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Development and Analysis of Sibujing-Turmeric Seasoning: An Instructional Recipe for Home Economic Course

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Abstract. Home Economics education plays a significant role in promoting sustainable living by fostering environmental awareness, resource conservation, and cultural preservation. Utilizing locally available ingredients, such as sibujing—a traditional spice widely used in Maranao cuisine from Mindanao, Philippines—supports these goals by encouraging sustainable food practices and reducing reliance on commercial alternatives. Despite its significance, sibujing remains under-researched in instructional contexts. This study aimed to develop and evaluate a culturally relevant Sibujing-Turmeric seasoning as an instructional recipe for the Home Economics course, showcasing sustainable food innovation through local ingredients. Utilizing a Research and Development (R&D) research design guided by the Design Thinking framework, the study followed five phases: Empathize, Define, Ideate, Prototype, and Test. A sequential mixed-methods design was employed to integrate qualitative and quantitative data. Nine semi-experts and sixty consumer panelists from a Maranao community high school participated in the evaluation. Three prototypes with varying sibujing content were assessed for aroma, color, taste, and texture using sensory tools and customer satisfaction metrics. The most preferred formulation was further analyzed for nutritional and physicochemical properties. Results revealed that the seasoning was highly acceptable, with 195.90 kcal, 0.74g fat, 40.76g carbohydrates, 6.55g protein, 5.23g moisture, and 46.72g ash per 100g. Data analysis used thematic analysis and descriptive statistics. The findings support the seasoning's use as an instructional recipe in teaching food preservation and sustainability. Future research may explore shelf-life enhancement and additional plant-based ingredients to strengthen sustainable practices in Home Economics education.

Keywords: Sibujing, Turmeric, Seasoning, Home Economics, Food Analysis, Design Thinking

1. Introduction

Locally produced food products reflect the unique environmental and cultural characteristics of a specific geographical region, with their quality often shaped by local natural conditions (Öztürk & Akoğlu, 2020; Kelemci Schneider & Ceritoglu, 2010). In the principle of sustainable food systems, the use of locally sourced ingredients is essential to reduce environmental impact and promote economic resilience (Öztürk & Akoğlu, 2020). When production is done locally, it minimizes the necessity for transportation and, therefore, lowers carbon emissions, which in turn reduces carbon footprint (Malalis et al., 2024). Home Economics education plays an important role in embedding these sustainable practices in the curriculum. In the Philippines, the education system integrates contextualized learning to honor students' cultural identities while encouraging the use of locally available resources in classroom instruction. This approach promotes ecological literacy and resource management skills among learners, which are both critical components of the Sustainable Development Goals (Malalis et al., 2024).

Moreover, food innovation that utilizes local ingredients not only supports environmental sustainability but also strengthens entrepreneurial skills and cultural appreciation. Within the Home Economics education framework, such innovation becomes a powerful instructional tool that enables students to engage in experiential learning while addressing real-world challenges. Thus, integrating food product development into Home Economics education enhances both sustainability and student engagement through practical, locally grounded applications (Malalis et al., 2024).

In the Maranao community of Mindanao, Philippines, culinary traditions are deeply rooted in locally available ingredients that define their distinct flavors and cultural identity. Among the widely utilized spices are turmeric (Curcuma longa) and Sibujing (native shallots), which are staple spices widely used in traditional Maranao dishes. Sibujing, an emerging condiment crop in the Philippines (Vera Cruz et al., 2023), holds significant culinary and cultural value, particularly in the preparation of palapa, a staple Maranao spice mix commonly found in Muslim households and local eateries (Dapanas & Duero, 2020). Likewise, turmeric has been widely used as a spice and as a natural colorant and medicinal ingredient, making it a valuable and sustainable component of Maranao cuisine (Corcolon et al., 2015). In the Maranao community, turmeric and sibujing are utilized separately as spices- turmeric as a food color and Sibujing as a flavor enhancer.

Spices and seasonings play a crucial role in enhancing the natural flavors of food by amplifying and complementing existing taste profiles (Lamkey, 2021). While spices are essential in global and regional cuisines, they are often combined as a seasoning (Śmiechowska et al., 2021). Seasoning powders, commonly derived from meat, fish, and vegetables, serve as flavor enhancers in various culinary applications (Hnin, 2019). However, there is currently no existing research on the combination of sibujing and turmeric into a ready-to-use powdered seasoning despite their established use in Maranao cuisine. This gap in the literature presents an opportunity for culinary innovation, particularly in developing a shelf-stable, convenient, and culturally significant spice blend (Dapanas et al., 2020)

Furthermore, existing food studies primarily analyze the individual properties of turmeric and shallots in fresh or processed forms (Sharma et al., 2020). There is limited research on their potential as a powdered seasoning that retains authentic flavors, aroma, and nutritional value while addressing modern food preparation needs as easy and ready to use seasoning mix. Additionally, no standardized formulation currently exists that captures the essence of these traditional Maranao ingredients in a convenient and sustainable form which are directly evaluated by the end user community. Moreover, the increasing demand for spice enhancement in Meranao cuisine has drawn significant attention to Sibujing-Turmeric in the culinary community as a promising seasoning ingredient.

