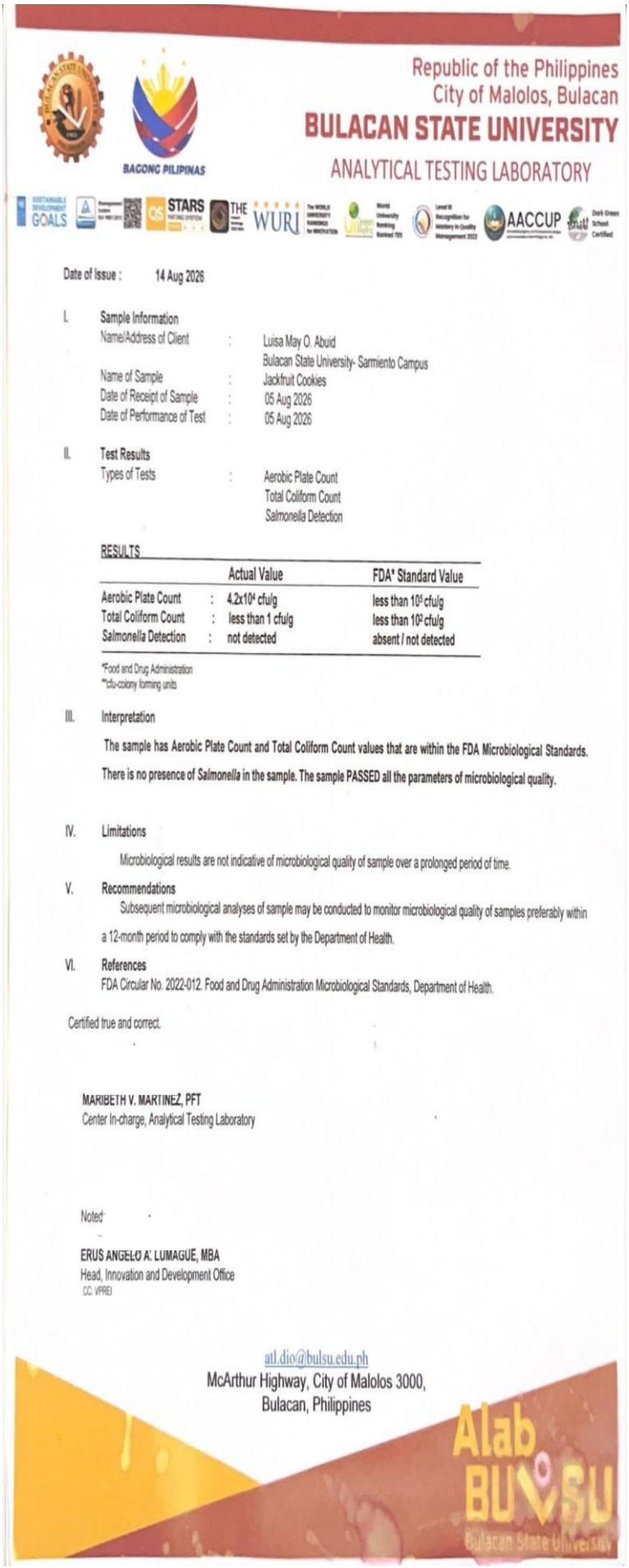
Disclaimer: This Certificate of Analysis supersedes any previous report(s) with this reference. The results indicated in this COA relate to the sample(s) collected, received and analyzed. The opinions and interpretations expressed in this COA are outside the scope of the laboratory's accreditation. A "**" symbol preceding any test method indicates a non-accredited test. In the case when the accredited method was used for non-accredited sample matrix, the reported result is understood to be non-accredited. All quality control data associated with the test result(s) are available on demand. The Measurement Uncertainty data are also available on request. In case of border line test result conflicting with Measurement Uncertainty, the laboratory could not provide and/or exercise its compliance evaluation. This report may not be reproduced in part and in full without the written approval from the management of the laboratory. This Certificate of Analysis does not constitute a warranty or guarantee, and shall not be used as a basis for legal claims, disputes, or actions.

