

Development and Evaluation of Water Spinach-Infused Keto Noodles

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Abstract

This study examined the effects of varying water spinach (*Ipomoea aquatica*) substitution levels on the sensory qualities and consumer acceptability of keto noodle formulations. Four samples were developed: a control (0%) and three fortified variants containing 25%, 50%, and 75% water spinach powder. Sensory evaluation by expert panelists showed that among the modified formulations, the 25% mixture received the most favorable scores (mean = 3.85), while the 50% and 75% formulations showed notable declines in sensory performance. ANOVA results ($F = 48.41$, $p < 0.00$) confirmed significant differences among samples, indicating that increased substitution levels reduced acceptability. The expert-recommended 25% formulation was further evaluated by Generation Z consumers in two preparation formats: plain noodles and lasagna. The lasagna version consistently obtained higher ratings in all sensory attributes, reaching the “Very Highly Acceptable” range, whereas the plain noodle format remained “Moderately to Highly Acceptable.” Consumer attitude responses (overall mean = 4.24) reflected strong agreement regarding taste satisfaction, health benefits, lifestyle compatibility, and purchase and recommendation intent. Overall, findings indicate that the 25% water spinach formulation, especially when prepared as lasagna, offers strong acceptability and commercialization as a keto-friendly functional food product.

Keywords: *water spinach, Ipomoea aquatica, keto noodles, sensory evaluation, substitution levels, consumer acceptability, Generation Z, functional food product, lasagna preparation.*

1. Introduction

Noodles are among the most widely consumed staple foods due to their affordability, convenience, and versatility. However, traditional wheat-based noodles are generally high in carbohydrates and calories, making them less suitable for individuals who aim to manage weight, regulate blood sugar, or follow low-carbohydrate and ketogenic diets. This has increased the demand for healthier noodle alternatives that provide improved nutritional value while maintaining consumer acceptability.

Generation Z consumers are among the leading drivers of wellness-oriented food consumption. Studies show that this generation prioritizes health, fitness, sustainability, and functional food products that support overall well-being. Many Gen Z consumers also seek innovative food options that combine nutrition, convenience, and sensory appeal. Since individuals aged 18–22 are at a stage where long-term dietary habits are being established, developing healthier food alternatives for this demographic may contribute to improved eating behaviors and reduced risk of diet-related health conditions.

Recent studies have demonstrated the potential of vegetable-enriched noodles and pasta to improve nutritional quality. Research involving spinach, chicory, nettle, and other plant-based ingredients reported increased fiber, vitamins, minerals, antioxidants, and lower glycemic impact while maintaining acceptable sensory qualities. In the Philippines, Soriano et al. (2020) showed that incorporating alugbati leaf powder into noodles improved nutritional value without significantly reducing acceptability. These studies support the feasibility of using locally available leafy vegetables in noodle formulations.

Water spinach (*Ipomoea aquatica*), locally known as kangkong, is a nutrient-dense and affordable vegetable rich in vitamins, minerals, fiber, and antioxidants. Despite its availability and nutritional benefits, limited research has explored its use in keto-friendly noodle products, particularly among Gen Z consumers. Existing literature also shows limited focus on low-carbohydrate noodle formulations and sensory evaluation among younger, health-conscious populations. These gaps highlight the need for further research on functional noodle products that combine nutritional benefits with consumer acceptability.

In response to these gaps, this study focuses on the development and evaluation of water spinach–infused keto noodles and their sensory acceptability among Generation Z consumers aged 18–22. Specifically, the study aims to determine the effects of varying water spinach substitution levels on sensory qualities, identify the most acceptable formulation, and evaluate consumer acceptability of the final product in different serving formats.

The study contributes to the growing field of functional food development by exploring the use of a locally available vegetable in a healthier noodle alternative. The findings may benefit consumers seeking nutritious low-carbohydrate food options, food developers interested in functional products, and researchers conducting studies on vegetable-enriched formulations. Furthermore, the study supports broader goals related to nutrition, public health, and sustainable food innovation through the use of accessible and plant-based ingredients.

2. Objectives

This study primarily aims to determine the sensory acceptability of water spinach–infused keto noodles at different substitution levels and to assess the acceptability of the expert-recommended formulation among Gen Z consumers aged 18–22 years.

1. How do different substitution levels of water spinach (25%, 50%, and 75%) affect the sensory qualities, taste, texture, appearance, and overall acceptability, of keto noodles as evaluated by an expert panel?
2. Which formulation of water spinach–infused keto noodles is identified by the expert panel as the most acceptable or preferred formulation?
3. What is the overall sensory and consumer acceptability of the expert-recommended formulation among Gen Z consumers (aged 18–22 years) when served (a) plain and (b) as a layered lasagna?