This research aims to develop a Sibujing-Turmeric Seasoning by systematically formulating a powdered blend that maintains the authentic taste of Maranao cuisine while offering greater convenience and accessibility. This objective aligns with one of the core goals of Home Economics education—to improve everyday living through the development and refinement of practical food processes. By developing a convenient and accessible Sibujing-Turmeric Seasoning in powdered form, the study not only preserves the authentic flavors of Maranao cuisine but also provides an example of a functional instructional resource. Such innovations demonstrate how Home Economics can promote food preservation, enhance culinary skills, and support sustainable practices both in educational settings and household use.

The Sibujing-Turmeric Seasoning undergoes food quality analysis and process of sensory evaluation, overall acceptability and consumer satisfaction surveys, as well as physicochemical and nutritional analysis to ensure that it meets both traditional flavor expectations and modern standards of convenience and quality. This systematic approach reflects the goals of Home Economics education, which emphasize improving everyday practices through informed, evidence-based innovations. By establishing a viable and standardized seasoning product, the research supports cultural preservation and offers a practical tool for instructional and home application and thus serves as an example of enhancing food accessibility, preparation efficiency, and sustainable living.

In this study, Design Thinking was utilized as a schematic and user-centered process framework to guide the development of the Sibujing-Turmeric Seasoning. While not a conceptual framework in the theoretical sense, Design Thinking provided a structured, iterative approach to innovation that aligns with the practical and learner-centered focus of Home Economics education. The process involves five non-linear phases—Empathize, Define, Ideate, Prototype, and Test—which were applied to understand users' needs, identify design challenges and problem opportunities (Zabala, et al., 2025), generate product ideas, develop prototypes, and evaluate them based on user feedback and scientific analysis. This approach was particularly suited for designing a food product that responds to cultural relevance, accessibility, and instructional value.

The educational system, particularly through Home Economics, plays a crucial role in promoting sustainable living by equipping learners with practical skills, ecological literacy, and cultural awareness. Instructional recipe innovation serves as a key pedagogical approach in Home Economics education, addressing real-life food challenges while enhancing culinary competencies and promoting sustainability (Granberg et al., 2017; Siripipatthanakul, 2024). The development of localized food innovations, such as the Sibujing-Turmeric seasoning, fosters both contextualized learning and the preservation of indigenous culinary heritage. The conceptual focus of this study lies in integrating sustainable food innovation into Home Economics education by emphasizing the use of local resources and learner-centered instruction. The Design Thinking framework was adopted as a schematic and process-oriented approach to support this goal. As a user-centered, iterative methodology, Design Thinking enables the translation of educational goals into tangible innovations by progressing through five phases: Empathize, Define, Ideate, Prototype, and Test (Brown, 2009). This process emphasized empathy for local communities, problem reframing, and collaborative solution development—core principles of 21st-century education. The problem addressed by this research is the lack of instructional resources that both reflect local food culture and promote sustainable practices in Home Economics education. While Sibujing is a widely used ingredient in Maranao cuisine, its potential as a shelf-stable and convenient seasoning remains unexplored.

Therefore, this research aims to develop and evaluate a Sibujing-Turmeric seasoning that maintains the authentic taste of Maranao cuisine while offering enhanced accessibility and convenience. Specifically, it aims to (1) formulate three seasoning prototypes using

locally sourced ingredients through a design thinking process; (2) assess their sensory qualities through evaluation of the seasoning's sensory attributes and overall acceptability through a hedonic scale and consumer satisfaction survey; (3) and analyze the nutritional and physicochemical properties of the most acceptable prototype. With this approach to food innovation, this research's final product can be established as an instructional recipe for food preservation within the Home Economics curriculum.

Aligned with the Philippine K to 12 TLE curriculum, which promotes performance-based, contextualized, and competency-driven instruction (Department of Education, 2013), this research contributes a practical and culturally meaningful instructional resource. It integrates active learning strategies, such as collaborative tasks, contextual problem-solving, and design-based learning (Hmelo et al., 2000), while modeling sustainability and local food utilization. Prior studies affirm that instructional innovations grounded in community-based food systems enhance student engagement, promote lasting behavioral change, and support the goals of education for sustainable development (Zampollo & Peacock, 2024).

2. Materials and Methods

This study utilizes research and development and sequential mixed-methods research design. A research and development research design were used in the process of developing the product using the design thinking process. A mixed-method research design was also used starting with an exploratory qualitative phase to gain in-depth insights into the cultural preferences and expectations of the target end users regarding Sibujing-Turmeric Seasoning. In this phase, in-depth interviews were conducted using researcher made validated questionnaire and data was analyzed through Empathy Map to capture what the end users' say, feel, think and do. Upon completing qualitative exploration, the research transitions to a quantitative phase, incorporating experimental designs and statistical analysis.

The research participants included nine (9) semi-experts, and sixty (60) consumer panel purposely selected as end user of the product. The inclusion criteria for the consumer-type panelists were chosen based on their willingness to participate in the study, they should be 18 years old and above and having no allergic reactions, whereas the semi-trained panelists were chosen based on their knowledge of food-related topics. Limitations in knowledge, age below 18, and allergic reactions to seasoning ingredients were the exclusion criteria for both groups. These standards were cautiously developed to guarantee a range of knowledgeable viewpoints for the thorough assessment of the Sibujing Seasoning. The meticulously semi-structure interview guide questionnaire was used to ease the data collection and analysis for the Empathy Stage while a Sensory scorecard and Hedonic scale questionnaire were used for the Food Tasting evaluation of the product. Ethical approval was obtained from the College of Education Research and Ethics Committee before data collection.