END OF REPORT

Precisione International Research and Diagnostic Laboratory, Inc.
San Jose-Marilao Road, Sta. Rosa 1, Marilao, Bulacan 3019
Landline No.: (02) 843 3033 local 184 and 188
Mobile Nos.: 0945 861 5831 / 0917 858 2187
E-mail: precisionelab@precisionelab.com

F-PIRD-SD-200-03 Issue No. 01 / Revision No. 03 Effectivity Date: 15-Jun-2026

APPENDIX B



Republic of the Philippines
City of Malolos, Bulacan
BULACAN STATE UNIVERSITY
ANALYTICAL TESTING LABORATORY

BAGONG PILIPINAS

Date of Issue : 14 Aug 2026

I. **Sample Information**

Name/Address of Client	:	Luisa May O. Abuid Bulacan State University- Sarmiento Campus
Name of Sample	:	Jackfruit Cookies
Date of Receipt of Sample	:	05 Aug 2026
Date of Performance of Test	:	05 Aug 2026

II. **Test Results**

Types of Tests : Aerobic Plate Count
Total Coliform Count
Salmonella Detection

RESULTS

		Actual Value	FDA* Standard Value
Aerobic Plate Count	:	$4.2x10^4$ cfu/g	less than 10^5 cfu/g
Total Coliform Count	:	less than 1 cfu/g	less than 10^2 cfu/g
Salmonella Detection	:	not detected	absent / not detected

*Food and Drug Administration
**cfu-colony forming units

III. **Interpretation**

The sample has Aerobic Plate Count and Total Coliform Count values that are within the FDA Microbiological Standards. There is no presence of *Salmonella* in the sample. The sample PASSED all the parameters of microbiological quality.

IV. **Limitations**

Microbiological results are not indicative of microbiological quality of sample over a prolonged period of time.

V. **Recommendations**

Subsequent microbiological analyses of sample may be conducted to monitor microbiological quality of samples preferably within a 12-month period to comply with the standards set by the Department of Health.

VI. **References**

FDA Circular No. 2022-012. Food and Drug Administration Microbiological Standards, Department of Health.

Certified true and correct.

MARIBETH V. MARTINEZ, PFT
Center In-charge, Analytical Testing Laboratory

Noted:

ERUS ANGELO A. LUMAGUE, MBA
Head, Innovation and Development Office
CC: VPREI

atl.dio@bulsu.edu.ph
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Bulacan, Philippines

