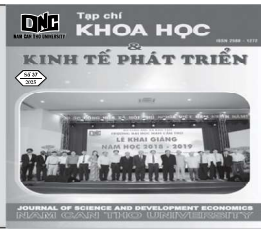
Journal of Science and Development Economics
Nam Can Tho University

Website: jsde.nctu.edu.vn



Research on the production process of breadfruit (*Artocarpus altilis*) steamed bun

Nguyen Ai Thach[1*], Van Thi Nhu Y[1], Tran Duy Khang[2]

[1]*Tien Giang University*

[2]*Nam Can Tho University*

[*]*Corresponding author: Nguyen Ai Thach (email: nguyenaithach@tgu.edu.vn)*

DOI: 10.64632/jsde.37.2025.605

Received: 10/5/2025
Revised: 12/6/2025
Accepted: 8/7/2025

Keywords: *Artocarpus altilis, dumplings, quality, ratio, sake*

ABSTRACT

The research was conducted to establish the process of making sake dumplings through investigating influencing factors such as sake ratio (25 - 40%), yeast ratio (0.5 - 2g), sugar ratio (8 - 14%) added to the dough and incubation time (40 - 70 minutes) to the quality of sake dumplings. Study results showed that the added ratio of 35% sake, 1.5% yeast, and 12% sugar would improve the fermentation process and created a harmonious sweetness for dumpling products. The appropriate incubation time was 60 minutes for the product to have good quality.

1. INTRODUCTION

Dumplings are a world-renowned dish with a tradition originating from China, made from meat and vegetables (Moin et al., 2019). Chinese dumplings are traditionally eaten on special occasions such as celebrations and festivals; however, they have been more widely consumed in recent years and have spread to various other countries (Buell et al., 2020). In Vietnam, steamed buns are a traditional savory snack with a savory or sweet filling. The main ingredient is wheat flour and it can be mixed with tapioca starch to create a more elastic and soft texture. Steamed buns are usually shaped into round or flower shapes by hand before cooking or steaming.

Food consumption patterns are constantly changing with the changes in social lifestyles. An important factor to consider in consumption patterns is the glycemic index (GI) of food, an indicator of the relative human glycemic response to dietary carbohydrates in food. Among traditional starches, breadfruit is a staple food and traditional crop in the Pacific for over 3000 years and is widely cultivated in the Caribbean and other tropical regions of the world. Currently, it is being recognized for its potential to positively impact hunger in tropical regions and the developing world. A breadfruit tree yields 200-

400 kg of fruit or more per year, which can be cooked and eaten in various ways. The fruit can be roasted, boiled, dried, pickled, fermented, or used to make bread. Breadfruit trees require little care, begin bearing fruit after 3 to 5 years, and yield for decades. There is some evidence that traditional diets based on breadfruit and other staple foods in the Pacific may prevent the onset of type II diabetes based on field observations, ethnobotanical reports, and medical records. However, a detailed scientific study has not yet been conducted and there is no full understanding of the nutritional value and diversity of breadfruit (Christina et al., 2015). This study was conducted to establish the process of processing breadfruit-added steamed bun products by identifying influencing parameters such as the ratio of breadfruit, yeast, and added sugar, and the dough incubation time.

2. MATERIALS AND METHODS

2.1 Experimental design method

The ingredients used in the experiment included Meizan all-purpose flour (Vietnam Wheat Milling Co., Ltd.); meat and eggs (Big C supermarket, My Tho, Tien Giang); breadfruit bought at Vinh Kim market, Chau Thanh, Tien Giang; Mauripan instant dry yeast - gold label (Mauri Vietnam Company); refined saccharose sugar (Bien Hoa Sugar Joint Stock Company); sweetened fresh milk (Vinamilk Vietnam Dairy Products Joint Stock Company); salt (Southern Salt Joint Stock Company); MSG (Vedan Vietnam Company).