3. Materials and Methods

Research Design

This study employed an experimental–quantitative research design to evaluate the sensory acceptability of water spinach (*Ipomoea aquatica*)–infused keto noodles. The study involved the development of keto noodle formulations with varying levels of water spinach powder: control, 25%, 50%, and 75% substitution. Sensory evaluations were conducted to objectively assess consumer preference and acceptability using numerical data and statistical analysis.

Locale of the Study

The study was conducted at LORMA Colleges, Campus for Learning and Innovation (CLI), San Juan, La Union. The location was selected due to the accessibility of the target respondents and the availability of facilities suitable for sensory evaluation activities.

Respondents of the Study

The preliminary sensory evaluation was conducted by an expert panel composed of ten (10) professionals, including chefs, food technologists, and hospitality management practitioners. The panel evaluated the noodle formulations based on taste, texture, appearance, and overall acceptability to identify the most acceptable formulation for consumer testing.

The consumer evaluation involved Generation Z students aged 18–22 enrolled at LORMA Colleges CLI under various academic programs. Using Cochran’s formula at a 95% confidence level and 5% margin of error, a sample size of 129 respondents was determined from a population of 267 students.

Research Instruments

Two instruments were utilized in the study: the expert sensory evaluation form and the consumer sensory evaluation questionnaire. Both instruments used a 5-point Hedonic Scale to evaluate sensory attributes such as taste, texture, appearance, and overall acceptability. The consumer questionnaire also included a 5-point Likert Scale to assess perceptions regarding health appeal, satisfaction, willingness to purchase, and likelihood of recommendation.

The instruments underwent content and face validation by three experts consisting of a research specialist and culinary professionals. Pilot testing was conducted among selected experts and students with characteristics similar to the actual respondents.

Reliability testing using Cronbach's Alpha was also performed, with a coefficient of 0.70 or higher considered acceptable.

Data Gathering Procedure

The study followed three stages: product development and expert evaluation, respondent recruitment, and consumer sensory evaluation.

First, keto noodle formulations with varying water spinach substitution levels were developed and evaluated by the expert panel using a sensory evaluation form. The formulation with the highest overall acceptability rating was selected for consumer testing.

Second, eligible Generation Z respondents were recruited voluntarily. Participants were informed about the study objectives and procedures, and informed consent was secured prior to participation. Individuals with food allergies or sensory conditions affecting evaluation were excluded from the study.

Third, the selected formulation was evaluated by respondents in two serving formats: plain noodles and lasagna. Participants completed the sensory evaluation questionnaire after tasting the samples in a controlled setting. Respondents were instructed to rinse their mouths with water between samples to minimize flavor carryover.

Ethical Considerations

The study strictly followed ethical research standards and the provisions of the Data Privacy Act of 2012 (Republic Act No. 10173). Participant information and responses were kept confidential and reported only in summary form. Participation was voluntary, and respondents were allowed to withdraw at any time without penalty. The study protocol was reviewed and approved by the LORMA Colleges–Research Ethics Committee (LC-REC) prior to implementation.

4. Results

Sensory Qualities

The sensory evaluation conducted by the expert panel showed that increasing the level of water spinach substitution significantly affected the sensory qualities of the keto noodles. Based on the hedonic ratings presented in Table 6.1, the 25% formulation obtained the highest mean rating (3.85), followed by the 50% formulation (3.33) and the 75% formulation (2.68). The 25% mixture received favorable ratings in taste (3.70), texture (3.50), appearance (4.30), and overall acceptability (3.90), while the 75% formulation recorded the lowest ratings across most sensory indicators.

The Analysis of Variance (ANOVA) results in Table 6.2 revealed a statistically significant difference among the formulations, with a computed F-value of 48.41 exceeding the critical F-value of 3.49 and a p-value of 0.00. The findings indicate that the varying levels of water spinach substitution significantly influenced the sensory evaluation scores of the product.

Best Formulation

Based on the expert panel evaluation, the 25% water spinach–infused keto noodle formulation emerged as the most acceptable modified variant. It achieved the most balanced sensory performance while still incorporating a functional amount of water spinach powder. Compared with the higher substitution levels, the 25% formulation maintained acceptable taste, texture, appearance, and overall acceptability, making it the most suitable formulation for further consumer evaluation and product development.

Level of Acceptability Among Gen Z

The expert-recommended 25% formulation was further evaluated by Gen Z consumers in two serving formats: plain noodles and lasagna. Results presented in Table 7 showed that the lasagna preparation consistently received higher ratings across all sensory attributes. The lasagna form obtained mean ratings of 4.53 for taste, 4.26 for texture, 4.32 for appearance, and 4.46 for overall acceptability, all of which were significantly higher than the ratings for the plain noodle format ($p < 0.01$).