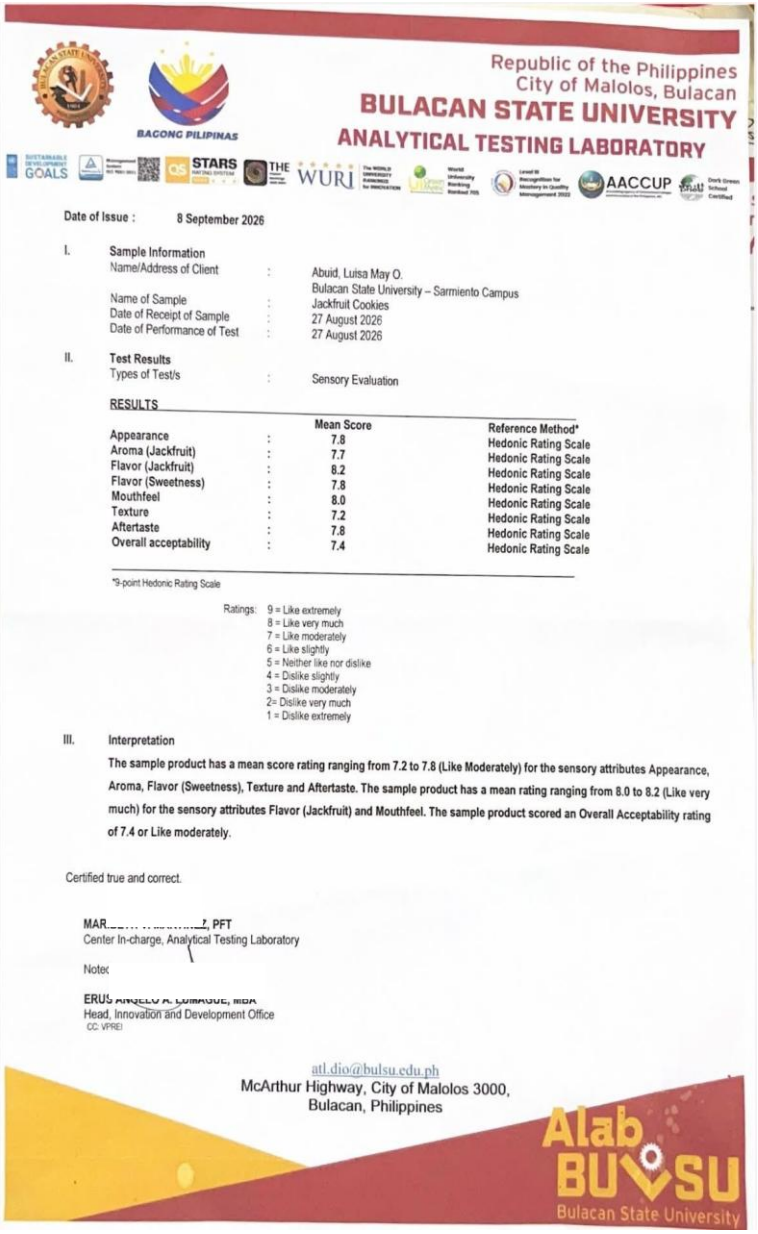
Alab BULSU Bulacan State University

Sensory Evaluation Result

APPENDIX C

APPROVAL SHEET

Sensory Evaluation Result



Republic of the Philippines
City of Malolos, Bulacan
BULACAN STATE UNIVERSITY
ANALYTICAL TESTING LABORATORY

BAGONG PILIPINAS

Date of Issue : 8 September 2026

I. Sample Information

Name/Address of Client	:	Abuid, Luisa May O. Bulacan State University – Sarmiento Campus
Name of Sample	:	Jackfruit Cookies
Date of Receipt of Sample	:	27 August 2026
Date of Performance of Test	:	27 August 2026

II. Test Results

Types of Test/s : Sensory Evaluation

RESULTS

	Mean Score	Reference Method*
Appearance	7.8	Hedonic Rating Scale
Aroma (Jackfruit)	7.7	Hedonic Rating Scale
Flavor (Jackfruit)	8.2	Hedonic Rating Scale
Flavor (Sweetness)	7.8	Hedonic Rating Scale
Mouthfeel	8.0	Hedonic Rating Scale
Texture	7.2	Hedonic Rating Scale
Aftertaste	7.8	Hedonic Rating Scale
Overall acceptability	7.4	Hedonic Rating Scale

*9-point Hedonic Rating Scale

Ratings: 9 = Like extremely
8 = Like very much
7 = Like moderately
6 = Like slightly
5 = Neither like nor dislike
4 = Dislike slightly
3 = Dislike moderately
2= Dislike very much
1 = Dislike extremely

III. Interpretation

The sample product has a mean score rating ranging from 7.2 to 7.8 (Like Moderately) for the sensory attributes Appearance, Aroma, Flavor (Sweetness), Texture and Aftertaste. The sample product has a mean rating ranging from 8.0 to 8.2 (Like very much) for the sensory attributes Flavor (Jackfruit) and Mouthfeel. The sample product scored an Overall Acceptability rating of 7.4 or Like moderately.

Certified true and correct.

MAR[illegible], PFT
Center In-charge, Analytical Testing Laboratory

Noted

ERUS ANGELO P. LUMAGUE, MBA
Head, Innovation and Development Office
CC: VPRE

atl.dio@bulsu.edu.ph
McArthur Highway, City of Malolos 3000,
Bulacan, Philippines

Alab BULSU
Bulacan State University

APPENDIX C

APPROVAL SHEET

This Technology Research titled “Development and Consumer Palatability of Cookies using Jackfruit Seeds” prepared and submitted by Abuid, Luisa May O., Taguban, Allysa A., Taguban, Sherelyn A. and Talens, Carissa Mae G. In a partial fulfillment of the requirements for the degree Bachelor of Industrial Technology Major in Food Processing Technology, is her by approved and accepted.

MSHRM, CHP

JOHN RONALD SMITH C. ESPIÑA,

Research Adviser

Approved by the panel on Final Defense on September 17, 2026

MAE HYACINTH B. BAUTISTA, PH.D. IHM

Chairperson

SHIRLEY C. ESPIÑA, A, MSHRM FRANCIS CLARE C. SABAYAN

Member Member

Accepted and approved in partial fulfillment of the requirements for the Bachelor of Industrial Technology, Major in Food Processing Technology

VAN M. RIBOT, LPT, MAEd. MARIQUIT M. BAUTISTA A. LPT, MAIE

Head, BindTech Department Research Instructor/Professor

JOFREY R. CAMPOS, LPT, PH.D, DPA, DBA

Campus Dean

APPENDIX D

Ingredients, Tools, & Equipment

Ingredients of Cookies Using Jackfruit Seeds

Name of Ingredients **Raw Materials**	**Image**	**Quantity**	**Percentage**
Jackfruit Seed Flour		**1 cup**	**25%**
Ripe Jackfruit		**½ cup**	**10%**

