

DEVELOPMENT AND ACCEPTABILITY OF TARO STALK KIMCHI

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Abstract: Taro stalk kimchi is a dish made from the stalks of taro plants that have been fermented with various seasonings. While kimchi is typically associated with cabbage, taro stalk kimchi offers a unique and distinct flavor profile. The products of this developmental-experimental study were evaluated as to sensory and acceptability qualities in terms of appearance, aroma, taste, and texture. Significant differences in the sensory qualities and acceptability were also determined. Proximate and microbial analysis of the best treatment was submitted and the shelf-life was also studied.

The study used the Completely Randomized Design (CRD) and was conducted in three replications and one (1) final process for consumer preference evaluation by one hundred (100) tasters. Scorecards with Nine (9) Point Hedonic Scale were used to obtain the data.

The mean and analysis of variance (ANOVA) were used to analyze the data with the alpha level set at 0.01 for the inferential test. Treatment A (Abalong) Kimchi was extremely appealing, extremely pleasant, extremely delicious, and extremely crunchy. Treatment B (Gabi China) was extremely appealing, extremely pleasant, extremely delicious, and very much crunchy. Treatment C (Gutaw) was very much appealing, extremely pleasant, very much delicious, and very much crunchy. Abalong, Gabi China, and Gutaw stalk kimchi were liked extremely by the consumers with Gabi China kimchi getting the highest results in all quality attributes.

There was no significant difference in the sensory qualities of the taro stalk kimchi among the treatments in terms of appearance, aroma, taste, and texture. Moreover, there was no significant difference in the acceptability of taro stalk kimchi among the treatments considering the sensory qualities. The shelf-life of the Gabi China stalk kimchi when stored at room temperature was seven (7) days and six (6) months when sealed well.

The taro kimchi was safe for human consumption based on the results of microbial analysis of the product and based on the BFAD standard for microorganism test for products belonging to the fermented vegetables ready to eat.

Keywords: Taro Stalk, Taro Corm, Kimchi, and Shelf-life

I. INTRODUCTION

Many can attest that Filipinos love to eat, and that Korean culture and products has invaded the Philippines. As many Filipinos became fans of Korean dramas and music, many were also influenced by Korean idols to buy foods and other products. It cannot be denied that Korean foods have become common in the market. The rise of Korean stores in malls and commercial centers in many parts of the country cannot be denied as well. Filipinos are amazed by how Korean people dress up, and present themselves, including the food they eat and their culture.

Samgyeopsal, gimbap, kimchi chapchae are some of the Korean foods that are loved by Filipinos, and it is really evident that their food is amazing even just from the looks. This just proves that Filipinos are greatly influenced by the culture and flavors of South Korea, and the seasoned Korean dishes and delicacies are breathtaking experiences that Filipinos get to taste. (Adhikari, et al. 2017).

Kimchi, the national food of South Korea, is a spicy pickled vegetable dish. Kimchi is traditionally made by combining cabbage, scallions, or radishes in a brine with garlic, ginger, chili pepper, and fish sauce, and the ingredients are allowed to ferment. Traditionally, kimchi is fermented in a cool pit in the ground to help control the speed at which bacteria can grow (Jang, et al 2016).

Taro (*Colocasia esculenta*) is a tropical root vegetable widely cultivated for its edible corms and leaves. However, while the corms and leaves of taro have been extensively studied and utilized, there is limited information available on the

potential utilization of its stalks. Taro stalks are often overlooked and discarded and it offer untapped possibilities in terms of their composition, nutritional value, culinary uses, and potential applications in various industries (Han, et al., 2017).

Taro stalk, also known as taro stems or petioles refers to the thick, fibrous portion of the plant that connects the leaves to the corm. These stalks exhibit unique characteristics that set them apart from other parts of the plant. While the corms and leaves have been the focus of attention, exploring the potential of taro stalks can contribute to reducing waste, maximizing resources and utilization, and uncovering new avenues for sustainable agriculture and innovation (Jeong, et al, 2016).