The findings also revealed that consumers strongly accepted the 25% formulation. Based on the Likert scale evaluation shown in Table 8, the product achieved an overall mean rating of 4.24, interpreted as “Strongly Agree.” Respondents agreed that the noodles were visually appealing, fresh, enjoyable in texture, and satisfying in taste. Consumers also strongly agreed that the product was healthier than regular noodles, appreciated the incorporation of water spinach, and expressed willingness to purchase and recommend the product.

5. Discussion

The findings of the study demonstrate that water spinach substitution significantly influences the sensory qualities of keto noodles. As the proportion of water spinach increased, sensory ratings gradually declined, particularly in taste and texture. This suggests that excessive incorporation of water spinach negatively affects the product’s palatability and overall eating quality. These results support the Sensory Acceptability Theory, which explains that consumer acceptance is strongly influenced by sensory characteristics such as flavor, appearance, and mouthfeel.

The identification of the 25% formulation as the most acceptable modified variant supports the principles of Functional Food Theory. The formulation successfully incorporated a nutrient-rich ingredient without greatly compromising sensory quality. The results indicate that moderate incorporation of functional ingredients can improve nutritional value while maintaining consumer acceptability, making the 25% mixture the optimal balance between health benefits and sensory appeal.

The consumer evaluation further highlights the importance of product presentation and preparation style in influencing acceptability. Gen Z respondents consistently preferred the lasagna preparation over the plain noodle format, suggesting that layering, sauce absorption, moisture retention, and visual presentation enhanced the overall sensory experience. These findings align with Consumer Behavior Theory, which states that food preferences are influenced not only by taste and texture but also by presentation, lifestyle compatibility, and perceived product value.

Additionally, respondents demonstrated strong positive attitudes toward the health benefits of the product, particularly its vegetable content and perceived nutritional value. Their willingness to purchase, consume regularly, and recommend the product supports the Health Belief Model, which explains that consumers are more likely to accept foods they perceive as beneficial to health. Overall, the findings confirm the feasibility and market potential of water spinach–infused keto noodles, especially the 25% formulation when prepared in lasagna form.

6. Conclusion

The study concludes that water spinach (*Ipomoea aquatica*) can be successfully incorporated into keto noodle formulations when used at moderate substitution levels. The findings revealed that increasing the proportion of water spinach significantly affected the sensory qualities of the product, with higher substitution levels resulting in lower ratings for taste, texture, appearance, and overall acceptability. Among the tested formulations, the 25% water spinach–infused keto noodles emerged as the most acceptable modified variant, achieving the best balance between nutritional enhancement and sensory quality.

The study further concludes that product preparation and presentation significantly influence consumer preference and acceptability. Gen Z respondents consistently preferred the lasagna preparation over the plain noodle format, indicating that enhanced flavor distribution, texture, and visual appeal contributed to a more favorable sensory experience. Consumer evaluations also showed positive attitudes toward the product’s health benefits, vegetable incorporation, and lifestyle compatibility, reflecting strong acceptance and market potential among health-conscious consumers.

Overall, the study confirms the feasibility, acceptability, and potential commercial value of water spinach–infused keto noodles as a functional and innovative food product. The findings emphasize the importance of balancing nutritional functionality with sensory appeal to ensure consumer satisfaction and support future product development within the functional food industry.

7. Acknowledgements

The researchers of “DEVELOPMENT AND EVALUATION OF WATER SPINACH-INFUSED KETO NOODLES” would like to express their deepest gratitude to all individuals and institutions who contributed to the successful completion of this study.

First and foremost, sincere appreciation is extended to the research adviser for their invaluable guidance, expertise, and constructive feedback throughout the research process. Their continuous support and encouragement greatly contributed to the completion and refinement of this study. The researchers would also like to thank the panel members and faculty of the College of Business for their insightful comments, suggestions, and professional evaluations, which significantly improved the quality and rigor of this research.

Special thanks are extended to the expert panelists and Generation Z respondents who generously shared their time and honest feedback during the sensory evaluation and consumer testing. Their participation was essential in obtaining reliable and meaningful data. Gratitude is likewise extended to the school administration and laboratory personnel for providing the necessary facilities, resources, and technical assistance needed for the conduct of this study.

The researchers are deeply thankful to their families, partners, and friends for their unwavering support, patience, and encouragement throughout the research journey. Above all, the researchers give thanks to the Almighty for the wisdom, strength, and perseverance granted throughout the completion of this study.

