

Acceptability of Rice Cakes Subjected to Water Retort Using Three Process Schedules

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Abstract One of the most famous native delicacies among the Filipinos is rice cake prepared by mixing coconut milk and subjecting it to the steaming process. With the utilization of the technology introduced by the Department of Science and Technology High Impact Technology Solutions (DOST-HITS), the production of rice cakes at a very short period of time can be made possible. This study aimed to develop rice cakes popularly known as “suman sa lihiya” through the adoption of the water retort technology. This specifically determined the acceptability of the quality attributes of water retorted rice cakes and its hypothesized differences in terms of color, taste, texture, aroma and general acceptability by employing the three process schedules. Three (3) batches of washed and packed glutinous rice were subjected to water retorting machine at 115°C temperature for 50 minutes, 60 minutes, and 70 minutes respectively. The water retorted rice cakes were subjected to sensory evaluation of its quality attributes in terms of color, taste, texture, aroma and general acceptability using the 9-point Hedonic Scale by the selected panelists (n=30) who were considered as potential customers. Results of the sensory evaluation showed that the quality attributes of the water retorted rice cakes were liked very much by the panelists however, significant differences existed in terms of the texture and general acceptability of the product. The panelists considered water retorted rice cakes which were subjected to the second and third process schedules highly acceptable.

Keywords: department of Science of Technology, food preservation, rice cakes, water retort

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1. Introduction

Oriental Mindoro is endowed with vast agricultural land with varying types of soil suited for growing fruits and crops. The province has been producing citrus fruits and vegetables that are distributed within the MIMAROPA and other regions in the Philippines.

Among the grains richly grown in the province is rice thus Oriental Mindoro is considered as the Rice Granary of Southern Tagalog [1]. Rice (*Oryza sativa*) being the staple food of the Filipinos [2] comes in different varieties and each of them has its remarkable characteristics. Dinorado is considered as best seller variety of rice due to its texture, color and aroma. Landrace rice, pureline selection rice, crossbred rice, semi-dwarf rice, hybrid rice, new plant type rice, designer rice - from the traditional to modern to futuristic - rice becomes all of these while traversing time in the Philippines [3].

On the other hand, *Oryza sativa* var. glutinosa or glutinous rice popularly known as “malagkit” in Tagalog, is the most commonly used main ingredient among Filipino native delicacies. These are termed as rice cakes. It varies from suman, puto, bilo-bilo, biko and others.

Rice cakes like “suman sa lihiya” are prepared by mixing coconut milk and a pinch of salt. The mixture is usually pre-cooked and then wrapped using banana leaves or coconut leaves before subjecting it to the steaming process. During rice cake processing, puffing of rice grains occurs upon rapid heating in a hot mold. Unbound water vaporizes and the steam nucleates gas cells within the matrix of starchy liquid. The gas diffuses into the cells, which expand while the temperature decreases rapidly due to the energy absorbed as the latent heat of vaporization. The puffed foam structure solidifies on cooling [4]. Moreover, Setyaningsih et al. [5] found out that the composition of phenolic compounds is noticeably different between glutinous and non-glutinous rice grains. The level of both melatonin and total phenolic in non-glutinous rice was higher than its glutinous variety. Hence, higher amylose content exhibits relatively higher amount of antioxidant compounds.

Sodium carbonate (Na_2CO_3), a white alkaline substance aids in the softening of glutinous rice. Reepholkul & Charoenrein [6] found out that the starch granules from rice treated with Sodium carbonate (Na_2CO_3) had smoother surfaces than untreated ones. The glutinous rice cakes exhibited an increase in softness and stickiness with the increased concentration of sodium carbonate.

On the other hand, Park et al. [7] obtained meaningful results confirming that rice cake containing *C. lanceolata* powder has high marketability and functionality. An increase in the demand for rice cakes containing medicinal plant extracts is highly commendable to enhance the value of rice cake as a healthy food. Although the steaming process minimizes the loss of nutrients and lessens the chance of burning or scorching, it does not guarantee sterilization of food. The recommended shelf life of rice cakes in Korea is one day at room temperature because of concerns over quality deterioration and microbial safety [8]. This is one of the reasons that the researcher considered in the conduct of this study.