Unlocking the hidden potential of different varieties of taro stalks can contribute to a more comprehensive understanding of this versatile plant and promote its holistic utilization, making use of its edible and non-edible parts. This can inspire further research, innovation, and exploration into the untapped opportunities presented by taro stalks, opening the door to new culinary experiences, nutritional benefits, and sustainable applications (Chung, et al, 2019).

The researcher has observed that many young people nowadays love to eat Korean food like Kimchi and since Taro leaf stalk is very abundant in the locality, this drove the researcher to create Kimchi from Taro Stalks.

Objectives of the Study

Primarily, this study was conducted to determine the acceptability of using Taro Stalk for making Kimchi. Specifically, it sought to:

1. describe the sensory qualities of the taro stalk kimchi among three treatments in terms of appearance, aroma, taste, and texture as evaluated by semi-trained panelists;
2. determine the general acceptability of the taro stalk Kimchi among three treatments in terms of the four sensory qualities as evaluated by consumers;
3. find out if there is a significant difference in the sensory qualities of taro stalk kimchi among the three treatments;
4. find out if there is a significant difference in the general acceptability of taro stalk kimchi among the three treatments;
5. determine the shelf life of the best taro stalk kimchi at room and chilling temperature; and
6. determine the microbial and proximate analysis of the best treatment.

Hypotheses

The following hypotheses were tested in the study:

1. There is no significant difference in the sensory qualities of Taro Stalk Kimchi among the three treatments in terms of appearance, aroma, taste, and texture.
2. There is no significant difference in the general acceptability of the Taro Stalk Kimchi among the three treatments.

II. METHODOLOGY

The study utilized the developmental and experimental methods of research. Developmental research is defined as the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness (Wayne, 2001). The developmental method was used in the production of Taro stalk kimchi for potential product development and commercialization.

On the other hand, an experimental method is a method involving control or manipulation of a condition for the purpose of studying the relative effect and various treatments applied to members of different samples (Worth, 2016). However, the experimental method focused on the utilization of varieties of Taro in making kimchi.

Experimental and Developmental methods are valuable tools in experimental research because they offer rigorous control, manipulation, randomization, replication, and insights into developmental processes. These methods allow researchers to draw strong conclusions about causal relationships and better understand how variables operate in various contexts (Jeong,et al, 2019).

III. EXPERIMENTAL DESIGN

The experimental design used in the study was the completely randomized design (CRD). The Completely randomized design (CRD) is a fundamental experimental design used in statistics and scientific research. It is a type of experimental design where the experimental units, such as subjects, participants, or objects, are randomly assigned to different treatments or conditions.

The experimentation was carried out in three (3) treatments: Treatment A- Abalong, Treatment B-Gabi China, and Treatment C-Gabi. The three treatments on differed in the variety of Taro used.

IV. TOOLS AND EQUIPMENT

The tools and equipment used in the study were the following: 3 pieces' tray, working table, knife, chopping board, strainer, mixing bowl, rubber scraper, casserole, blender, bowl, portion scale, one set of measuring cups, measuring spoon, plastic container, and stove.

V. INGREDIENTS OF THE STUDY

The ingredients of the research were the three varieties of Taro (Abalong, Gabi China, and Gabi), Gabi corm, garlic, onions, ginger, fish sauce, and chili powder. The proportions of the ingredients are found in Table 1.

In this study, the product developed was Taro stalk kimchi using stalks of Taro. The proportions of other ingredients were the same throughout three (3) treatments except for the variety of Taro stalks used.

VI. EXPERIMENTAL TREATMENTS

The experiment was carried out in three (3) treatments namely: Treatment A (250g Abalong stalk), Treatment B (250g Gabi China stalk), and Treatment C (250g Gabi stalk). Taro corm-200 grams, onions-28.3 grams, garlic-28.3 grams, ginger-28.3 grams, chili powder- 40 grams, salt-5 grams, sugar- 56.7 grams, and water- 1000ml. The proportion of the ingredients is found in Table 1.