Accompanied by the attached ethical approval from the ethics committee, the researcher wrote a formal letter addressed to the College Dean of the University, the Assistant Vice Chancellor for Academic Affairs (External Units), and the School Principal of the Community High School. Seeking permission to conduct the research. The letter emphasized the significance of obtaining informed consent and outlined the intention to identify respondents from the members of the community for tasting the product Sibujing-Turmeric Seasoning.

The Data-gathering procedure follows a five-phase design thinking cycle. The first phase is empathy stage where the researcher conducted an interview with the target end users using a researcher made and validated questionnaire to determine how the user's feel, say, think, and do about the Sibujing-Turmeric Seasoning. Data gathered was content

analyzed and presented through an Empathy Map which revealed the underlying needs, problems and concerns of the target end users. The second phase is define stage which determines the problem opportunities and design challenges based from the result of the empathy map. Third phase is ideation stage which develops ideas based on the suggestions and recommendation of the semi-experts and the results of the empathy map. The fourth phase is prototype stage which was done in the Food Laboratory Facilities throughout the prototyping of the product. In this phase the researcher was able to formulate the first recipe based on what and how the target end user wanted. Further, consultation with semi-food experts were conducted for the development and enhancement of the formulated recipe. Semi-food experts were involved in the product formulation as they are food experts in judging flavor difference testing and flavoring and are handling food and laboratory subjects. Semi-trained panels were involved in the formulation of the recipe as they are capable of discriminating differences and communicating their reactions, though they may not have been formally trained. The fifth and the last stage is test phase which involves the evaluation of the 1st, 2nd and 3rd prototype of Sibujing-Turmeric Seasoning. The first prototype of Sibujing-Turmeric Seasoning was evaluated by Nine (9) faculty semi-experts of a university. The formulated recipe undergoes Product Sensory Evaluation whereby the sensory characteristics were evaluated. Product Sensory Acceptability Scorecard, Hedonic Scale, and Customer Satisfaction Metric were used in the evaluation. Moreover, for the second prototype, fifty (50) consumer panels, Faculty, Staff and Students of a community high school within a Maranao community in Mindanao Philippines evaluated the Sensory attributes of the product in terms of Color, Aroma, Taste and Texture. The Hedonic Scale, and Customer Satisfaction Metric were used in the evaluation. Lastly, for the third prototype of Sibujing-Turmeric Seasoning with three (3) reformulated recipes labeled as “Formulation 1 (F1), Formulation 2 (F2), Formulation 3 (F3)” were evaluated by the fifty (50) consumer panel, who are the faculty, staff and students of the identified community high school. The three reformulated recipes undergo Product Sensory Evaluation whereby the Sensory characteristics were evaluated. Product Sensory Acceptability Scorecard, Hedonic Scale, and Customer Satisfaction Metric were used in the evaluation. and the most acceptable formulations undergo a test for food quality analysis which includes nutritional analysis and physico-chemical properties such as ash content, crude protein, total fat, and moisture content. Hence, throughout its production and evaluations of the product it was conducted at the Food Laboratory facilities of the College of Education of a University and the Food Laboratory of a community high school. The food laboratory facility was chosen since it is a conducive and ideal environment for the panel of tasters to evaluate the Sibujing-Turmeric Seasoning and its sensory attributes. The food laboratory is equipped with the proper lighting for the correct evaluation of food products’ color, is well-ventilated, is ideal for concentration, and is efficient for product testing needs.

The researcher used various statistical tools and techniques for the Analysis to examine the data gathered from the product evaluation. The researcher used Thematic Analysis in the empathize stage to capture what the end users say, think, feel, and do. Themes coded the data gathered to reveal the typical responses of the participants; data analysis in qualitative research consists of preparing and organizing the data, then reducing the data into themes through coding and condensing the codes, and finally representing the data in figures, tables, or a discussion. For Sensory Evaluation the researcher used Weighted Mean and Standard Deviation to determine the sensory attribute of the product in terms of Aroma, Color, Taste, and Texture. For the Hedonic Scale Weighted Mean and Standard Deviation was also used to assess a respondent's pleasure, or satisfaction, with a product or service at an overall level. For instance, the scale might range from 'very satisfied' to 'very dissatisfied' with the product or service in question. And Lastly, Weighted Mean and Standard Deviation was also used for the Customer Satisfaction Metric Scale to measures

the satisfaction of a customer using a customer satisfaction rating scale question that asks survey takers to rate their satisfaction level with their product or service. The rating scale can be either 1-10, 1-7, or 1-5. CSAT is calculated by dividing your number of happy customers by the total number of customers.

3. Results and Discussion

This study aims to develop and evaluate the sensory attributes, acceptability and satisfaction of consumers of powdered sibujing-turmeric seasoning through the design thinking process. Significantly the study evaluates the physico-chemical properties and nutritional contents of the most acceptable formulation. Three formulations of sibujing-turmeric powdered seasoning were prepared, and the most acceptable formulations were analyzed for physicochemical parameters and nutritional facts.

