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Consumers' acceptability of white yam dudol

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Abstract

This research focuses on the formulation of white yam dudol, which uses a quantitative research method. It was conducted at the Ilocos Sur Polytechnic State College with 50 panels of evaluators. Frequency count, percentage, weighted mean, and ANOVA were the statistical tools used. It was found that 50% rice flour and 50% white yam flour is the best formulation. It contains ash, moisture, crude protein, crude fat, and carbohydrates.

Keywords: Wild yam, dudol, native delicacies, sensory qualities

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1. Introduction

Preserving Ilocano cuisine is an important part of Filipino culture and starts with a deep grasp of its various elements. Traditional food or native delicacy is a term used worldwide and has different meanings depending on where one originates. Every type of native delicacy has its history and background. Typically, it involves special preparation techniques developed by an individual or group of people in a particular area who share certain cultural practices and lifestyles. According to Albayrak and Gunes (2010), the diversity of a country's culture influences the nature of traditional foods and native delicacies. The dish or menu itself has several traditional qualities. This term is particularly relevant to traditional cuisine with a distinct cultural identity, historical time, legacy, and specific locations' authenticity and unique identity. Traditional foods or native delicacies include "puto", "bibingka", "suman", "sinambong" and "dudol".

"Dudol" is a sweet toffee-like sugar palm-based confection commonly found in Southeast Asia and the Indian subcontinent. Originating from the culinary traditions of Indonesia, it is also popular in Malaysia, Singapore, Brunei, Philippines, South India, Sri Lanka, Thailand, and Burma, where it is called mont Kalama. It is made from coconut milk, jaggery, and rice flour. It has a sticky texture, thick consistency, and sweet taste. One of the main components of "dudol" is closely linked to its production history: gula aren or palm sugar, a traditional sugar made from the Arenga pinnata's sap plant, and rice flour. It is a popular sweet food and one of Maritime Southeast Asia's oldest indigenous sweets. Although the precise origin of "dodol" is unknown, the Java and Sumatra Island civilizations have a wide range of preparation methods. The differences are mostly post-colonial crop adaptations. Sundanese people call it "dudol," whereas Javanese people call it "jenang."

It is believed that "Dudol" was brought to Sri Lanka and Southern India by migrants from Indonesia. The Portuguese, who inhabited sections of the country in the 16th and 17th centuries, have also been blamed. Sri Lanka has evolved several "dodol" recipes, including Kalu "dodol." It is a popular dish in Kilakarai, Tamil Nadu, and is thought to have been introduced by Sri Lankan Muslim immigrants. It is also popular among Roman Catholics from the Indian west coast, known as the former Estado da India Portuguesa, including East Indians from Mumbai, Goa, and Mangalore. Dodol Hj Ideris is a dodol manufacturer that has recently expanded into the Middle Eastern market, particularly Iran. "Dudol" has been designated one of the Ilocos Region's endangered heritage foods. It is prepared with glutinous rice flour, palm sugar, and coconut milk and has a chewy, caramel-like, and sticky feel (Seow et al., 2021). Previous researchers claimed that the first record of the "dodol" was discovered in 1926 in Betawi, Indonesia, during the Dutch colonial period. During this time, "dodor" could only be obtained by the wealthy, and "dodor" refers to sweet or sweet-tasting candies. state), Sri Lanka, India (Goa), and Myanmar are fans of Dodol. Several names in these countries, such as mont Kalama in Myanmar and kalamata in Thailand, know Dodol. Dodol is referred to as halwa in India and East Africa, and as jenang in Central and East Java (Aziz, 2018).

The use of rice as one of the ingredients in dodol is significant since it represents the Betawi people's agrarian tradition (Sharifah et al). Another interesting fact is that "Betawi" comes from the Dutch word "Batavia," which refers to ancient Java (Seow et al., 2017). Dudol is a dessert that demands painstaking and rigorous preparation; it takes about six to eight hours to cook. Furthermore, dudol, usually cooked in a large wok, necessitates unique expertise in controlling the heat and manual mixing technique. It is usually prepared on wood-burning stoves, which emit a distinct smokey aroma that imparts a nostalgic and distinct flavor to the dish. (Md. Amin, 2021) The modern way of creating dudol differs slightly from the ancient approach in that manual labor is substituted with mechanized machinery. When making dodol with current technology, preparation time, energy expenditure, method of cooking, and aroma are drastically altered. The contemporary method uses the convenience of machinery to stir the dodol mixture throughout the cooking time (Abu Bakar, 2021).