Table 1. Proportion of Ingredients in Taro Stalk Kimchi.

Ingredients	Treatment A	Treatment B	Treatment C
Abalong stalk	250g	-	-
Gabi China Stalk	-	250g	-
Gabi Stalk	-	-	250g
Taro Corm	200g	200g	200g
Onion	28.3 g	28.3 g	28.3 g
Garlic	28.3 g	28.3 g	28.3 g
Ginger	28.3 g	28.3 g	28.3 g
Fish Sauce	28.3 g	28.3 g	28.3 g
Chili Powder	40 g	40 g	40 g
Salt	5 g	5 g	5 g
Sugar	56.7 g	56.7 g	56.7 g
Water (Mineral)	1000ml	1000ml	1000ml

Table 1 above shows also the proportion of ingredients of Taro stalk kimchi and its variety used for the consumer's acceptability during the establishment of the product formulation for the three treatments. The recipe for the kimchi was taken from the standard recipe coming from the radish kimchi (Lee, et al. 2017).

The quantity of the other ingredients is the same it only varies on the variety of stalks used. The purpose of the treatments was to find out the acceptability of the utilization of varieties of Taro stalks in making kimchi. The measurements for the ingredients such as Taro corm, garlic, onions, ginger, fish sauce, chili powder, vinegar, salt, sugar, and water were all in the same amount in every treatment.

VII. EXPERIMENTAL PROCEDURES

Step 1. Preparation of the Taro Stalk

The Taro stalk was gathered, peeled individually and cut into pieces. Then, the Taro stalk was boiled in 1000ml of water and 25 ml of vinegar with salt and sugar until it became crisp. The boiled Taro stalk was strained using a strainer. Then, was set aside for later use.

Step 2. Preparation of Kimchi Paste

The Taro corm was selected and washed thoroughly using running water. Then it was cut into cubes. Then it was boiled until tender and was left to cool for a few minutes. When it has cooled down, it was mashed and set aside. Minced garlic, onions, and ginger. The measured 200g taro corm, 10ml ginger, 10ml garlic, 10ml onion, 15ml fish sauce and 40g chili powder were combined in a mixing bowl and was set aside for later use.

Step 3. Procedure in making Taro Kimchi

All needed ingredients were gathered and prepared. Three (3) treatments were administered following the same procedure. In a mixing bowl, the boiled Taro stalks and the prepared kimchi paste were combined. Thoroughly rub the kimchi paste unto the Taro stalks until the paste completely covers the Taro stalks. After the mixing is done, the mixture was transferred in sterilized bottles, sealed and labelled. It was the stored in a cool and dry shelf.

VIII. COLLECTION OF DATA

For the sensory evaluation, the instrument used was a scorecard. It looked into the quality attributes of the Taro kimchi in terms of appearance, aroma, taste, and texture. These four sensory qualities were also the bases for determining the general acceptability of the Taro kimchi.

The evaluators were invited and oriented on how to evaluate the product. The evaluation sheet was given to the 10 semi-trained panelists from Capiz State University, Main Campus, and their honest opinions were solicited. The evaluators were instructed to evaluate the product using the Nine (9) – Point Hedonic Scale.

The one hundred (100) evaluators of the study composed of ten (10) Technology and Livelihood Education teachers, fifty (50) students in different year levels of Jagnaya National High School and Jagnaya Elementary School, and forty (40) potential consumers composed of vendors and housewives of Jagnaya, Jamindan, Capiz did the consumer evaluation of the Taro Kimchi to determine its acceptability.

After the evaluation of the product, the evaluation sheets were gathered, tallied, summarized, and submitted to the statistician for analysis. The mean was used to determine the sensory qualities as well as the acceptability of the Taro Kimchi. On the other hand, the One-Way ANOVA was used to determine if there is a significant difference in the sensory qualities and general acceptability of the Taro kimchi. This test was set at .01 level of significance.