The formulation of the powdered seasoning follows the design thinking process, beginning with an empathy map to understand end-user perspectives.

3.1 Empathy Map

The researcher conducted interviews with end users using a structured researcher made questionnaire to gather their perspectives on Sibujing-Turmeric and its use as a seasoning. The insights—encompassing what users say, think, feel, and do—were then synthesized into an empathy map to understand their experiences better. Figure 1 presents the Empathy map, which shows what the end users say, think, feel, and do. The empathy map shows the thematic analysis of the end users' responses regarding Sibujing-Turmeric as a seasoning. These themes were identified by analyzing the insights the participants shared. At this stage, ten (10) end users were interviewed to gather their perspectives and experiences.

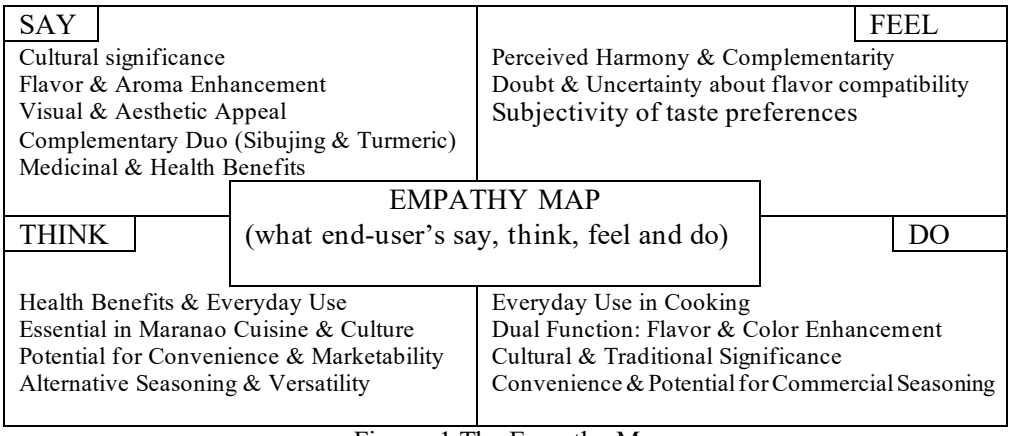

Figure. 1 The Empathy Map

Thematic analysis reveals that respondents view turmeric and sibujing as complementary duos with cultural significance in the Maranao community. They enhance flavor and aroma, provide culinary and visual appeal, and offer medicinal benefits. Turmeric has long been valued as a spice and a natural dye (Corcolon et al., 2015), thereby reinforcing its role in adding flavor and color. Likewise, sibujing is also a staple in Maranao cuisine (Añides et al., 2019) and is traditionally used in various medicinal preparations, such as decoctions, poultices, and infusions. Maranao has long utilized sibujing to treat ailments like cough, skin infections, body pain, spasms, hypertension, blood clotting issues, high blood sugar, and loss of appetite, confirming its recognized health benefits (Añides et al., 2019).

The thematic analysis on what the end-users feel about sibujing and turmeric showed that respondents have opposing feel regarding the combination of turmeric and sibujing,

with some respondents feeling it is a complementary pairing. In contrast, others feel that the tastes do not complement each other. This variation aligns with the subjectivity of taste preferences, which can differ based on cultural background and individual sensory (Spence et al., 2017). Research by Foroughi et al. (2019) found that combining turmeric and shallot extracts significantly improved the shelf life of silver carp paste by reducing microbial, lipid, and protein spoilage, suggesting a potential synergistic effect between these ingredients (Foroughi et al., 2019). While this study focuses on preservation, it implies that turmeric and sibujing may also interact to influence overall flavor perception. These findings highlight the importance of sensory evaluation and targeted marketing strategies to appeal to consumer segments that appreciate this combination, which in this research is the Maranao community. Further research on the flavor chemistry of turmeric and sibujing could provide deeper insights into their compatibility in culinary applications.

Also, the thematic analysis of the empathy map regarding what respondents think about turmeric and sibujing includes that both have health benefits, are essential in Maranao cuisine and culture, and offer the potential for convenience, marketability, and versatility as alternative seasonings. These perceptions align with existing research on both spices' medicinal and culinary properties. Turmeric is recognized for its bioactive compound, curcumin, which exhibits anti-inflammatory, antioxidant, and antimicrobial properties, which makes it valuable for traditional and modern medicine (Prasad & Aggarwal, 2011). Similarly, sibujing has been identified as a significant culinary ingredient in Maranao households, with research highlighting its phytochemical content, including flavonoids and alkaloids, which contribute to its antioxidant and antimicrobial activities (Añides et al., 2019). Moreover, the cultural relevance of these spices in Maranao cuisine suggests that their combination as a seasoning could cater to consumer preferences for authenticity and health-conscious choices. These results suggested that the development of sibujing-turmeric as a seasoning could enhance traditional dishes and can provide potential health benefits, reinforcing its marketability and everyday usability.