Objectives of the study **-** The study tried to formulate dudol using white yam as the main ingredient. Specifically, it sought to determine the following: (1) microbial analysis of the dudol formulations; (2) sensory characteristics of dudol in terms of color, aroma, texture, taste, and consistency using three mixtures; (3) significant differences among the different yam dudol mixtures; (4) proximate analysis of the best formulation; (5) return of investment of each mixture; and (6) shelf life of the yam dudol product.

2. Methods

Research Design - This study used an experimental research method utilizing the Completely Block Design. In complete block design, every treatment is allocated to every block. In other words, every combination of treatments and conditions (blocks) is tested. It composes of three treatments namely: T0 as the control (rice flour + basic ingredients), T1 (pure yam flour + basic ingredients), T2 (75% yam flour and 25% rice flour + basic ingredients), and T3 (50% yam flour and 50% rice flour + basic ingredients).

Data Gathering Procedure **-** Fifty panels of evaluators were identified and invited, consisting of students, housewives, farmers, and faculty from different Barangays of Candon, City, Ilocos Sur. Pre-trials of the different dudol formulations were done to get the desired measurements and processes before subjecting them to microbial analysis. When subjected to microbial analysis, the products were found safe for human consumption. Thus, a sensory evaluation was made. Products were evaluated three times by the panel of evaluators. The evaluators were asked to gargle after tasting the product and before tasting another. The evaluation form was retrieved immediately. The ingredients are: 1 cup rice flour/yam; 3 cups water; 1 cup sugar; 1 cup coconut milk; and 2 tbsp butter. As to its procedure: Mix the dry ingredients, coconut milk, and water then stir; Heat the pan with medium flame and melt the butter; Pour the mixture and continuously stir until it attains the desired consistency; Let it cool and cut in desired shapes.

Data Gathering Instrument and Analysis **-** An evaluation form was the primary instrument used, which included the color, aroma, texture, taste, and consistency of the products formulated. For the level of acceptability of the evaluators, the Likert Scale below was utilized: 4.21- 5.00- Excellently Acceptable; 3.41- 4.20- Very Acceptable; 2.61- 3.40- Moderately Acceptable; 1.81 - 2.60- Fairly Acceptable; 1.00 - 1.80- Not Acceptable. Meanwhile, data were encoded and statistically analyzed using frequency count, percentage, weighted mean, Analysis of Variance (ANOVA), and ranking.

3. Results and discussions

3.1 Sensory Qualities of Yam Dudol

Table 1

Sensory Qualities of Yam Dudol

Parameter	Experimental Lot	Mean	Description
Aroma	T0 – Control (Rice Flour)	4.41a	Very Much Acceptable
	T1 – Pure Yam Flour	3.60ab	Very Acceptable
	T2 – 75% Yam flour + 25% Rice Flour)	4.02b	Very Acceptable
	T3 – 50% Yam Flour + 50% Rice Flour)	4.48bc	Very Much Acceptable
ANOVA result = 476.129**			
Texture	T0 – Control (Rice Flour)	4.57a	Very Much Acceptable
	T1 – Pure Yam Flour	3.77b	Very Acceptable
	T2 – 75% Yam flour + 25% Rice Flour)	4.02bc	Very Acceptable
	T3 – 50% Yam Flour + 50% Rice Flour)	4.51d	Very Much Acceptable
ANOVA result = 405.9293			
Taste	T0 – Control (Rice Flour)	4.38	Very Much Acceptable
	T1 – Pure Yam Flour	3.04	Very Acceptable
	T2 – 75% Yam flour + 25% Rice Flour)	3.69	Very Much Acceptable
	T3 – 50% Yam Flour + 50% Rice Flour)	4.48	Very Much Acceptable
ANOVA result = 737.3818			

Consistency	T0 – Control (Rice Flour)	4.45	Very Much Acceptable
	T1 – Pure Yam Flour	4.01	Very Acceptable
	T2 – 75% Yam flour + 25% Rice Flour)	4.18	Very Acceptable
	T3 – 50% Yam Flour + 50% Rice Flour)	4.47	Very Much Acceptable
ANOVA result = 159.6543			
Color	T0 – Control (Rice Flour)	4.63abc	Very Much Acceptable
	T1 – Pure Yam Flour	4.18ab	Very Acceptable
	T2 – 75% Yam flour + 25% Rice Flour)	4.39bc	Very Much Acceptable
	T3 – 50% Yam Flour + 50% Rice Flour)	4.69c	Very Much Acceptable
ANOVA result = 161.4556			

The sensory qualities of yam dudol were evaluated based on color, aroma, texture, taste, and consistency.