IX. RESULTS AND DISCUSSIONS

Sensory Qualities of the Taro Stalk Kimchi

Table 3 reflects the sensory qualities of the Taro stalk kimchi as evaluated by ten (10) semi-trained panelists. In terms of appearance, Treatment A (Abalong) and Treatment B (Gabi China) were rated “Extremely Appealing” with means of 8.20 and 8.30. Treatment C (Gutaw), on the other hand, was found to be “Very Much Appealing” as shown by the mean of 7.60. The findings on the adjectival difference in the appearance of the product may be attributed to the different varieties of Taro used in making kimchi.

As to its aroma, all three treatments were found to be “Extremely Pleasant” as shown by the mean of 8.60 for Treatments A and B and 8.50 for Treatment C. This implies that kimchi made from different Taro stalks have the same aroma, as evaluated by the semi-trained panelists.

Treatment A (Abalong) and Treatment B (Gabi China) were both found “Extremely Delicious” since they reflected the mean result of 8.60 while Treatment C (Tugaw) was “Very Much Delicious” with a mean of 7.90.

Taro Kimchi from Abalong and Gabi China showed excellence in taste while Tugaw kimchi was found to be very delicious. The taste of Taro Kimchi depends on the Taro stalk that is used.

Table 3. Sensory Qualities of the Varieties of Taro Stalk in Making Kimchi by Semi-Trained Panelist.

SENSORY QUALITY	TA (Abalong)	AD	TB (Gabi China)	AD	TC (Gutaw)	AD
Appearance	8.20	EA	8.30	EA	7.60	VMA
Aroma	8.60	EP	8.60	EP	8.50	EP
Taste	8.60	ED	8.30	ED	7.90	VMD
Texture	8.50	EC	8.10	VMC	7.70	VMC

Legend:

AD –Adjectival Description EA - Extremely Appealing VMA- Very Much Appealing
 EP- Extremely Pleasant VMP- Very Much Pleasant ED-Extremely Delicious
 VMD- Very Much Delicious VC – Very Much Crunchy EC – Extremely Crunchy

As to the texture of the Taro kimchi, the evaluators found Treatment A as “Extremely Crunchy” reflecting a mean rating of 8.50 while Treatments B and C were rated as “Very Much Crunchy” with means of 7.70 and 8.10.

General Acceptability of Taro Stalk Kimchi

Table 4 shows the preferences of the 100 consumers who are teachers, students, and potential consumers regarding the utilization of Taro Stalk in Making Kimchi in terms of appearance, aroma, taste, and texture. The three treatments were “Liked Extremely” in terms of appearance as shown by the mean rating that ranges from 8.43 to 8.90. Treatments A and B were “Liked Extremely” in terms of aroma with means of 8:64 and 8.77, while Treatment C was “Liked Very Much” as shown by the mean of 7.96. Likewise, in terms of taste, two treatments, A and B were “Liked Extremely” in terms of taste with means of 8.64 and 8.84.

Table 4. General Acceptability of Taro Stalk Kimchi.

SENSORY QUALITY	TA Abalong	QD	TB Gabi China	QD	TC Gutaw	QD
Appearance	8.58	LE	8.90	LE	8.43	LE
Aroma	8.64	LE	8.77	LE	7.96	LVM
Taste	8.64	LE	8.84	LE	7.76	LVM

Texture	8.30	LE	8.76	LE	7.23	LVM
General Acceptability	8.54	LE	8.79	LE	7.85	LVM

Legend:

Scale of Means	Qualitative Description
8.12 – 9.00	Liked Extremely
7.23 – 8.11	Liked Very Much
6.34 – 7.22	Liked Moderately

On the other hand, Treatment C was “Liked Very Much” with a mean of 7.76. Considering the texture of the Taro kimchi, Treatments A and B were “Liked Extremely” as shown by the means of 8:30 and 8:76 while Treatment C was “Liked Very Much” as shown by the mean of 7.23.