With the utilization of water retort introduced by the Department of Science and Technology-High Impact Technology Solutions (DOST-HITS), the cooking and sterilization processes would be possible. Water retort is a vessel capable of withstanding extreme pressures is designed to destroy all microbes to prolong shelf-life and make products safe for consumption. The researcher strongly believed that the production of sterilized rice cakes at a very short period of time but with longer shelf-life can be made possible through the use of this technology.

2. Objectives of the Study

Generally, this study aimed to develop rice cakes subjected to water retort introduced by the Department of Science and Technology using three process schedules.

Specifically, this study aimed to: (1) determine the acceptability of the quality attributes of rice cakes in terms of color, taste, texture, aroma, and general acceptability; and (2) determine the degree of variation among the quality attributes of rice cakes subjected to water retort in three process schedules.

3. Materials and Methods

This developmental research used descriptive and comparative analysis. It aimed to develop rice cakes subjected to water retort. It utilized three process schedules in which the temperature was set at 115°C with varying length of time in cooking.

Two and three fourth (2.75) kilograms of glutinous rice, “*sinongsong*” variety were bought from the market. Young banana leaves were subjected to heat penetration, were cooled and wiped using clean cloth. Strings were also provided to fix the packed rice cakes.

3.1. Preparation of Rice Cakes

About 2.75kg of glutinous rice were washed with water ten times until the mixture was clear. Three fourth (3/4) cup of Sodium carbonate (Na_2CO_3) and one fourth (1/4) cup of iodized salt were mixed with glutinous rice. Glutinous rice cakes were packed using banana leaves and were fixed using plastic strings.

3.2. Sensory Evaluation

The rice cakes were subjected to sensory evaluation by selected panelists (n=30) who were potential customers of

the product. Numerical score sheets were provided to rate the color, taste, texture, aroma and general acceptability of rice cakes using the 9-point Hedonic Scale. Respondents' consent was solicited prior to the conduct of sensory evaluation.

3.3. Statistical Analysis

The data collected were treated and analyzed using descriptive statistics. Analysis of Variance (ANOVA) was used to test the degree of variation among the quality attributes across the three process schedules.

4. Results and Discussion

4.1. Quality Attributes of Rice Cakes

Table 1 shows the acceptability attributes of rice cakes using process schedule 1 (115°C temperature for 50 minutes). Results of the sensory evaluation revealed that the panelists liked moderately the color, taste, texture and general acceptability of the product. However, the aroma of the rice cakes was rated liked very much. This means that the natural scent of banana leaves could still be sensed by the panelists. With an overall mean of 7.30 described as liked moderately, the panelists perceived the product slightly acceptable.

Table 1. Acceptability Attributes of Rice Cakes using Process Schedule 1

Quality Attributes	Weighted Mean	Description
Color	7.33	Liked Moderately
Taste	7.30	Liked Moderately
Texture	6.97	Liked Moderately
Aroma	7.53	Liked Very Much
General Acceptability	7.37	Liked Moderately
Overall Mean: 7.30		Description: Liked Moderately

Table 2 shows the acceptability attributes of rice cakes using process schedule 2 (115°C temperature for 60 minutes). With an overall mean of 7.77 described as liked very much, the panelists perceived that the quality attributes of the product were highly acceptable.

Table 2. Acceptability Attributes of Rice Cakes using Process Schedule 2

Quality Attributes	Weighted Mean	Description
Color	7.70	Liked Moderately
Taste	7.97	Liked Moderately
Texture	7.70	Liked Moderately
Aroma	7.73	Liked Very Much
General Acceptability	7.77	Liked Moderately
Overall Mean: 7.77		Description: Liked Very Much

Table 3 shows the acceptability attributes of rice cakes using process schedule 2 (115°C temperature for 70 minutes). All the quality attributes of the product were perceived to be highly acceptable as shown by an overall mean of 7.69 described as liked very much. High pressure soaking and cooking have potential to improve rice sensory properties [9]. Through the use of water retort set at the second process schedule, it can be gleaned that the

quality attributes of rice cakes were of high level of acceptability.