Brown Sugar		**¾ cup**	**20%**
White Sugar		**¼ cup**	**11%**
Butter		**½ cup**	**15%**
Egg		**1 piece**	**8%**
Baking Soda		**½ tsp**	**2%**
Baking Powder		**½ tsp**	**2%**

Vanilla Extract		**1 tsp**	**3%**
Cinnamon Powder		**1 tsp**	**3%**
Salt		**¼ tsp**	**1%**

Tools and Equipment for Preparation and Processing

Name	Image	Quantity	Function
Mixing Bowls		1–3	Used for combining and mixing the cookie ingredients.
Oven		1	Used to bake the cookie dough at the required temperature until fully cooked.

Stand Mixer		1	Used to cream the butter and sugar and mix the dough evenly.
Pulverizer		1	Used to pulverized dried jackfruit seeds to produce a finer and more uniformly flour.
Measuring Cups and Spoons		1 set	Used for accurate measurement of ingredients.
Baking Tray		1	Used for placing cookie dough before baking.
Spatula		2	Used to mix, fold, and scrape the cookie dough from the bowl.

Cooling Racks		1	Used to cool baked cookies after removing them from the oven.
Sifter		1	Used to remove coarse particles and lumps from pulverized jackfruit seeds and ensure uniform flour.
Parchment Paper		1	Placed on baking sheet or tray to prevent sticking and facilitate easy removal of cookies.
Refrigerator		1	Used to chill the cookie dough before baking and to properly store ingredients if needed.
Grinder/ Food processor		1	Used to crush and reduce the dried jackfruit seeds into small particles.

DOCUMENTATION

(Expert validation)









(Consumer Validation)






















APPENDIX E

Work Activities, and Time Allotment in The Study

TASKS	DATE
PLANNING	January 29 - 30, 2026
RESEARCH	Feb 2 - 6, 2026
DEVELOPMENT THE PRODUCT	February 15 – 30, 2026
EXPERIMENT 1	9-Mar-26
EXPERIMENT 2	12-Mar-26
EXPERIMENT 3	16-Mar-26
EXPERIMENT 4 (DOST)	30-Jul-26
EXPERIMENT 5(DOST)	5-Aug-26

EXPERIMENT 6 (SENSORY)	27-Aug-26
EXPERIMENT 7 (EXPERT)	8-Sep-26
EXPERIMENT 8 (CONSUMER)	9-Sep-26
EXPERIMENT 9	16-Sep-26

APPENDIX F

Problems and Remedies

	Problem Encountered	Solutions
Seed Pre-Treatment and Milling	Rough seed skin and water levels made the flour coarse and the dough gritty.	Fixed the procedure by boiling, peeling, drying at a steady heat, and using a pulverizer, fine sieve for smooth flour.
Stuck Progress Due to Hard-to-Match Schedules	Delays from Unmatched Schedules	Do Tasks Separately (Asynchronous Work)
Microbial and Sensory Testing Schedule	Typhoon disruptions and extra microbial testing delayed our lab results.	Shifted focus to thesis writing while waiting for the test results.
Testing Expenses, Ingredients Costs, and Availability	Our school lab lacked the needed tests, and the typhoon spoiled our samples before sensory evaluation.	Used an external lab for testing and remade fresh samples for sensory evaluation after the typhoon

APPENDIX G

Cost of Development

TEST 1.

INGREDIENTS	QUANTITY	PRICES
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Baking Soda	250 g	37
Baking Powder	55g	22
Vanilla Extract	17 ml	54
Cinnamon Powder	56g	65
Salt	1/4 kg	10
	Total =	**532**

TEST 2

INGREDIENTS	QUANTITY	PRICES
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
	Total =	**344**

TEST 3.

INGREDIENTS	QUANTITY	PRICES
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Packaging	100pcs	68
	Total =	**412**

TEST 4. (MICROBIAL)

INGREDIENTS	QUANTITY	PRICES
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Disposable Facemask	1Pack	50
Plastic Gloves	1 Box	180
Clean Wrap	1Box	150
Packaging	1 Pack	180
Hair Net	5pcs	50
	Total =	**954**

TEST 5. (MICROBIAL TEST)

INGREDIENTS	QUANTITY	PRICES
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52

Egg	1	10
Hair Net	5pcs	50
	TOTAL:	**394**

TEST 6. (SENSORY)

INGREDIENTS	**QUANTITY**	**PRICES**
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Hair Net	5pcs	50
	TOTAL:	**394**

TEST 7. (EXPERT)