Furthermore, the consumers of the product generally preferred Treatment B with a mean of 8.79, followed by Treatment A got a mean of 8.54 and last was Treatment C with a mean of 7.85.

Shelf-life of Taro Stalk Kimchi in Chilling Temperature

Table 7 and 7.1 presents the observed shelf-life of different varieties of Taro stalk (Abalong, Gabi China, and Tugaw) used in making kimchi. The prepared kimchi was sealed in sterilized bottles. One bottle was observed at room temperature while the other one was chilled. The prepared kimchi was kept away from water and sunlight. The observation of the shelf-life was done every day. This was done by looking for changes that may affect the quality of the kimchi.

Microbial Analysis of Taro Kimchi

Table 8 showed the microbial report analysis of Taro Kimchi samples conducted by the DOST Regional Standard and Testing Laboratory, Iloilo City. Test Service Request No. R6-032023-MIC-0226-0391 was submitted dated August 30, 2022 and was analyzed from March 27, 2023 to April 05, 2023 as attached in Appendix J.

The Taro Kimchi at 200grams per pack were subjected to Escherichia coli Count, Salmonella spp. and Mold and Yeast Count using spread plate method, 25°C, 5-7 days., PCA, USFDA BAM Online (2001).

As shown in the result above, the C Taro Kimchi has the molds and yeast count it had the result of <100 cfu/g sample with the BFAD criteria which was both acceptable in m and M. The Escherichia coli Count <1.8 MPN/g sample, and Salmonella spp. Not detected in 25gram sample. The result given in this report was during the time of examination and referred only to the particular sample submitted.

Table 8. Microbial Analysis of Taro Kimchi

Sample Description	Parameter	DOST	FDA Standards	
			m	M
Taro Kimchi, 200g	Escherichia coli Count	<1.8 cfu/g sample	3	0
	Molds and Yeast Count	<100 cfu/g sample (estimated)	10	0
MFD:03/27/2023	Total Coliform	2.0 MPN/g sample	50	10 ³



Legend: m –acceptable level of microorganism determined by a specified method: values are generally based on levels that are achievable under GMP

M – level which when exceeded in one or more samples would cause the lot to be rejected as this indicates a potential health hazard or imminent spoilage.

X. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the findings of the study, the following conclusions were formulated.

Taro stalk can be used as the main vegetable in making kimchi due to positive results of the sensory qualities as evaluated by semi-trained panelists in terms of appearance, aroma, taste, and texture.

The Taro stalk Kimchi was very acceptable in terms of the four sensory qualities due to its unique and distinct qualities compared to traditional Kimchi.

The unique texture and flavor of taro stalks provide an interesting twist compared to traditional kimchi.

The different varieties of taro stalk did not have a substantial effect on the sensory qualities of the kimchi. All three varieties of taro stalks (Abalong, Gabi China and Gutaw) can be used in making taro kimchi but the best variety is Gabi China.

The Taro Stalk Kimchi when stored at room temperature could last for seven days and six (6) months with no changes in the sensory attributes when completely sealed and refrigerated.

The taro kimchi was safe for human consumption based on the results of microbial analysis of the product and based on the BFAD standard for microorganism test for products belonging to the fermented vegetables ready to eat.

RECOMMENDATIONS

Based on the conclusions, the following recommendations are forwarded:

Varieties of taro stalk such as abalong, gabi china, and gutaw are recommended as the main vegetable in making kimchi because of their unique qualities that complement the flavor of kimchi and its abundance locally.

The product can be exhibited to more consumers to discover the new and unique flavor and taste of kimchi using varieties of taro stalks.

Taro stalk kimchi must be undergone a vacuum sealing process to prolong its shelf-life for storing purposes. Other researchers may try other variants/factors not covered in the current study.

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