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9. Appendices

Appendix A. Certificate/Letter of Ethics Approval



LC-REC Form #024
APPROVAL LETTER

REC Reference #: 2025-177

November 12, 2025

To: **Vincent Allen Biniola, Ma. Nicole Galvan, Mark Angelo Maala and John Paul Joshua Mays**
LORMA Colleges, College of Business

Subject: Approval of the Research Study – “DEVELOPMENT AND EVALUATION OF WATER SPINACH - INFUSED KETO NOODLES” – by the Research Ethics Committee (REC).

Dear Researcher/s,

The Research Ethics Committee (REC) has reviewed your application to conduct the above-mentioned research study in LORMA Colleges – Campus of Learning and Innovation, San Juan, La Union with you as the Principal Investigators within a duration of November 12, 2025 to November 12, 2026.

The Following documents have been reviewed and approved:


1. Endorsement of the Research Institute
2. Title and Statement of the Problem/Objective
3. Literature Review
4. Methods and Procedures
5. Population and Locale
6. Exclusion/Inclusion Criteria
7. Data Analysis
8. Ethical Considerations

We approve the study to be conducted in the presented form provided the following are integrated in the final research protocol:

1. In the Informed Consent Form, (a) Risks: Use the pronoun “you” to directly communicate the risks to the participants; (b) Confidentiality: Add the location of data storage and the length of data retention prior to deletion and (c) Certificate of Consent: Input the date beside “Date Submitted”.
2. In Chapter II, use “Treatment of Data,” not “Data Analysis” and all the information in the ICF should be incorporated in the manuscript.

The institutional REC expects to be informed about the progress of the study, any revision in the protocol before implementation and participants’/respondents’ information/informed consent. Likewise, you are required to provide the Board a copy of the final report.

Yours Sincerely,



JEROME P. VERA, LPT
Chairman, LC-REC

Appendix B.
Letter to Validators

November 17, 2025

(Name of Validator)

Subject: Request for Validation of Research Questionnaire on **Development and Evaluation of Water Spinach-Infused Keto Noodles**

Dear Sir/Ma'am,

We hope this message finds you well. We are writing to request your expert validation of a research questionnaire. The focus of our study is to evaluate the acceptability of Water Spinach-Infused (*Ipomoea Aquatica*) Keto Noodles.

As part of this research, we developed a questionnaire designed to gather insights from potential consumers regarding their perceptions, preferences, and willingness to try water spinach-infused keto noodles. To ensure the validity and reliability of our data collection instrument, we are seeking your expertise in reviewing and validating the questionnaire.

The questionnaire covers various aspects, including:

Sensory evaluation: Assessing the taste, texture, and overall sensory experience of water spinach-infused keto noodles.

Consumer Perceptions: Gauging consumer acceptance and likelihood of purchasing water spinach-infused keto noodles.

I have attached a copy of the questionnaire for your review. I would greatly appreciate your feedback on the following:

Clarity and comprehensiveness of the questions: Ensure the questions are clear, concise, and cover all relevant aspects.


Relevance to the research objectives: Verify that the questions effectively address the research aims.

Suitability for the target audience: Assess the appropriateness of the language and format for the intended respondents.

Your validation would significantly contribute to the success of this research project.

Thank you for your time and consideration. I look forward to your feedback and any suggestions you may have.

Sincerely



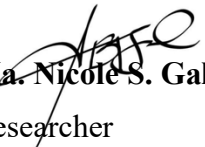
Vincent Allen B. Biniola

Head Researcher



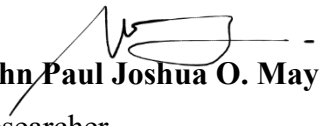
Mark Angelo B. Maala

Researcher



Ma. Nicole S. Galvan

Researcher



John Paul Joshua O. Mays

Researcher

Noted by:



Gell Cortez

Research Adviser

Appendix C.

Questionnaire Validity Result

For the overall validity of the questionnaire:

Validity Tools Result

Question	Validity Score	Description	
1. Comprehensiveness of the indicators	4.67	Very Valid	Highly
2. The words used are simple and easy to comprehend	4.33	Very Valid	Highly
3. Precision and clarity of the indicators/items to elicit the appropriate response as the basis for obtaining relevant and accurate data.	5.00	Very Valid	Highly
4. Use of correct and appropriate grammar and syntax	4.33	Very Valid	Highly
5. Use of appropriate and acceptable structure in terms of style, format, appearance, and length of the questionnaire to sustain the respondents' focus and enthusiasm in diligently answering the entire questionnaire.	5.00	Very Valid	Highly
OVERALL	4.67	VERY HIGHLY VALID	