Table 3. Acceptability Attributes of Rice Cakes using Process Schedule 3

Quality Attributes	Weighted Mean	Description
Color	7.53	Liked Moderately
Taste	7.80	Liked Moderately
Texture	7.63	Liked Moderately
Aroma	7.87	Liked Very Much
General Acceptability	7.63	Liked Moderately
Overall Mean: 7.77	Description: Liked Very Much	

As shown in Table 4, significant difference exists in terms of the color of rice cakes subjected to water retort across the three process schedules since the computed F-value of 0.797 exceeded the critical F-value of 0.454. The color of the products was perceived to be different across the three process schedules. This is due to the length of time the products were subjected to water retort. The shorter the time the products immersed in the water retort, the lighter the color of the rice cake. In addition, Nawaz et al. [10] found out that NaOH treatment at a concentration above 0.04% induced yellowness in grains. Since the amount of Na₂CO₃ used in this study was the same, the variations in color can be attributed to the length of time as well as the cooking temperature.

Table 4. ANOVA Summary Table on the Differences on the Quality Attributes of Rice Cakes in Terms of Color

	SS	df	MS	F	Sig.	Result
Between Groups	2.022	2	1.011	0.797	0.454	Significant
Within Groups	110.433	87	1.269			
Total	112.456	89				

As shown in Table 5, significant difference exists in terms of the taste of the product. The computed F-value of 4.024 exceeded the critical F-value of .021. Variations could be attributed to the length of time the products were subjected to water retort. This means that process schedules 2 (115°C, 60 minutes) and 3 (115°C, 70 minutes) produced rice cakes with more intense taste compared to process schedule 1 (115°C, 50 minutes) with a shorter time of cooking. Yu et al. [9] confirmed that high temperature treatments change the color and flavor of convenience rice. The variations in color are dependent on the length of time and cooking temperature.

Table 5. ANOVA Summary Table on the Differences on the Quality Attributes of Rice Cakes in Terms of Taste

	SS	df	MS	F	Sig.	Result
Between Groups	7.222	2	3.611	4.024	0.021	Significant
Within Groups	78.067	87	0.897			
Total	85.289	89				

Table 6 shows that a significant difference exists on the texture of the rice cakes across the three process schedules. The computed F-value of 3.570 exceeded the critical F-value of .032. Reepholkul & Charoenrein [6] emphasized that the starch granules from rice treated with Sodium carbonate (Na₂CO₃) had smoother surfaces than untreated ones. Variation on texture is caused by the length of time the rice cakes were subjected to water retort.

Table 6. ANOVA Summary Table on the Differences on the Quality Attributes of Rice Cakes in Terms of Texture

	SS	df	MS	F	Sig.	Result
Between Groups	9.867	2	4.933	3.570	0.032	Significant
Within Groups	120.233	87	1.382			
Total	130.100	89				

As shown in Table 7, significant difference exists on the aroma of the rice cakes across the three process schedules since the computed F-value of 0.866 exceeded the critical F-value of 0.424. This means that the longer the time of cooking using water retort, the more that the aroma of rice cakes would be enhanced by the natural scent of banana leaves.

Table 7. ANOVA Summary Table on the Differences on the Quality Attributes of Rice Cakes in Terms of Aroma

	SS	df	MS	F	Sig.	Result
Between Groups	1.689	2	0.844	0.866	0.424	Significant
Within Groups	84.800	87	0.975			
Total	86.489	89				

As shown, significant difference exists on the general acceptability of rice cakes across the three process schedules. This is supported by the mean perception of the panelists as to the general acceptability of the product. Rice cakes produced from the second process schedule (115°C, 60 minutes) got the highest overall mean as presented on Table 8.

Table 8. ANOVA Summary Table on the Differences on the Quality Attributes of Rice Cakes in Terms of General Acceptability

	SS	df	MS	F	Sig.	Result
Between Groups	1.689	2	0.844	0.866	0.424	Significant
Within Groups	84.800	87	0.975			
Total	86.489	89				

5. Conclusion and Recommendation

Three batches of rice cakes of varying time and constant temperature were successfully prepared. Results of sensory evaluation revealed acceptable quality attributes in terms of color, taste, texture and general acceptability using treatments 2 and 3. The product which was subjected to the second process schedule was evaluated discreetly acceptable in terms of the color, taste, aroma, and general acceptability. On the other hand, results of the sensory evaluation revealed that the potential customers liked very much its texture due to its softness yet sticky consistency which made it more appealing. The rice cakes subjected to water retort is a nutritious sterilized snack that offers longer shelf-life compared to rice cakes produced from the usual steaming process.

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