After weighing, wheat flour was mixed with water, sake (steamed and mashed) at four different ratios: 25, 30, 35, and 40% and sugar was added at ratios of 8, 10, 12, and 14% (by weight of flour) to a fixed amount of flour. Activated yeast solution (1% yeast, 25 mL fresh milk at room temperature) was also added and mixed at ratios of 0.5, 1.0, 1.5, and 2.0% and kneaded until the dough reached a moderate elasticity and was not sticky but not exceeding 20 minutes. Then, the dough was incubated for a period of time for the buns to expand (40, 50, 60, and 70 minutes). The dough was divided into balls of about 70-75 g. The filling was put into the dough and shaped into buns. Then, the buns were steamed at boiling water temperature until fully cooked (about 15 minutes).

2.2 Analytical methods

Several analytical methods used in the experiments are presented in Table 1.

Table 1. Analytical parameters and methods used in the experiment

Parameter	Equipment used	Method
Moisture (%)	Moisture analyzer (A&D MX-50, Japan, weighing resolution 0.001g, humidity accuracy: >1g: 0.1%)	Drying at 105 °C to constant weight
Lipid content (%)	Soxhlet extraction system	Soxhlet

Parameter	Equipment used	Method
Total sugar (%)		Ferry cyanure
Starch (%)		Ferry cyanide, starch hydrolysis with 2% HCl acid.
Vitamin C (mg)		Titrate with a 0.01 N I2 solution until a blue color appears with a starch indicator.
Color	Colorimeter CR-410, Konica Minolta, Japan	L*, a*, and b* values
Volume (cm^3)		Sesame seeds were used to determine the volume of steamed buns. Fill a container with sesame seeds, level the top with a ruler, and weigh. Then, pour out half of the sesame seeds, place the bun in the center, and refill the container with the poured-out sesame seeds. Continue to level with a ruler. The volume of sesame seeds displaced is the volume of the bun.
Ash content (%)	Muffle furnace Nabertherm HTC08/14, Germany	Incineration until the sample becomes white or dark gray ash
Texture (g force)	Food texture analyzer (CT3–1000, Brookfield, USA) with 0.1 mm resolution, ±0.1 mm error, 0.1-10 mm/s travel speed, 0.01 mm/s speed error, and specialized probe model TA 25/1000 for determining the chewiness (g force) of steamed buns at room temperature.	

Parameter	Equipment used	Method
Sensory		Quantitative Descriptive Analysis (QDA) to evaluate the sensory attributes of the product

2.3 Data processing

The collected data were statistically processed by analysis of variance (ANOVA) with LSD test using Statgraphics Centurion XVI software at p-value less than 0.05 to determine the significant differences between experiments, thereby selecting the optimal parameters.

3. RESULTS AND DISCUSSION

The results presented in Table 2 show that breadfruit pulp has a relatively high moisture content (66.7%) and is rich in vitamin C (23.76 mg). In addition, breadfruit also contains an abundant source of starch (12.4%), which will be beneficial for adding breadfruit pulp to the steamed bun processing.

Table 2. Some physicochemical parameters of breadfruit raw material per 100 g of fresh breadfruit

Parameter	Content
Moisture (%)	66.7
Ash content (%)	0.106
Vitamin C (mg)	23.76
Lipid (%)	0.45
Total sugar (%)	3.98
Starch (%)	12.40
L^*	78.77
a^*	1.95
b^*	18.98

3.1 Effect of added breadfruit ratio on product quality

Table 3 shows that as the breadfruit ratio added to the product increased from 25 to 40%, the color indices and Vitamin C also changed, and there was a statistically significant difference between the samples. Specifically, the L* value of the samples tended to increase gradually. As the added breadfruit ratio increased, the color was directly proportional to the breadfruit ratio added to the bun. Steamed buns with 25% added breadfruit showed the lowest L* value, vitamin C, and starch, with values of 72.14, 6.1 mg, and 34.39 g/100g, respectively, compared to the other samples.

