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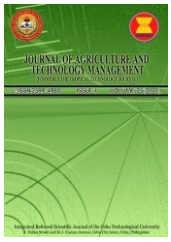

Sensory quality and consumer acceptability of rice (*Oryza sativa L.)* puff chips as affected by flavorants

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ABSTRACT

Ampao is a crunchy delicacy snack made from cooked, dried and puffed rice of the City of Carcar, Cebu, Philippines and has been developed into chips with a variety of flavorants. Consumer acceptability of the product was studied using a 9-point Hedonic scale and Analysis of Variance was used to determine significant effects. These involved different flavors added to the prepared rice puff chips namely: caramel and peanut, barbeque and cheese powders. The negative and positive controls were included as treatments, the unflavored chips and the commercially available Vietnamese rice chips, respectively. The study was arranged in Randomized Complete Block Design (RCBD). Color attribute of cheese flavored rice puff chips were comparable to the commercial Vietnamese rice chips with a "like very much" rating while the caramel and peanut flavored chips were comparable to the positive control in terms of flavor and aroma having a rating of "like very much" for both sensory attributes. The barbeque flavored rice puff chips was also rated as "like moderately" and was also comparable to the positive control. The quality attributes of the rice puff chips were generally enhanced with the addition of flavorants as indicated by their mean general acceptability scores.

KEYWORDS: *consumer preference; flavored rice puff; flavoring; leftover rice; sensory evaluation*

1 INTRODUCTION

Rice *(Oryza sativa L.)* is an edible starchy cereal grain and considered as the most widely consumed staple food for a large part of the world population including mostly all of East and Southeast Asia. It is an important part of a person's diet in the Philippines and can also be processed into an array of food and beverage products. It was reported by the Food and Agriculture Organization of the United Nations that the global milled rice production from 2015 to 2019 was at an average of 499 million tons and approximately an average of 449 million tons which is about 89.9% of milled rice produced globally comes from the region of Asia alone (FAOSTAT, 2020).

It was assessed by the Food and Agriculture Organization (FAO) of the United Nations that one-thirds of the edible parts of the food produced intended for human consumption were lost or wasted globally which sums up to approximately 1.3 billion tons per year (Gustavsson et al., 2011; FAO, 2013; FAO, 2015). Part of this is cereals which include rice. According to the International Rice Research Institute (IRRI), the rice wastage of Filipinos was reported to be approximately more than Php 23 million a day and summing up to roughly 8.4 billion a year (Macalintal, 2012).

Losses and wastage of rice are caused by various factors such as poor harvesting and post harvesting activities, inefficient transportation, lack of storage, and spoilage in market consumption. Usually leftovers and throwaways are the final occurences of rice wastage. Leftover rice is a common problem in households. Also, it is a problem in hotels, restaurants and school canteens. There are various methods of recycling these leftovers to avoid them from being thrown away. A way to settle this problem is by producing delicacies from these leftover rice.

Ampao is a popular native delicacy of the City of Carcar, Cebu, Philippines (City of Carcar, n.d.; Lao, 2005). It is made from dried cooked rice that is mainly

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leftover rice which is then sun dried and deep fried in hot oil to make it puff. The common puffed rice is creamy white to white in color. It has a very crunchy to hard texture that is usually molded into brick-like shapes. It is offered in the roadside kiosks and stalls in Carcar City, Cebu and its bordering municipalities and from vendors who come aboard buses to peddle the delicacy to the commuters (Sabanpan-Yu, 2007; Villarin et al., 2021).

In this study, the rice puff chips were added with a variety of flavorants to enhance the product and for the delicacy to move beyond only ambulant vending to go into supermarkets or malls. This study aimed to enhance the rice puff chips using different flavorants and to determine the sensory quality and consumer acceptability of the flavored product.

2 MATERIALS AND METHODS

Procurement of Materials

Rice and other materials such as the vietnamese rice chips, sugar, peanut, calamansi, barbeque, and cheese powders were sourced from the local supermarket in Carcar City, Cebu, Philippines.