Aroma. Based on the result, it was found that the highest mean rating of 4.48 was obtained in T3 (50% yam flour and 50% rice flour), and the lowest rating was seen in T1 (pure yam flour). This indicates that 50% yam flour and 50% rice flour have a better aroma. This was supported by the Analysis of Variance (ANOVA) result, which indicated a significant difference between and among treatment means. It was further tested to determine which treatments have significant differences. This implies that the combination of 50% rice flour and 50% yam flour was found to be the best treatment among the treatment combination.

Texture. As regards the texture, it was noticed that T0 has the highest mean rating of 4.57 followed by T3 with a mean of 4.51 and described as "Very Much Acceptable". This implies that rice flour is still the best for making dudol. However, when the data were treated with ANOVA, it was indicated that there is a significant difference between and among treatment means. The Post Hov test was used to examine the data further, and it was discovered that there is a substantial difference between T0 and T1, T0 and T2, T1 and T2, and T2 and T3. It conforms to the findings of Ahmad (2021) that a traditional dudol is often made in big batches with multiple people working on it. The traditional process can also be taxing because it entails much human labor from beginning to end, such as gathering firewood, mixing the ingredients, and constantly stirring the loose liquid mixture until it becomes chewy, sticky, and dark brown.

Table 2

Post-Hov Test of Significant Differences Between and Among Treatment Means

Treatment Comparison	Mean	Mean Difference	Description
Aroma			
X0 -X1	4.41-3.60	0.81	Not Significant
X0- X2	4.41-4.02	0.39	Not Significant
X0 -X3	4.41-4.48	0.07	Not Significant
X1- X2	3.60-4.02	0.42	Not Significant
X1- X3	3.60-4.48	0.88	Significant
X2- X3	4.02-4.48	0.46	Not Significant
CV= 0.86			
Texture			
X0 -X1	4.57-3.77	0.80	Significant
X0- X2	4.57-4.02	0.55	Significant
X0 -X3	4.57-4.51	0.06	Not Significant
X1- X2	3.77-4.02	0.25	Not Significant
X1- X3	3.77-4.51	0.74	Significant
X2- X3	4.02-4.51	0.49	Significant
CV= 0.26			
Taste			
X0 -X1	4.38-3.04	1.34	Not Significant
X0- X2	4.38-3.69	0.48	Significant
X0 -X3	4.38-4.48	0.10	Not Significant
X1- X2	3.04-3.69	0.65	Not Significant
X1- X3	3.04-4.48	1.44	Significant
X2- X3	3.69-4.48	0.79	Significant
CV= 0.44			
Consistency			
X0 -X1	4.45-4.01	0.44	Not Significant
X0- X2	4.45-4.18	0.27	Not Significant

X0 -X3	4.45-4.47	0.02	Not Significant
X1- X2	4.01-4.18	0.17	Not Significant
X1- X3	4.01-4.47	0.46	Significant
X2- X3	4.18-4.47	0.29	Not Significant
CV= 0.45			
Color			
X0 -X1	4.63-4.18	0.45	Not Significant
X0- X2	4.63-4.39	0.24	Not Significant
X0 -X3	4.63-4.69	0.06	Not Significant
X1- X2	4.18-4.39	0.23	Not Significant
X1- X3	4.18-4.69	0.51	Significant
X2- X3	4.39-4.69	0.30	Not Significant
CV= 0.49			

Taste. Regarding taste, the combination of 50% rice flour and 50% yam flour has the highest mean of 4.48, followed by pure rice flour of 4.38, with a descriptive rating of "Very Much Acceptable." This was proven by the result of the ANOVA, stating that there is a significant difference between and among means. Further, when compared with T0 vs. T2, T1 vs. T3, and T2 vs. T3, it is found to be significant.

Similarly, the Malaysian version of dudol comes in a variety of flavors. Many modern variants of dudol are inspired by novel ideas, resulting in unique color, texture, and flavor variations. Durian, coconut, and banana are Malaysia's most common dudol ingredients. Dudol durian is delectable and has a lasting flavor that will gratify durian connoisseurs and allow them to appreciate durian in all its splendor. Like the Indonesian kind, Dudol durian is made with glutinous rice flour, durian flesh, coconut, and sweetening components such as brown sugar. It's also important to remember that upih, or dried betel leaf, is how dodol is traditionally packaged.