Validity Tools Mean Interpretation Guide

Mean Range	Interpretation
4.21-5.00	Very Highly Valid
3.41-4.20	Highly Valid
2.61-3.40	Moderately Valid
1.81-2.60	Fairly Valid
1.00-1.80	Not Valid

For the individual item validity, in terms of relevance to the study:

Validity Tools Result on Consumer Questionnaire

Question	Validity Score	Description
1. I found the noodles to be visually appealing.	3.33	Very Relevant
2. The noodles looked fresh and appetizing.	3.00	Quite Relevant
3. The texture of the noodles was enjoyable.	3.33	Very Relevant
4. The taste of the noodles was satisfying.	3.33	Very Relevant
5. I would consider eating these noodles regularly.	3.33	Very Relevant
6. I believe these noodles are healthier than regular noodles.	3.33	Very Relevant
7. I appreciate that the noodles incorporate vegetables like water spinach.	3.33	Very Relevant
8. I am open to purchasing this product if it were available in the market.	3.33	Very Relevant
9. I think this product fits well with the lifestyle of Gen Z consumers.	3.00	Quite Relevant
10. Overall, I would recommend this product to others.	3.33	Very Relevant
OVERALL	3.27	VERY RELEVANT

Validity Tools Likert Scale Mean Interpretation Guide

Mean Range	Interpretation
3.26-4.00	Very Relevant
2.51-3.25	Quite Relevant
1.76-2.50	Somewhat Relevant
1.00-1.75	Not Relevant

Appendix D.
Reliability Result

Reliability Test Results of the Pilot Study

Instrument Section	No. of Items	Cronbach's Alpha	Interpretation
Sensory Attributes (5-point Hedonic Scale)	4	0.8425	Good
Perception Items (5-point Likert Scale)	10	0.8238	Good

Cronbach's Alpha Interpretation Guide

Cronbach's Alpha Range	Interpretation
≥ 0.90	Excellent
0.80 - 0.89	Good
0.70 - 0.79	Acceptable
0.60 - 0.69	Questionable
< 0.60	Poor

Appendix E.
Cover Letter to Respondents

December 2, 2025

Dear Respondent,

Warm greetings!

We are from the College of Business – LORMA Colleges 4th Year Hospitality Management students conducting a study titled “Development and Evaluation of Water Spinach-Infused Keto Noodles”. This research aims to evaluate the acceptability and consumer perception of a newly developed keto noodle formulation enriched with water spinach (kangkong). Your participation will help us determine whether the product is acceptable in terms of taste, texture, appearance, and overall quality, as well as assess your general perception of its potential as a healthier noodle alternative.

You are being invited to participate because the study focuses on Generation Z consumers, and you belong to this age group. Your participation will involve tasting two samples of our final formulation (Plain Noodles and Lasagna-style noodles) and answering a short questionnaire consisting of a 5-point Hedonic Scale and a 5-point Likert Scale. The activity will take approximately 30-50 minutes.


Please be assured that there are no anticipated risks with participation. The noodles contain almond flour and vegetable ingredients. Participation is voluntary, and you may withdraw at any time without any consequences. All information you provide will be kept confidential and used solely for academic and research purposes. No personally identifiable information will be linked to your responses.


The results of this study will contribute to the academic requirements of our research course and may support future development of healthier noodle alternatives. Your input is extremely valuable to us and will directly shape the interpretation and recommendations of this study.


If you have any questions or concerns, you may contact the head researcher Vincent Allen B. Biniola at vincentallen.biniola@lorma.edu or our research instructor Ms. Ma. Veronica A. Balatero at maveronica.balatero@lorma.edu.

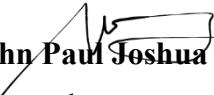
Thank you for considering our request. We deeply appreciate your time, effort, and valuable input in helping us complete this study.

Warm regards,


Vincent Allen B. Biniola
Head Researcher


Ma Nicole S. Galvan
Researcher


Mark Angelo B. Maala
Researcher


John Paul Joshua O. Mays
Researcher

Noted by:


Gell Cortez
Research Adviser

Appendix F.

Expert Panel Questionnaire

EXPERT PANEL QUESTIONNAIRE

You are invited as part of an expert panel consisting of chefs and hospitality management professionals to evaluate three formulations of water spinach-infused keto noodles. The formulations contain varying kangkong powder substitution levels. Please taste each coded sample in the order presented. Rinse your mouth with water between samples. Using the evaluation form below, assess each formulation based on the listed sensory attributes. Your ratings will help determine the best formulation to be used for consumer sensory testing.

Part 1:

Evaluation Scale (5-Point Hedonic Scale):

- 1 – Dislike Very Much
- 2 – Dislike
- 3 – Neither Like nor Dislike
- 4 – Like
- 5 – Like Very Much

064					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					
946					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					
730					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					
519					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					

Expert Recommendation:

Based on your overall evaluation, which formulation do you recommend for consumer testing?