3.2 Define

The researcher identified problem opportunities and design challenges related to utilizing Sibujing and Turmeric by analyzing respondents' perspectives—what they say, think, feel, and do—through an empathy map (Figure 3). This analysis has defined the problem opportunities and design challenges outlined in Table 1. The problem opportunities defined include separating the preparation of Sibujing and Turmeric when used in the same recipe which would lead to increased preparation time and inconvenience. While Turmeric enhances the visual appeal of a dish but lacks strong flavor, Sibujing contributes to taste, making them complementary. Additionally, both ingredients are seasonal and can be costly. Given these constraints, the researcher identified two primary design challenges: (1) developing a seasoning formulation that effectively integrates Sibujing and Turmeric and (2) ensuring year-round availability. The problem opportunities and design challenges in the utilization of the sibujing-turmeric in Maranao cuisine were defined as presented in Table 1.

To address these issues, in the ideation stage, researchers come up with the idea of developing a sibujing-turmeric seasoning that simplifies preparation while retaining their complementary flavors. This product innovation improved practicality, guaranteed year-round availability, and preserves the ingredients' properties which was defined as the design challenges.

Table 1: Problem opportunities and design challenges

Problem Opportunities	Design Challenges
"Sibujing and Turmeric are prepared separately and are utilized in the same recipe, making it a complete dish—however, this increases preparation time."	*"How might the researcher develop a formulation of a seasoning using both Sibujing and Turmeric?"*
"Turmeric is not tasty when used alone but improves food appearance while Sibujing adds taste thus both complements in a dish."	*"How might the Sibujing and Turmeric as a seasoning and food coloring be developed to make it available all year round*
"Sibujing and turmeric are available in season and are sometimes expensive, specifically due to inflation. "	

3.3 Ideate, Prototype and Testing Stage

Based in the defined problem opportunities and design challenges the ideation of developing a formulated Sibujing-Turmeric Seasoning was conceptualized in the ideate stage. In the process of ideation, brainstorming on formulation of seasoning and how it will be prepared or what processed will be done to make it more convenient to use was discussed among the researchers and consultation with semi experts in the field of home economics. Specifically, the researchers formulated sibujing-turmeric as a seasoning in powdered form highlighting sibujing as the main ingredient during the ideation stage.

In the prototype stage, the researchers created the first formulation of sibujing seasoning in powdered form. Nine (9) faculty semi-experts then evaluated the prototype in one of the departments of a state university in the Philippines that specifically offered technology education programs. Faculty members were consulted and evaluated the sensory characteristics and acceptability of sibujing-turmeric seasoning through food tasting by answering the questionnaires, including sensory attributes of the seasoning in terms of color, aroma, taste, and texture. Another questionnaire is the hedonic scale of the overall acceptability and satisfaction metric evaluation of the sibujing-turmeric and this process involves the test stage. Table 2 presents the sensory-attributes of the sibujing-turmeric seasoning.

Table 2: Sensory Attributes of the first formulation of Sibujing-Turmeric Seasoning

Sensory Attributes Indicator	Value	Description
Color	2.55+ 0.52	Dark Yellow
Aroma	2.66+ 0.5	Very Pleasant
Texture	2.33+ 0.70	Fine

Values represent mean ± standard deviation (n = 50)

Table 2 presents the sensory evaluation of the Sibujing-Turmeric Seasoning revealed favorable results across key attributes. Color received a mean score of 2.55 (SD = 0.52), reflecting a dark yellow hue primarily attributed to curcumin, turmeric's principal bioactive compound, known for enhancing both visual appeal and potential health benefits (Priyadarsini, 2014; Nayak et al., 2022). This vibrant coloration is associated with perceptions of freshness and quality, positively influencing consumer attitudes (Spence, 2019). The seasoning's aroma, described as "very pleasant," is largely due to turmeric's volatile compounds, which impart a warm, spicy aroma that improves sensory attractiveness and consumer acceptance (Li et al., 2016; Krishna, 2018). Additionally, its fine texture was achieved through superfine grinding that contributes to improved dispersibility, bioavailability, and mouthfeel—factors that significantly boost both sensory appeal and marketability (Adeyeye et al., 2019; Patel et al., 2021).

Table 3: Sensory attributes of the sibujing – turmeric seasoning mixed with Rice

Sensory Attributes Indicator	Value	Description
Color	2.22± 0.78	Medium Yellow
Aroma	2.55 ± 0.52	Very Pleasant
Taste	3.00 ± 0.00	Hot and Tangy

Values represent mean ± standard deviation (n = 50)

Table 3 presented the sensory evaluation of the Sibujing–turmeric seasoning revealed a mean color score of 2.22 (SD = 0.78), indicating a medium yellow hue attributed to the curcumin content of turmeric. This pigmentation, resulting from moderate curcumin levels, plays a role in shaping consumer perception of quality (Nayak et al., 2022). The seasoning's "very pleasant" aroma is mainly due to turmeric's volatile compounds, which impart a warm, spicy scent that significantly enhances sensory appeal (Li et al., 2016; Krishna, 2018). The hot and tangy flavor profile stems from the turmerones in turmeric, which contribute pungency, combined with Sibujing's mild spiciness and natural sweetness, resulting in a well-balanced taste (Singletary, 2020). This bold and layered flavor enhances the seasoning's versatility, making it an appealing natural flavor enhancer for consumers seeking aromatic and flavorful alternatives. Additionally, its pungency may arouse appetite and support digestion, that may result for increase functional benefits and market potential (Li et al., 2016). Based on these findings and semi-expert feedback, the researchers proceeded to reformulate the seasoning to enhance its sensory and functional attributes.