Rice Puff Chips Preparation

Rice puff chips were prepared following the method of Villarin et al. (2021) with slight modification to reflect addition of flavorants per treatment. The rice was washed and parboiled in a rice cooker (Eureka ERC-1.0L/EP) using the ratio of 200 grams rice and 400 ml water (w/v). The parboiled rice was then blended (3D Blendrerizer Model BC-210PL) and was gradually added with 300 ml water to make a fine puree. The rice puree was spread into a non-stick baking sheet and formed into circular sheets that are about 1-1.5 mm thick. It was then oven (Union UGCR-530) dried at about 135°C for an hour or until constant weight was attained. The dried sheets were then deep fried in cooking oil heated up to 190°C until it was puffy. The rice puff chips were then drained on paper towels to remove excess oil.

Application of Treatments to the Rice Puff Chips

For the preparation of the caramel and peanut flavored chips, 64 g sugar was placed in a sauce pot and dissolved in 120 ml water and was heated while being stirred constantly until it was caramelized. The 3 ml of calamansi extract was added to the syrup. The caramel syrup was then drizzled over the rice puff chips and chopped peanuts were then sprinkled over it. The caramel syrup and chopped peanuts were allowed to coat the chips.

The preparation of the barbeque and cheese flavored rice puff chips involved placing 120 g of rice puff chips inside a closed container and adding 50 g barbeque or cheese powders to it. The closed containers were vigorously shaken for about 30-60 seconds to coat the rice puff chips.

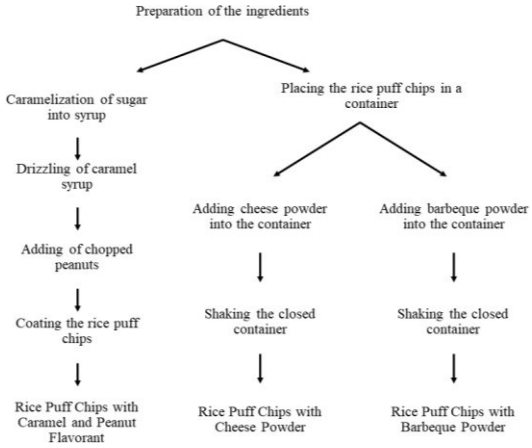

Figure 1. Process flow of the preparation of rice puff chips with flavorants.

Experimental Design

The treatments were arranged in a Randomized Complete Block Design (RCBD) with fifty (50) samples per treatment and three replications. These involved different flavorants added to prepared rice puff chips namely: caramel and peanut, barbeque, and cheese powders. The negative and positive controls were included as treatments, the no flavor chips and the commercially available Vietnamese rice chips respectively. The treatments were as follows:

Table 1. Experimental treatments used in the study.

Treatment	Flavorants
T_0	Negative Control (unflavored)
T_1	Caramel and Peanut
T_2	Barbeque Powder
T_3	Cheese Powder
T_4	Positive Control (Commercial Vietnamese Rice Puff)

Consumer Sensory Evaluation

Sensory acceptability of the flavored rice puff chips was carried out to assess the sensory attributes of the samples. Data from consumer sensory evaluation of all the prepared product samples were gathered using a score sheet. The color, flavor, aroma, texture, and general acceptability of the product were evaluated by fifty consumer panelists (n=50) composed of students, faculty and staff from the university within the locality with ages 18-40 years old. They were instructed to evaluate each sensory attribute based on the 9-point Hedonic Scale: 1-dislike extremely and 9-like extremely. The samples

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presented to the panelists were randomly coded with three-digit random numbers. Water was given to the panelists in between samples as a palate cleanser. The panelist was also asked to provide any comments they have of the provided samples:

Data Analysis

Data collected from the sensory evaluation were tabulated, consolidated, and subjected to analysis. The significant effects were determined using Analysis of Variance (ANOVA) at 5% level of significance using IBM SPSS ver.20. If ever significant differences exist, further analysis was done employing Tukey's HSD in order to locate significant means.

3 RESULTS AND DISCUSSION

Sensory acceptability of the rice puff as affected by the addition of various flavorants as evaluated by consumer panelists (n=50), aged 18-40 years old is shown in Table 2.

Table 2. Mean acceptability of rice puff chips as affected by the kinds of flavorants used.