	25% Formulation
	50% Formulation
	75% Formulation

Additional comments/suggestions (optional):

Appendix G.

Gen Z Consumer Evaluation Questionnaire

CONSUMER PANEL QUESTIONNAIRE

You will evaluate two samples of water spinach-infused keto noodles: one served plain (Sample A) and one served as a layered lasagna (Sample B). Taste the samples in the order presented, rinsing your mouth with water between samples. For Part 1, please rate each sample on taste, texture, appearance, and overall acceptability using the 5-point Hedonic Scale below. For Part 2, indicate your level of agreement with each statement regarding your perceptions and acceptability of the product. There are no right or wrong answers—please provide your honest opinion.

Part 1:

Evaluation Scale (5-Point Hedonic Scale):

1 – Dislike Very Much

2 – Dislike

3 – Neither Like nor Dislike

4 – Like

5 – Like Very Much

Final Formulation (Plain)					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					
Final Formulation (Lasagna)					
	1	2	3	4	5
TASTE					
TEXTURE					
APPEARANCE					
OVERALL ACCEPTABILITY					

Part 2:

Consumer Perception & Acceptability (5-Point Likert Scale)

1 – Strongly Disagree; 2 – Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly Agree

Please indicate your level of agreement with the following statements about the product overall (considering both plain and with sauce):

STATEMENT	1	2	3	4	5
1. I found the noodles to be visually appealing.					
2. The noodles looked fresh and appetizing.					
3. The texture of the noodles was enjoyable.					
4. The taste of the noodles was satisfying.					
5. I would consider eating these noodles regularly.					
6. I believe these noodles are healthier than regular noodles.					
7. I appreciate that the noodles incorporate vegetables like water spinach.					
8. I am open to purchasing this product if it were available in the market.					
9. I think this product fits well with the lifestyle of Gen Z consumers.					
10. Overall, I would recommend this product to others.					

Appendix H.
Certificate from the Statistician

CERTIFICATION

This is to certify that the data analysis conducted for the research entitled
"DEVELOPMENT AND EVALUATION OF WATER SPINACH-INFUSED KETO
NOODLES"
have been thoroughly reviewed. The review included the accuracy of the calculations and
interpretation.
The undersigned also discussed the context of the results with the researchers.
This certification confirms the integrity and accuracy of the data analysis conducted in this
research, ensuring that the findings are reliable and valid for academic or practical application.


LOU BENEDIC C. VALLE, REE, M.A.-Math
Statistician 12/08/2025

Appendix I.
Certificate of English Editing

English Editing Certificate

This is to certify that I have edited this research manuscript entitled

**DEVELOPMENT AND EVALUATION OF WATER SPINACH-INFUSED KETO
NOODLES**

Prepared by:

Biniola, Vincent Allen B.

Galvan, Ma. Nicole S.

Maala, Mark Angelo B.

Mays, John Paul Joshua O.

And I have found it thorough and acceptable with respect to grammar and composition.

Issued this 16th day of December 2025.

REINALYN J. BUCSIT

English Critic

Appendix J.

Standardized Experimental Procedure for Water Spinach-Infused Keto Noodles (25%)

Yield: one 4-layer lasagna serving (sufficient for 1–2 persons)

Formulation (per batch):

Almond flour - 33.75 g

Water spinach powder - 11.25 g

Egg yolks - 4 (approx. 68–80 g total depending on size)

Xanthan gum powder - 1 tsp (\approx 3–4 g)

PROCEDURE - Noodle Dough and Sheet Preparation

A. Sifting and Mixing (Dry phase)

Pre-weigh almond flour (33.75 g), water spinach powder (11.25 g), and xanthan gum (1 tsp) on a calibrated digital scale.

Sift the almond flour and xanthan gum together into a clean mixing bowl to remove lumps and ensure uniform distribution.

Separately, sift the water spinach powder (to break clumps) and add to the dry mix. Combine by gentle folding with a spatula to obtain a homogeneous dry mixture.

B. Incorporation of Egg Yolks (Wet phase)

Create a well in the center of the dry mix. Add the 4 egg yolks to the well.

Using a fork or small whisk, slowly incorporate the dry ingredients into the yolks in a circular motion until the mixture begins to come together.

C. Kneading and Resting

Transfer the dough to a lightly dusted surface (use a tiny amount of almond flour to prevent sticking) and knead gently for 2–4 minutes until a uniform, non-sticky dough is formed. Do not over-knead, the goal is a cohesive, pliable dough.