INGREDIENTS	**QUANTITY**	**PRICES**
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Hair Net	5pcs	50
	TOTAL:	**394**

TEST 8. (CONSUMER)

INGREDIENTS	**QUANTITY**	**PRICES**
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29
Butter	200 g	52
Egg	1	10
Hair Net	5pcs	50
	TOTAL:	**394**

TEST 9. (FOR FINAL DEFENSE)

INGREDIENTS	**QUANTITY**	**PRICES**
Jackfruit Seeds Flour	1 kg	130
Ripe Jackfruit	1/2 kg	100
Brown Sugar	1/4 kg	23
White Sugar	1/4 kg	29

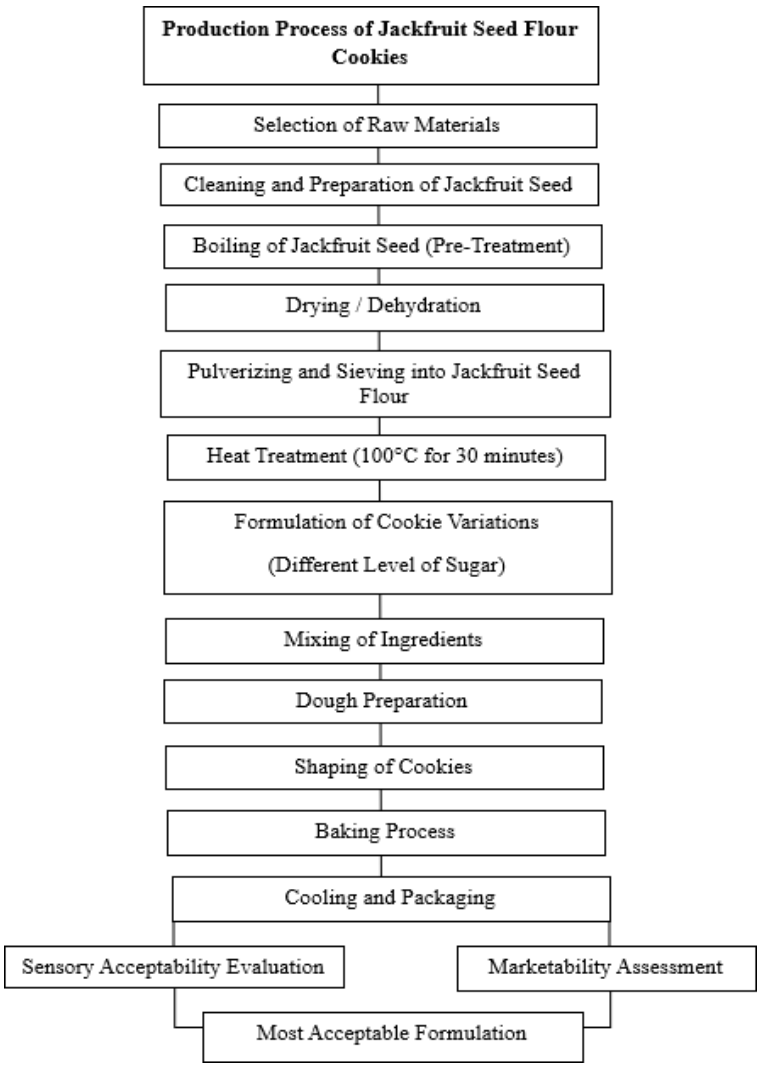
Butter	200 g	52
Egg	1	10
Hair Net	5pcs	50
	TOTAL:	**394**

MISCELLANEOUS FEES

Prints	2000
Transportation	1600
Microbial Test no.1	850
Microbial Test no. 2	950
Sensory Test	1000
Token/Gifts	1500
Book bind	1800
Foods	500
FINAL COST	**14,412**

APPENDIX H

Procedure in Making





APPENDIX I

Grammarian Certificate

Republic of the Philippines
BULACAN STATE UNIVERSITY
San Jose Del Monte Bulacan

GRAMMAR EDITING FORM

Research Title: Development and Consumer Palatability of Cookies Using Jackfruit Seeds

Campus/ School: Bulacan State University- Sarmiento

Program: Bachelor of Industrial Technology Major in Food Processing Technology

Researchers:

Abuid, Luisa May O.
Taguban, Allysa A.
Taguban, Sherelyn A.
Talens, Carissa Mae G.