Treatment**	Mean Acceptability*				
	Color	Flavor	Aroma	Texture	General
T_0	6.77±0.06^{c}	5.94±0.14^{c}	6.23±0.12^{b}	6.56±0.04^{d}	6.65±0.10^{c}
T_1	7.71±0.14^{b}	8.11±0.16^{a}	7.54±0.12^{a}	7.29±0.09^{c}	7.93±0.04^{b}
T_2	7.63±0.15^{b}	7.73±0.09^{b}	7.67±0.11^{a}	7.71±0.17^{b}	7.97±0.08^{b}
T_3	8.01±0.07^{a}	7.55±0.13^{b}	7.62±0.06^{a}	7.54±0.06^{bc}	7.76±0.11^{b}
T_4	8.05±0.11^{a}	8.10±0.07^{a}	7.73±0.20^{a}	8.13±0.13^{a}	8.27±0.08^{a}

*n=50; Students, Faculty and Staff (18-40 years old);
Mean scores with the same letter within a column are not significantly different from each other at $p<0.05$;
Scale: 1-dislike extremely; 2-dislike very much; 3-dislike moderately; 4-dislike slightly; 5-neither like nor dislike; 6-like slightly; 7-like moderately; 8- like very much; 9- like extremely
**T_0-negative control (unflavored); T_1-caramel and peanut flavorant; T_2-barbeque powder; T_3-cheese powder; T_4-positive control (Commercial Vietnamese rice puff)

Color Acceptability

The effect of different flavorants on the color acceptability of rice puff chips is shown in Table 2. The treatments added with caramel and peanut flavorants (T1), barbeque powder (T2), and cheese powder (T3) were observed to be significantly better compared to the negative treatment with no flavorants (T0) added. Results revealed that the addition of flavorants has significantly enhanced the color acceptability of the rice puff chips as observed from the results.

Analysis revealed that the rice puff chips flavored with cheese powder has a mean acceptability rating of 8.01±0.07 equivalent to like very much of the 9-point Hedonic Scale. It was comparable to the positive control which was the commercially available rice chips having the acceptability of 8.05±0.11. Among the treatments evaluated, the cheese flavored rice puff chips were found most acceptable in terms of color attribute. The cheese powder has imparted a vibrant yellow-orange color to the rice puff chips. It appeared more palatable to the panelists as compared to the brownish color imparted by the caramel and peanut flavorant and barbeque powder.

Flavor Acceptability

The mean flavor acceptability rating of the different flavored rice puff chips is shown in Table 2. It revealed that the rice puff chips flavored with caramel peanut (T1) was significantly ($p<0.05$) favored compared to the other treatments with 8.11±0.16 acceptability score and it is comparable to the positive control (T4) with a score of 8.10±0.07. Rice puff chips with cheese (T3) and barbeque powders (T2) showed improvement in the flavor acceptability with the description of like very much compared to that of the negative control (T0). It was also observed that the rice puff chips added with flavorant and the positive control (T4) had a significantly ($p<0.05$) higher mean flavor acceptability than the negative control which was expected since no flavorant was added to the rice puff chips in T0. Caramel and peanut flavored rice puff chips exhibited a distinct sweetness and was found most acceptable by the sensory panelist. The positive control (T4) had a slightly salty and sweet flavor with a sweet aftertaste. It was observed that the rice puff chips flavored with caramel and peanut (T1) and the positive control (T4) had perceptible sweet flavors. It can be said that the consumer panelists (n=50, ages 18-40) preferred the treaments that imparted a sweet flavor to the rice puff chips.

Aroma Acceptability

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The caramel and peanut, barbeque, and cheese flavored rice puff chips were found to be acceptable with mean acceptability scores of 7.54±0.12, 7.67±0.11, and 7.62±0.06, respectively, equivalent to like moderately. Treatments 1, 2, and 3 were found to be comparable ($p<0.05$) to the positive control (T4) with mean acceptability rating of 7.73±0.20 equivalent to like moderately of the scale.

The aroma of the different flavored rice puff chips were significantly ($p<0.05$) acceptable as compared to the unflavored rice puff chips (T0) as shown in Table 2. Result implies that the addition of the different flavorants to the rice puff chips has significantly improved the aroma acceptability of the product.