To enhance the quality and characteristics of the initial Sibujing-Turmeric Seasoning prototype. Table 4 and 4.1 presents these respondent suggestions:

Table 4: Respondents' comments to enhance the first prototype of sibujing-turmeric seasoning

Themes	Coded Responses
"Adjustment of Ingredient Ratios"	"The seasoning's spiciness and heat linger in the mouth, requiring water to neutralize the sensation." R1 "I suggest adjusting the spiciness level and increasing the salt content for better balance." R2 "Adjust the ingredient ratio to better align with the tasters' preferences." R3

Table 4 presents respondents' comments and suggestions for improving the first formulation of the sibujing-turmeric seasoning. Key themes emerged from their feedback, including the adjustment of ingredient ratios. Coded responses highlighted concerns, particularly the lingering spiciness, heat intensity, and salt content.

Table 4.1 Respondents' comments to enhance the first prototype of sibujing-turmeric seasoning mixed in rice

Themes	Coded Responses
Adjustment of Ingredient Ratios"	"The seasoning has a pleasant color, aroma, and texture. It blends well with rice, offering an appealing appearance and a mild yet enjoyable scent. Its spiciness is tolerable, and the overall acceptability is high, providing a satisfying taste experience." R2 "It's too spicy for my preference since I'm not accustomed to spicy foods." R7

Table 4.1 presents the respondents' comments and suggestions for improving the first formulation of the sibujing-turmeric seasoning. Key themes emerged from their feedback, including adjustment of ingredient ratios. Coded responses highlighted specific concerns, such as "It's too spicy for my preference." From these comments and suggestions,

respondents developed three formulations for the first prototype with varying amounts of sibujing as the main ingredient.

These targeted suggestions aim to refine the seasoning's formulation, aligning it closely with expert insights and consumer preferences. Table 5 presents the sensory attributes of the third prototype in three formulations of sibujing-turmeric powdered form.

Table 5.1 Sensory attributes of the third prototype with three formulations of sibujing-turmeric seasoning

Sensory Attributes	F1 Mean	F1 Description	F2 Mean	F2 Description	F3 Mean	F3 Description
Color	2.66	Dark Yellow	2.00	Medium Yellow	1.16	Light Yellow
Aroma	2.42	Very Pleasant	2.26	Moderately Pleasant	2.18	Moderately Pleasant
Texture	2.46	Fine	2.42	Fine	2.56	Fine

Values represent the mean (n = 50)
[1]F1 – sibujing- turmeric seasoning with 20g sibujing
[2]F2 – sibujing - turmeric seasoning with 25g sibujing
[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 5.1 presents the sensory evaluation results of the Sibujing–turmeric powdered seasoning, assessed by fifty (50) panelists. Among the three formulations, Formulation 1 received the highest mean color score of 2.66, indicating a dark yellow hue. Formulation 2 had a mean score of 2.00, reflecting a medium yellow color, while Formulation 3 scored 1.16, corresponding to a light-yellow shade. The coloration is primarily attributed to curcumin, the principal pigment in turmeric, which enhances the seasoning's visual appeal and positively influences consumer perception of freshness and quality (Spence, 2015; Spence & Piqueras-Fiszman, 2016). Results suggest that end-users prefer a dark yellow pigment, aligning with the traditional use of turmeric in Maranao cuisine. In terms of aroma, panelists described the seasoning as very pleasant, a characteristic credited to the presence of ar-turmerone and β-turmerone in turmeric, as well as sulfur compounds in Sibujing. These volatile components contribute to its warm, pungent scent, which increases consumer preference (Li et al., 2016). The fine texture of the seasoning is attributed to superfine grinding, which reduces particle size, improves uniformity, and enhances physicochemical properties—making the product more appealing both in functionally and sensory aspects. Table 5.2 presents the sensory attributes of the third prototype with three formulations of sibujing -turmeric seasoning when mixed in cooked rice

Table 5.2 Sensory attributes of the third prototype with three formulations of sibujing-turmeric seasoning when mixed with rice

Sensory Attributes	F1 Mean	F1 Description	F2 Mean	F2 Description	F3 Mean	F3 Description
Color	1.92	Medium Yellow	2.32	Medium Yellow	1.72	Medium Yellow
Aroma	2.22	Very Pleasant	2.58	Very Pleasant	2.26	Very Pleasant
Taste	2.44	Hot and Tangy	2.36	Hot and Tangy	2.22	Astringent

Values represent the mean (n = 50)
[1]F1 – sibujing- turmeric seasoning with 20g sibujing
[2]F2 – sibujing - turmeric seasoning with 25g sibujing
[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 5.2 presents the sensory evaluation of three Sibujing–turmeric powdered seasoning formulations mixed with cooked rice, as assessed by fifty (50) end users. Among the formulations, Formulation 2 (F2) received the highest overall sensory scores, with a mean color score of 2.32, described as medium yellow, and an aroma score of 2.58, rated as very pleasant. Both Formulation 1 (F1) and F2 were noted for their hot and tangy flavor profiles. This distinct taste aligns with current consumer preferences for bold and adventurous flavors. Supporting this trend, a study by Kalsec reported that 80% of U.S. consumers enjoy hot and spicy foods, particularly those featuring sophisticated blends of heat and flavor. The results recommend that the synergy of Sibujing's mild spiciness and turmeric's pungency creates a flavor profile that resonates with both local and global palates. The high sensory ratings for F2 highlight its strong potential for commercial acceptance, particularly among consumers seeking vibrant, aromatic, and complex taste experiences.