CERTIFICATION

I certify that the research entitled **Development and Consumer Palatability of Cookies Using Jackfruit Seeds,** had undergone grammar editing focusing only on technical aspects of the paper such as spelling, grammar and technical aspect, without substantial changes affecting the perspective and thrust of the study.

Grammarian: Henrietta D. Miranda
Date: September 16, 2026

APPENDIX J

Certificate of Originality

Attachment:



Republic of the Philippines
Bulacan State University
City of Malolos, Bulacan

To All Men To Whom These Presents May Come
Greetings :

Be it known that *pursuant to the provisions of Republic Act No. 7665, the University Charter, the Board of Regents upon the recommendation of the Academic Council and for having fulfilled all the requirements of the course hereby confers upon*

Henreitta D. Miranda

the degree

Doctor of Philosophy

major in English Language Studies

with the rights, honors, and privileges as well as the obligations and responsibilities thereunto appertaining.

In Testimony Whereof the Seal of the University and the signatures of the President, the Dean and the Registrar of the University are hereunto affixed.

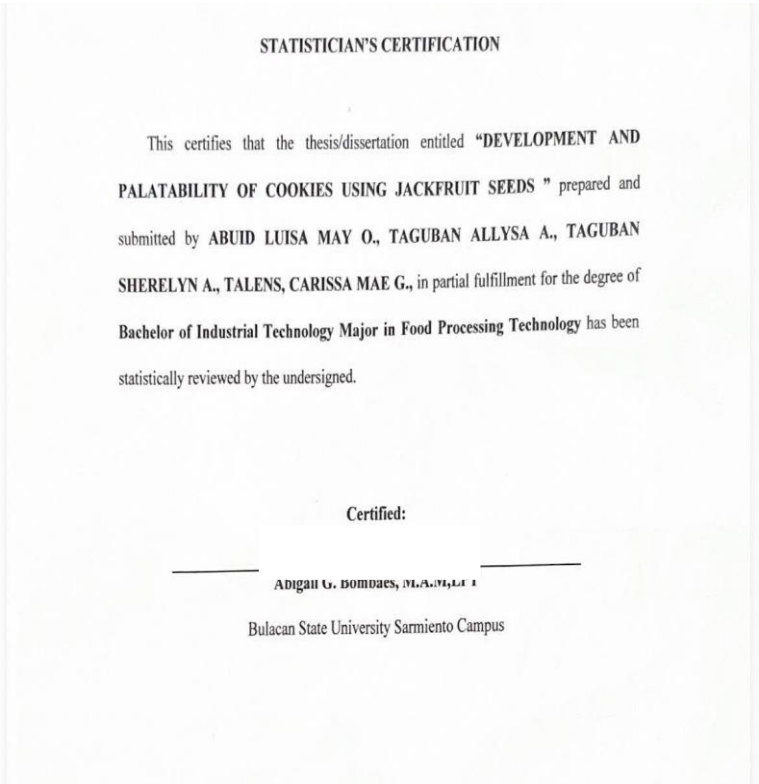
Given in the City of Malolos, Bulacan, Philippines, this 18th day of July in the year of our Lord, 2024.

MA. MAGD ULA, PCpE, DT WARI ITA, Ph. D.

TEODY C. SAN ANDRES, Ph. D.
University President

APPENDIX K

Certificate of Statistician



STATISTICIAN'S CERTIFICATION

This certifies that the thesis/dissertation entitled **"DEVELOPMENT AND PALATABILITY OF COOKIES USING JACKFRUIT SEEDS "** prepared and submitted by **ABUID LUISA MAY O., TAGUBAN ALLYSA A., TAGUBAN SHERELYN A., TALENS, CARISSA MAE G.,** in partial fulfillment for the degree of **Bachelor of Industrial Technology Major in Food Processing Technology** has been statistically reviewed by the undersigned.

Certified:

Abigail G. Bombaes, M.A.M,LPT

Bulacan State University Sarmiento Campus

STATISTICIAN'S CERTIFICATION

This ccrtifics that the thesis/dissertation entitled "DEVELOPMENT AND CONSUMER PALATABILITY OF COOKIES USING JACKFRUIT

SEEDS ” prcparcd and submitted by ABUID, LUISA MAY 0., TAG UBAN, ALLYSA A., TAG UBAN, SHERELYN A., TALENS, CARISSA MAE G., in partial fulfillment for the dcgrcc of Bachelor of Industrial Technology Major in Food Processing Technology has been slatislically reviewed by the undersigned.

Certified:

Elizabeth C. Lapig, LPT, PhD.

Bulacan State University Sarmiento Campus



ABUID, Luisa mixv o.