Texture Acceptability

The mean texture acceptability rating of the different flavored rice puff chips is shown in Table 2. Results show that there is a significant ($p<0.05$) difference between the flavored rice puff chips, the positive control, and negative control in terms of their mean texture acceptability scores. The positive control had the highest mean acceptability rating of 8.13±0.13. However, the mean texture acceptability ratings of T1, T2, and T3 were found to be significantly higher than the negative control (T0). It can be noted that even though the mean texture acceptability score of the caramel and peanut flavored rice puff chips was rated to be 7.29±0.09, panelists claimed that the product got stuck in their tooth due to the stickiness of the caramelized sugar. It was observed that with the addition of flavorant to the rice puff chips has enhanced the mouthfeel of the product that contributed to its texture acceptability.

General Acceptability

The mean general acceptability ratings of the different flavored rice puff chips is presented in Table 2. It was observed that there is a significant ($p<0.05$) difference between the general acceptabilities of the different flavored rice puff chips and the negative control having a general acceptability of 6.65±0.10 equivalent to like a slight category of the scale. The caramel and peanut, barbeque, and cheese flavored rice puff chips were found to be acceptable with general acceptability scores of 7.93±0.04, 7.97±0.08, and 7.76±0.11, respectively which is equivalent to like moderately of the 9-point Hedonic Scale. It can be inferred that the addition of the different flavorants to the rice puff chips has significantly increased the general acceptability of the product. On the other hand, the Vietnamese rice chips as the positive control were evaluated to have the highest mean general acceptability score of 8.27±0.08.

As observed, the texture acceptability of the flavored rice puff chips were significantly ($p<0.05$) lower than the positive control. This could have resulted in the lowering of the general mean acceptability rating of the flavored rice puff chips as compared to the positive control. However, it can still be said that the color acceptability, aroma acceptability, and flavor acceptability of rice puff chips were enhanced with the addition of flavorants to the rice puff chips.

4 CONCLUSIONS AND RECOMMENDATION

The addition of cheese flavorant significantly enhanced the color acceptability of the product which was comparable to the positive control. Addition of barbeque powder to the rice puff chips as a flavorant has also significantly enhanced the aroma acceptability of the product. The addition of caramel and peanut flavorant enhanced both flavor and aroma acceptability of the product. In general, the quality attributes of the rice puff chips were enhanced with the addition of flavorants as indicated by their mean general acceptability ratings. It can be recommended to add the identified flavorants to the rice puff chips to enhance the sensory quality of the product.

REFERENCES

City of Carcar. (n.d). History of Carcar. https://cityofcarcar.gov.ph/history-of-carcar/

FAOSTAT. (2020). FAOSTAT Database. Food and Agriculture Organization of the United Nations. Rome, Italy. http://www.fao.org/faostat/en/#data/QC/visualize.

Food and Agriculture Organization of the United Nations (FAO). (2015). Global initiative on food loss and waste reduction, 8.

Food and Agriculture Organization of the United Nations (FAO). (2013). Food wastage footprint: Impacts on natural resources: Summary Report. http://site.ebrary.com/ id/10815985.

Gustavsson, J., Cederberg, C., Sonesson, U. (2011). Global food losses and food waste. Extent, causes and prevention. *Food and Agriculture Organization of the United Nations* (FAO): Rome, Italy.

Lao, G.B. (2005). Kabkaban fest focuses on Carcar art, culture. *The Philippine Star.* Retrieved from https://www.philstar.com/cebu-news/2005/11/21/307833/kabkaban-fest-focuses-carcar-art-culture

Macalintal, A. (2012). That rice you throw away. International Rice Research Institute. https://ricetoday.irri.org/that-rice-you-throw-away/.

Sabanpan-Yu, H. (2007). Cebuano food festivals: A matter of taste. *Philippine Quarterly of Culture and Society, 35*(4), 384–392. http://www.jstor.org/stable/29792629.

Villarin, M.D., Salinasal, J.C.A., Aller, M.C., & Pascual,

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P.R.L. (2021). Development of rice (Oryza sativa L.) puff "Ampao" chips. *Plant Cell Biotechnology and Molecular Biology, 22(*11-12), 34-42.

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