Table 5.3 General acceptability of the third prototype with three formulations of sibujing-turmeric seasoning

Sensory Attributes	F1 Mean	F1 Description	F2 Mean	F2 Description	F3 Mean	F3 Description
Acceptability	7.50	Liked Very Much	7.64	Liked Very Much	7.34	Liked Very Much

Values represent the mean (n = 50)

[1]F1 – sibujing- turmeric seasoning with 20g sibujing

[2]F2 – sibujing - turmeric seasoning with 25g sibujing

[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 5.3 The findings reveal the overall acceptability of the three Sibujing–turmeric powdered seasoning formulations, with all rated as "Liked Very Much" by end users based on the 9-point hedonic scale. Among them, the formulation containing 25 grams of Sibujing received the highest overall acceptability score of 7.64, indicating strong consumer preference. A key consideration in food product development is a positive response underscores the product's market potential and reflects the crucial role of sensory attributes in consumer acceptance (Lawless & Heymann, 2013). Furthermore, the results reinforce the value of incorporating natural spices and herbs, such as Sibujing and turmeric, which not only elevate sensory appeal but also meet the increasing demand for health-conscious seasoning alternatives (García-Casal et al., 2016).To optimize the product for wider commercial distribution, further enhancement of ingredient ratios and detailed sensory characteristics of the product is recommended to ensure consistent quality and broaden its culinary applications.

Table 5.4 General acceptability of the third prototype with three formulations of sibujing-turmeric seasoning when mixed with rice

Sensory Attributes	F1 Mean	F1 Description	F2 Mean	F2 Description	F3 Mean	F3 Description
Acceptability	7.78	Liked Very Much	8.08	Liked Extremely	7.62	Liked Very Much

Values represent the mean (n = 50)

[1]F1 – sibujing- turmeric seasoning with 20g sibujing

[2]F2 – sibujing - turmeric seasoning with 25g sibujing

[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 5.4 presents the acceptability ratings of the three sibujing-turmeric powdered seasoning formulations mixed with cooked rice. The results show that Formulations 1 (F1) and 3 (F3) were rated as "Liked Very Much," while Formulation 2 (F2) received the

highest rating of “Liked Extremely” from end-users. This indicates that F2 was the most favorable treatment of sensory attributes in terms of flavor, aroma, and texture that effectively enhancing consumer preference. These findings highlight the importance of taste perception and consumer acceptance as critical factors in the market success of food products (Lawless & Heymann, 2013). The strong positive response to F2 suggests that its formulation aligns closely with consumer expectations, indicating promising potential for commercial marketability and product development. Additionally, the findings emphasize the significance of ingredients in the enhancement of the seasoning’s formulation, even minor adjustments can considerably impact the consumer preference (García-Casal et al., 2016). it is recommended to explore on the product’s long-term stability and shelf life to further improve consistency and market readiness.

Table 6.1: Customer satisfaction on the sensory attributes of the third prototype with three formulations of sibujing-turmeric seasoning

Sensory Attributes	F1	F2	F3
Color	4.14	4.16	3.86
Aroma	4.14	4.12	3.96
Texture	4.24	4.16	4.12

Values represent the mean (n = 50)

[1]F1 – sibujing- turmeric seasoning with 20g sibujing

[2]F2 – sibujing - turmeric seasoning with 25g sibujing

[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 6.1 summarizes the customer satisfaction ratings for the sensory characteristics of the three reformulated Sibujing-Turmeric Seasoning formulations (F1, F2, and F3), as evaluated by 50 end users. In terms of color, Formulation 2 (F2) received the highest mean score of 4.16, closely followed by Formulation 1 (F1) at 4.14, and Formulation 3 (F3) at 3.86—all categorized as “Satisfied.” For aroma, Formulation 1 (F1) led with a mean score of 4.14, followed by F2 at 4.12 and F3 at 3.96—again, all rated as “Satisfied.” Regarding texture, F1 recorded the highest mean score of 4.24, earning a “Very Satisfied” rating, while F2 and F3 scored 4.16 and 4.12 respectively, both falling under the “Satisfied” category. These findings highlight that all three formulations met consumer expectations, with F1 consistently performing well across aroma and texture dimensions.

Table 6.2: Customer Satisfaction of the third prototype with three formulations of sibujing-turmeric seasoning when mixed with rice

Sensory Attributes	F1	F2	F3
Color	4.42	4.52	4.42
Aroma	4.28	4.42	4.12
Texture	4.30	4.58	4.18

Score values, represented by the mean (n = 50), indicated that all parameters for the samples were described as “very satisfied”.