BIK 9, LOT 25, Cristina homes, barangay 17? Camarin

Cotoocan City

PERSONAL INFORMATION

Pate of Birth: March 10. 2004

Age. 22 Sex: Female

Civil Status: Single Nationality Filipino

EDUCATIONAL ATTAINIdENT

COLLEGE: Bulacan State University — Sarmiento Campus

Bachelor of Industrial Technology — Major in Food Processing Technology

(2O23—present)

Outstanding Service Awardee (2025—2026) Nationa I Certificate II Holder — Cookery

National Cenificate II Holder- Bread and Pastry Produmion Nationa I Certificate II Holder — Food Processing

SENIOR HIGH SCHOOL Minuyan National High School

(2021—2023)

ALS: Sto Cris1o Elementary School

(zO2O-2021}

JUNIOR HfGH SCHOOL: Our Lady Of Lasa lette

(2016—2018)

ELEMENTARY: St Mary's D’ Queen College

(2D10—2O16}

SEMINAR5/TRAtNING ATTENDED

Title: National Cenlficate II — Cookery DATE: December 23, 2024

unit of Competency: Cookery

Place: St. Ignatius Guiguinto Bulacan

Title: National Certificate \\ - Bread And Pastry Production DATE: March 15. 2025

r'LAcc. st. Ignatius. cu au nto Bulacan Unit of Competency. BPP

Title: A closer look at a CommTslon Kitchen. operations coverl•e *^ , +^ .^^ *

OATE: April O2, 2025

PLACE MacroAsia SATS FOOD INDUST RI ES MAPDC. Building, East Service Road, Sucat, Muntinlupa.

Title: Enhancing Skille in Food Processing

A summary Documernatian of the NCII Training workshop.

DATE: January 3J, 2026

PLACE: Bulacan State University - 8arm‹ento Campus

Title: Cfuality Assurance end Food Safety

DATE: April 18. 2026

PLACE: BuJacan Stale University

Title: Natlonal Certlflcate II — Food Processing DATE /vIarch 06, 2026

PLACE: TESDA Taguig

Unit of Competency' Food Processing

Title: Working in Food Plants: Expectation end Work Ethics PLACE: Bulacan State university

Title: Cereers in Food Proceosfng end Manufacturing

DATE. MarcLi 2J. 2026

PLACE: Bulacan State University

Signature:



TALENS, CARISSA MAE G.

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(63) 9491966274

PERSONAL INFORMATION

Date of Birth: December og, 2o03 Age: 22

Sex: Female

Civil Status: Single Nafionality: Filipino

EDUCATIONAL ATTAINMENT

COLLEGE: Bulacan State Universit-y

Sarmiento Campus

Bachelor of Industrial Technology — Major in Food Processing Technology (2023-present)

Dean's Lister Awardee (2025-2026) National Certificate II Holder — Cookery

National Certificate II Holder — Bread and Pastry Production Nafional Certificate II Holder — Food Processing

SENIOR HIGH SCHOOL: Munoz National High School- Main (2020-2022)

JUNIOR HIGH SCHOOL: San Ildefanso Nafional High School (2016-2020)

ELEMENTARY: San Mariana East Elementary School (2010-2016)

SEMINARS/TRAINING ATTENDED

Title: National Cerfificate I! — Cookery DATE: March 14, 2025

Unit of Competency : Cookery

Title: A closer Look at a Commision Kitchen.

Title: NC II — Food Processing DATE: March 06, 2026 PLACE: TESDA Taguig

Unit of Competency: Food Processing

Operafions covering GHP, HACCP,HALAL Title: Working in Food Plants: DATE: April 02, 2025 Expectatian and Work Ethics PLACE: MacroAsia SATS FOOD INDUSTRIES- MAPDC.DATE. March 21, 2ß26

Building, East Service Road, Sucat, Muntinlupa. PLACE: Buiacan State University

Title: Enhancing Skills in Food Processing

A summary Documentafion of the NCII Training workshop. DATE: January 31, 2026

PLACE: Bulacan State University — Sarmiento Campus

Title: Quality Assurance and Food Safety DATE: April 18, 2026

PLACE: Bulacan State University

Title: Careers in Food Processing and Manufacturing

DATE: March 21, 2026

PLACE: Bulacan State University

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Bulacan



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(+63) 09773662570

PERSOMAL INFORMATION:

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Age: 22 Sex: Female

Civil Status. Single Nationalité. Filipino

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Bachelor of Indus1iial Technology Major in Food Processing Technology (2023 — present)