Shape dough into a ball, wrap in plastic wrap, and let rest at room temperature for 15 minutes. Resting relaxes the dough and improves rollability.

D. Rolling and Cutting Sheets

After resting, roll the dough into a thin sheet using a pasta roller or rolling pin. Target thickness: 1/8 cm. Verify with a ruler or thickness gauge at several points.

Cut the rolled dough into rectangular sheets sized to fit your baking dish for lasagna.

PROCEDURE - Lasagna Sauce (Simple Meat Tomato Ragù)

Ingredients (approximate; adjust to desired quantity for one 4-layer lasagna):

Tomato paste - 2 tbsp

Tomato sauce - 200–250 ml

Ground pork or beef - 150–200 g

Beef bouillon cube - 1 (crushed) or stock equivalent to taste
Onion - 1 small (finely chopped)
Garlic - 2 cloves (minced)
Salt and black pepper - to taste
Italian seasoning (dried oregano/basil) - ½–1 tsp
Cooking oil - 1 tbsp

Method:

Heat 1 tbsp oil in a saucepan over medium heat. Sauté the finely chopped onion until translucent (2–3 minutes). Add minced garlic and sauté 30 seconds.

Add ground meat; cook until browned and crumbly, breaking up lumps. Drain excess fat if needed.

Stir in tomato paste; cook for 1 minute to caramelize. Add tomato sauce and ½ cup water or stock; crumble in the bouillon cube. Season with Italian seasoning, salt and pepper. Simmer at low heat for 8–12 minutes until the sauce thickens. Adjust seasoning. Keep sauce warm at 60–65 °C until assembly.

Cheese: use a quick melting cheese. Grate or shred in advance.

ASSEMBLY - 4-Layer Lasagna (Standardized Layering)

- Layering sequence (from base to top):
- Spread a thin, even film of sauce on the bottom of the baking dish to prevent sticking.
- Place first sheet of noodle (pasta) on sauce.
- Spread an even layer of sauce over the sheet.
- Sprinkle a measured amount of cheese evenly over the sauce (e.g., 10–15 g per layer).
- Repeat steps 2–4 to achieve four layers (pasta → sauce → cheese) ending with a top layer of sauce and a generous final layer of cheese (e.g., 25–30 g) to ensure a uniform browned topping.

Baking:

Preheat the oven to 180 °C (conventional). Confirm oven temperature with thermometer.

Cover the lasagna dish with foil (optional - for even heating) and bake at 180 °C for 12–15 minutes. Remove foil for the last 3–5 minutes to brown the cheese if desired. Total bake time: ~15 minutes.

After baking, let the lasagna rest for 5 minutes before cutting and serving to allow juices to settle.

Appendix K.
Product Documentation



Appendix L.
Curriculum Vitae

LC-REC Form #003
CV TEMPLATE



CURRICULUM VITAE



VINCENT ALLEN B. BINIOLA

I. PERSONAL INFORMATION

Address : Brgy. Pagudpud, San Fernando City, La Union, 2500
Contact Number : 09772004685
Email Address : vincentallen.biniola@lorma.edu
Date of Birth : April 29, 2003
Place of Birth : San Fernando City, La Union, 2500

II. EDUCATIONAL BACKGROUND

Degree / Program	Institution	Year Graduated
Baccalaureate		
Bachelor of Science in Hospitality Management	LORMA Colleges CLI	2026
Secondary		
Senior High School	AMA Computer Colleges	2021
Junior High School	BHC Educational Institution	2019
Primary		
Primary Education	LORMA Colleges Basic Education System	2015

III. WORK EXPERIENCE

Job Title / Position	Institution	Inclusive Dates
Facilitator, Admin	LeadPro	October 2025-Present
Barista	Lokal Coffee	June 2024-August 2024
Front Desk Officer	Planet G	April 2023-September 2023
Sales & Service Representative	TF System	January 2022-September 2022
Dining Staff	Mashisoyo Korean Restaurant	October 2021-December 2021
Volunteer Guest Relations Officer	SFCC	March 2017-July 2018
Dining and Kitchen Staff	Patio Del Sol	April 2016-April 2019

IV. RESEARCH AND ETHICS TRAININGS ATTENDED

Title	Organizer	Venue and Date
Research Ethics Orientation	Ma. Veronica Balatero (COB)	LORMA Colleges CLI September 10, 2025

V. RESEARCH RELATED EXPERIENCE

Title of Research	Funding Agency	Year Finished
THE EFFECTS OF STEREOTYPING GENDER TO THE SOCIAL DEVELOPMENT OF ADOLESCENTS.	Personal Fund	2020
THE FEASIBILITY OF COIR FIBER (COCOS NUCIFERA) AS REINFORCED POLYMER TO BIOPLASTIC	Personal Fund	2019

I hereby certify that all information and data given are true and correct to the best of my knowledge and belief.