[1]F1 – sibujing- turmeric seasoning with 20g sibujing

[2]F2 – sibujing - turmeric seasoning with 25g sibujing

[3]F3 – sibujing - turmeric seasoning with 20g sibujing

Table 6.2 summarizes the end-user satisfaction ratings for the sensory characteristics of three sibujing-turmeric seasoning formulations (F1, F2, and F3), evaluated by fifty (50) respondents when mixed with cooked rice. Formulation 2 (F2) received the highest score for color (M = 4.52), followed closely by F1 and F3 (M = 4.42), with all formulations rated as "Very Satisfied." In terms of aroma, F2 again led (M = 4.42), while F1 (M = 4.28) and F3 (M = 4.12) were also positively evaluated, although F3 was classified as "Satisfied." For taste, F2 was the most preferred (M = 4.58), with F1 (M = 4.30) and F3 (M = 4.18)

slightly lower, leading to ratings of "Satisfied" for F1 and F3 and "Very Satisfied" for F2. These findings highlight the importance of enhancement of sensory attributes in terms of color, aroma, and taste to improve consumer acceptance and preference. Research affirms that sensory appeal plays a critical role in influencing consumer preferences and the commercial success of food products (Lawless & Heymann, 2013; Spence, 2015). The strong performance of F2 suggests that optimizing its ingredient proportions could further enhance its sensory appeal, stability, and market potential. As the most preferred formulation, F2 was subsequently subjected to physicochemical and nutritional analyses, detailed in Tables 7 and 8, respectively.

Table 7 Physicochemical properties of sibujing-turmeric seasoning

Physicochemical Properties	Formulation 2 Result (with 25 grams of Sibujing)
Ash	46.72g/100g
Crude Protein	6.55 g/100 g
Fat, Total	0.74 g/100g
Moisture Content	5.23 g/100g

Table 7 Table 7 presents the physicochemical properties of the most preferred formulation (F2) of the sibujing-turmeric seasoning, which includes 25 grams of Sibujing. The analysis showed an ash content of 46.72 g per 100 g, indicating a high mineral concentration. The crude protein content was measured at 6.55 g per 100 g, contributing to its nutritional value. Additionally, the total fat content was found to be 0.74 g per 100 g, reflecting a low-fat profile while providing essential macronutrients. The moisture content was recorded at 5.23 g per 100 g, slightly above the recommended threshold of 5% for seasoning powders (Tahmaz et al., 2022). Increased moisture levels may lead to problems such as caking and increased susceptibility to microbial growth, which may lead to compromise product stability and reduce shelf life. Maintaining moisture levels between 2% and 5% is optimal for improving pourability and extending the product's longevity.

Hence, these findings highlight the product's potential as a rich in mineral, nutritionally balanced seasoning, while also emphasizing the need for moisture control to enhance product stability, shelf life, and quality.

Table 8 Nutritional content of sibujing-turmeric seasoning with 25 grams of sibujing

Food Nutrient	Result of Chemical Analysis (per 100g)	Amount of Food Nutrient per Serving Size (Rounded Value per 80g)
Calories, kcal	195.90 kcal	5 kcal
Calories from fat, kcal	6.66 kcal	0 kcal
Total Fat, g	0.74 g	0 g
Total Carbohydrates, g	40.76 g	1 g
Protein, g	6.55 g	0 g

Table 8 reveals the nutritional analysis of the Sibujing-Turmeric Seasoning containing 25 grams of Sibujing as the main ingredients along with turmeric, ginger, chili, salt, and black pepper. The results highlight its low-calorie and low-fat composition that is suitable for health-conscious consumers. The seasoning comprises of 195.90 kcal per 100 g of carbohydrates as the primary component at 40.76 g per 100 g, supplying moderate energy. Its low total fat content (0.74 g per 100 g) aligns with heart-healthy dietary guidelines. The protein content is 6.55 g per 100 g, which is minimal at a typical serving size of 80 g, indicating that the seasoning functions mainly as a flavor enhancer rather than a significant macronutrient source. These findings support the research's main objective of improving food palatability and appearance (color) while maintaining minimal caloric intake,

consistent with the intended use of Sibujing-turmeric powdered seasoning for seasoning and flavoring foods or beverages (García-Casal et al., 2016).

4. Conclusion

The study successfully developed and evaluated sibujing-turmeric powdered seasoning, which demonstrates a high consumer acceptability, nutritional benefits, and market potential based on consumer satisfaction metric. Sensory evaluation revealed that Formulation 2 (F2) was the most preferred, rated as "Liked Extremely" due to its balanced flavor, aroma, and texture. It highlights the cultural significance of turmeric and sibujing in Maranao cuisine, strengthening their synergy as a seasoning. Furthermore, it was concluded that Physico-chemical and nutritional analysis of the seasonings were rich in mineral composition, low-fat content, and suitability for health-conscious consumers. Nevertheless, moisture content of the seasoning was suggested to be adjusted for its shelf life. Hence, the findings highlighting the functionality, flavorful, and cultural significance of the seasoning that aligns with consumer preferences and needs of the Maranao community, thus enhancing efficiency in the process of preparation and utilization of these spices in the Maranao culinary tradition. This food innovation presents a practical and culturally relevant resource for attaining the learning competencies in food preservation under the Home Economics curriculum. By incorporating both preservation methods and entrepreneurship concepts, it supports a holistic approach to skill development aligned with educational goals.

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