Consistency. Regarding consistency, T3 has the highest mean of 4.47 with a descriptive rating of "Very Much Acceptable," and T1 has the least mean rating of 4.01 with a descriptive rating of "Very Acceptable." This was proven by the result of the ANOVA, stating that there is a significant difference between and among means. Thus, the significant difference lies between T1 and T3. Due to the market's availability, both traditional and modern dudol is equally popular in Malaysia. Using a dodol machine or manually stirring the mixture takes time. The most significant distinction between traditional and modern dodol is the cooking procedure and how the dodol is preserved or packed. While using similar components such as glutinous rice flour, coconut milk, and palm sugar, traditional and modern dodol have very different tastes because the former uses firewood or charcoal, which gives it a distinctive scent and smokey flavor. (Ahmad, 2021).

Color. T3 has the highest mean of 4.69 with a descriptive rating of 4.69, described as 'Very Much Acceptable," and T1 has the least mean rating of 4.18 with a descriptive rating of "Very Acceptable." This was proven by the result of the ANOVA, stating that there is a significant difference between and among means. Thus, the significant difference lies between T1 and T3

Table 3

Proximate Analysis of White Yam Dudol

Analysis Name	Result	Methodology
Ash	0.77 g/100g	AOAC Official Methods of Analysis (International) 925.49., 20th Edition, 2016
Moisture Content	34.08 g/100g	AOAC Official Methods of Analysis (International) 925.49., 20th Edition, 2016
Crude Protein	2.69 g/100g	AOAC Official Methods of Analysis (International) 925.49., 20th Edition, 2016
Crude Fat	2.31 g/100g	AOAC Official Methods of Analysis (International) 920.177., 20th Edition, 2016
Total Carbohydrates	60.15 g/100g	By computation

The analysis found that the 50% Yam Flour and 50% Rice Flour have an ash content of 0.77 grams/100g. of the products made, moisture content of 34.08 grams/100g., crude protein of 2.69 grams /100g., crude fate of 2.31 grams/100 g., and 60.15 grams/100g. of total carbohydrates. This implies that the presence of yam flour has

higher nutrients and dietary fiber, similar to other types of grains and root crops.

As reflected in table 4, the cost and return analysis result shows that pure rice flour has the highest return on investment, followed by 50% yam flour and 50% rice flour. This indicates that dodol made of 50% yam flour and 50% rice flour is recommended for entrepreneurial activities or income-generating projects. Aside from its commercialization, the usability of white yam flour can now be utilized for native delicacies.

Table 4

Direct Material Cost of White Yam Dudol Formulations

Ingredients	As Purchased Price	Quantity	Unit	Total Cost (TO)	Total Cost (T1)	Total Cost (T2)	Total Cost (T3)
Rice Flour	50.00/kilo	1	Cup	12		3.00	6.00
Yam Flour	30.00/kilo		Cup		19.20	14.40	9.60
Sugar	90.00/kilo	1	Cup	21.60	21.60	21.60	21.60
Coconut Milk	45.00/240 ml	1	cup	45.00	45.00	45.00	45.00
Butter	55.00/225 grams	2	Tbsp	6.92	6.92	6.92	6.92
Total Expenses				85.52	92.72	90.92	89.12
No. of Pieces Produced/ Price per Piece	15 pieces/ Php 10.00			150.00	150.00	150.00	150.00
Net Income				64.48	57.28	59.08	60.87
ROI				75.40	58.54	64.98	68.30

3.2 Shelf Life of the Formulated Products

The products under experimentation were observed in refrigerated and room temperature conditions. Each product formulated was packed individually and evaluated based on the sensory evaluation used in white yam dudol. The results show that the control treatment and the formulated products containing 50% yam flour and 50% rice flour lasted two to three days in the refrigerator and one to two days at room temperature. Beyond that, the detection of molds starts to grow, which indicates that the product is not advisable for human consumption.

4. Conclusions and Recommendations

The researchers draw the following conclusions: (1) the sensory characteristics of dudol made from 50% rice flour and 50% white yam flour are very much acceptable; (2) proximate analysis of the best mixture shows that for every 100g, the following nutritional contents are present: ash (0.77g), moisture content (34.08), crude protein (2.69 g), crude fat (2.31 g), carbohydrates (60.15 g); (3) the presence of coconut milk causes the short shelf life of the product; and (4) the higher the amount of white yam powder, the higher the return on investment The researchers recommended the following: (1) T3 (50% rice flour and 50% white yam flour) is recommended in cooking dudol; (2) preparation of other native delicacies using white yam flour is recommended; (3) the use of fabricated materials in preparing white yam flour is suggested; and (4) the product formulated should be subjected to patenting.

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