VINCENT ALLEN BAUTISTA BINIOLA



MA. NICOLE S. GALVAN

I. PERSONAL INFORMATION

Address : Baracbac Este, Balaoan, La Union
Contact Number : 09453746148
Email Address : manicole.galvan@lorma.edu
Date of Birth : September 8, 2003
Place of Birth : Balaoan, La Union

II. EDUCATIONAL BACKGROUND

Degree / Program	Institution	Year Graduated
Baccalaureate		
Bachelor of Science in Hospitality Management	LORMA Colleges	
Secondary		
Grade 7-10 (Junior High School)	San Nicolas Academy	2020
Grade 11-12 (Senior High School)	Sinapangan National High School	2022
Primary		
Kindergarten-Grade 6	Sinapangan Sur Elementary School	2016

III. WORK EXPERIENCE

Job Title/Position	Institution	Inclusive Dates
Owner/Baker	Nicole's Ensaymada	2024-present
Owner/Cook	Afternoon Meryenda	2020-2021


IV. RESEARCH AND ETHICS TRAININGS ATTENDED

Title	Organizer	Venue and Date
Research Ethics Orientation	Ma'am Veronica Balatero	LORMA Colleges, CLI Campus September 10, 2025

V. RESEARCH RELATED EXPERIENCE

Title of Research	Funding Agency	Year Finished
Sensory Appreciation of Pastry Products from Rimas (Artocarpus Altilis) Flour	Personal Fund	2022

I hereby certify that all information and data given are true and correct to the best of my knowledge and belief.


MA. NICOLE SOBRIDO GALVAN



MARK ANGELO B. MAALA

I. PERSONAL INFORMATION

Address : Burayoc, Bacnotan La Union
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Email Address : markangelo.maala@lorma.edu
Date of Birth : October 10, 2002
Place of Birth : City of San Fernando La Union

II. EDUCATIONAL BACKGROUND

Degree / Program	Institution	Year Graduated
Baccalaureate		
Bachelor of Science in Hospitality Management	LORMA Colleges	
Secondary		
Grade 7-10 (Junior High School)	Lord of Zion Divine School	2019
Grade 11-12 (Senior High School)	Saint Louis College	2021
Primary		
Kindergarten-Grade 6	Lord Of Zion Divine School	2015

III. WORK EXPERIENCE

Job Title/Position	Institution	Inclusive Dates
Cashier	Johnmark Pharmacy	2020-present

IV. RESEARCH AND ETHICS TRAININGS ATTENDED

Title	Organizer	Venue and Date
Research Ethics Orientation	Ma'am Veronica Balatero	LORMA Colleges, CLI Campus September 10, 2025

V. RESEARCH RELATED EXPERIENCE

Title of Research	Funding Agency	Year Finished
Understanding Student's Experiences Brought About by Academic Motivation	Personal Fund	2021

I hereby certify that all information and data given are true and correct to the best of my knowledge and belief.


MARK ANGELO B. MAALA



COLLEGES

CURRICULUM VITAE



JOHN PAUL JOSHUA O. MAYS

I. PERSONAL INFORMATION

Address : Taboc San Juan La Union
 Contact Number : 09663146474
 Email Address : johnpauljoshua.mays@lorma.edu
 Date of Birth : July 16, 2003
 Place of Birth : San Fernando City, La Union

II. EDUCATIONAL BACKGROUND

Degree / Program	Institution	Year Graduated
Baccalaureate		
Bachelor of Science in Hospitality Management	LORMA Colleges	
Secondary		
Grade 7-10 (Junior High School)	LORMA Science Highschool	2020
Grade 11-12 (Senior High School)	LORMA Special Science Highschool	2022
Primary		
Kindergarten	Holy Angels Montessori School	-
Grade 1-3	Surigao Del Norte	-
Grade 4-6	LORMA Basic Education School	2016

III. RESEARCH AND ETHICS TRAININGS ATTENDED

Title	Organizer	Venue and Date
Research Ethics Orientation	Ma'am Veronica Balatero	LORMA Colleges, CLI Campus September 10, 2025

IV. RESEARCH RELATED EXPERIENCE

Title of Research	Funding Agency	Year Finished
Bamboo Straws	Personal Fund	2019
Lived Experiences of Senior Citizens Living in an Urbanized Area During Lockdown and their Coping Mechanisms	Personal Fund	2022

I hereby certify that all information and data given are true and correct to the best of my knowledge and belief.


JOHN PAUL JOSHUA O. MAYS

10. Author(s) Biodata
Mr.