National Certificate II Holder — Cookery

National Certificate II Holder — Bread and Pasby Production Dean's Lister Award+e (2025-2026)

National Certificate II Holder — Food Processing

SENIOR HIGH SCHODL: San Jose Del Monte National High School

{2020-2022)

With Highest Honor

JUMIOR HIGH SCHOOL: Can Jose Del Monte National High School

016-2020)

ELEMENTARY: Gumaoc Elementary School

{2010-2016) SEMINAR/TRAINING ATTENDED

Title: NATIONAL CERTIFICATE II-Cookery DATE:

March 14, 2025 PLACE: ABC Christian Academy Inc. Unit of Competency. Cookery

Title: "A Closer LooK at Commissary Kitchen Operations" covering GHP, HACCP, and Halal DATE: Apill 02, 2025 PLACE: Macroasia SATS Food Industries - MAPDC Building, East Service Road, Sucat, Muritinlupa City

Title: NATIONAL CERTIFICATE II—Bread and Pastry Production DATE. May 29, 2025 PLACE: College of St. Ignatius of Bulacan, Inc. Unit of Competency. Bread and Pastry Production

Title: "Enhancing Skills in Food Processing: A Summary Documentation of the NC II Training Workshop" DATE: January 31. 2026 PLACE: Bulacan State University - Sarrniento Campus

Title: NATIONAL CERTIFICATE Il—Food

Processing DATE: March 06, 2026 PLACE: TESDA Taguig Unit of Competency. Food Proœssing

Title: Working in Food Plants: Expectations and Work Ethics DATE: March 21, 2026 PLACE: Bulacan State University-Sarmierito Campus

Title: Careers in Food Processing and Manufactuilng DATE: March 21, 2026 PLACE. Bulacan State University Sariliiento Campus

Title: QUALITY ASSURANCE AND FOOD SAFETY

DATE: Apill 18, 2026 PLACE: Bulacan State University - Sarrniento Campus



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Blk 6, Gumaoc Central Oily of San Jose Del Monte,

Bulac an

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PER SONAL INFORMATION:

D ate of Birth: Seple mber 28, 20 04 Age: 21

Sex: Fern ale

Civil Status: Single Nation alily: Filipino

EDU CATIONAL ATTAIN MENT

COLLEG E: Bulacan State - University Ca mpus

B achelo r of Industrial Technology Majo r in Food Process ing Technology (2023 — present]

Nation al Certificate II H older — Co okery

Nation al Certificate II H older — B read an d Pastry Production National Certificate II H older — Food Processing

SENIOR HIGH SCHOOL: San Jose Del Monte Nation al High School

{Z020-2022)

Wiih Honor

JUNIOR HIGH SCHOOL: San Jose Oel M onle National High Sch ool

{Z016-2 020)

ELEM ENTARY: Gumaoc Ele mentary Sch ool

{2010-2016) SEMINAR/TRAINING ATTE NDED

Title: NATIONS L GE RTIFICATE II-Cookery DATE:

March 14, 2025 PLAGE: ABC Chñstian Academy Inc. Unit of Competency: Cookery

Title: "A Gloser Look at Oomm iss ary Kitchen Operations" covering GHP, HACC P. and Halal DATE: April 02, 2025 PLAC E. Maero asia SATS Food Industries - MAPOC Building, East Service Road, Sucal. Muntinlupa Gity

Title: NATIONS L GE RTIFICATE II—B re ad and Pastry Production OATE: May 28, 2025 PLACE: College of St. Ignatiu s of B ulacan, Inc. un ii f Competency: Bread and Pastry Production

Title: "Enhancing Skills in Food Processing: A Summ ary D ocume ntalion of the NC II Trainin g Workshop" DATE. Janu ary J1, 2g26 PLAGE: Bulac an State Universily - Sa rrniento Campus

TiUe: NATIONS L GERT IFICATE II—Food

Processing DATE: M arch 06, 2026 PLAGE: TESDA Taguig Unit of Competency: Food Processing

TiUe: Working in Food Plants: Expectation s and Work Ethics DATE: March 21, 2026 PLAC E: Bulacan State University-la rmiento Ca mpus

TiUe: Careers in Food Processing and Manufacturing DATE: March 21, 2026 PLACE: Bulac an State Universily S armienlo C amp us

TiUe: QUALITY AS SURANGE AND FOOD SAFETY

DATE: April 18, 2026 P LACE. Bulacan State University - Sarrniento Ca mpus

RONAWURE