Table 3. Effect of the added ratio on color, vitamin C, starch, and lipid

Breadfruit ratio (%)	L* Value	Vitamin C (mg)	Starch (g/100g)	Lipid (%)
25	72.14^a	6.1^a	34.39^a	17.2^a
30	73.08^b	6.7^b	35.51b	17.63^b
35	74.53^c	7.2^c	36.94^c	18.46^c
40	74.80^c	7.8^d	37.68^d	18.9^d

Note: Different letters in the same column indicate a statistically significant difference at 5% level

The results in Table 4 and Figure 1 show that when the breadfruit ratio added to the product increased from 25 to 40%, the moisture content of the product did not differ. Specifically, the

added breadfruit ratio of 25% resulted in a moisture content of 38.39%. An added breadfruit ratio of 30% resulted in a moisture content of 38.85%. An added breadfruit ratio of 35% resulted in a moisture content of 38.49%. An added breadfruit ratio of 40% resulted in a moisture content of 38.68%. This indicates that the amount of added breadfruit only affected the volume of the bun and not the moisture content of the product. The volume of the steamed bun also changed and showed a statistically significant difference between the samples.

Table 4. Effect of added breadfruit ratio on moisture and volume after steaming of buns

Breadfruit ratio (%)	Moisture (%)	Volume after steaming (cm^3)
25	38.39[a]	150.74[d]
30	38.85[a]	149.58[c]
35	38.49[a]	148.51[b]
40	38.68[a]	146.92[a]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

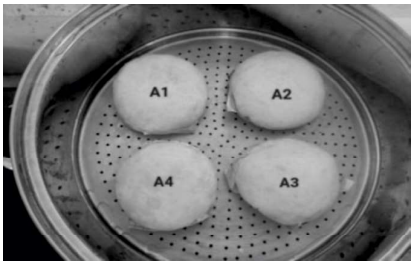


Figure 1. Breadfruit steamed buns with different added breadfruit ratios (%)

(A1: 25%, A2: 30%, A3: 35% và A4: 40%)

(A1: 25%, A2: 30%, A3: 35%, and A4: 40%)

The results in Table 5 show that as the breadfruit ratio added to the product increased from 25 to 40%, the color and texture indices of the product also changed and there was a statistically significant difference between the samples. Specifically, the higher the breadfruit ratio, the more characteristic the breadfruit aroma and the chewier the texture.

Table 5. Effect of added breadfruit ratio on the sensory value of the product

Breadfruit ratio (%)	Product characteristics	Flavor	Texture
25	The product has no breadfruit aroma. The bun is soft and porous.	2.67[a]	3[a]
30	The product has a slight breadfruit aroma. The bun is slightly porous and not too dry.	3.33[ab]	3.67[ab]
35	The product has a characteristic steamed bun aroma, sweet aroma of breadfruit. The bun is soft and porous with moderate chewiness.	4.67[c]	4.67[c]
40	The product has a characteristic breadfruit aroma. The bun is too chewy and not porous.	4[c]	4.33[bc]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

3.2 Effect of yeast ratio on breadfruit steamed bun quality

The results in Table 6 and Figure 2 show that the yeast ratio used greatly affects the texture and volume of the bun. When a low yeast ratio was used, the bun did not expand sufficiently, resulting in a dense and sticky texture. At high

yeast content, the steamed bun had a strong yeast odor.

Table 6. Effect of yeast ratio on texture and volume of buns after steaming

Yeast ratio (%)	Texture (g force)	Volume after steaming (cm^3)
0.5	2581.33[d]	148.48[a]
1.0	2427.67[c]	152.42[b]
1.5	2283.33[b]	157.41[c]
2.0	2180.67[a]	158.44[d]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

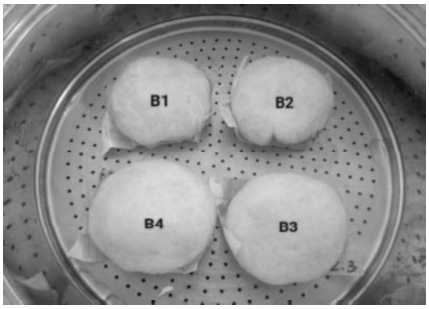


Figure 2. Breadfruit steamed buns with different added yeast ratios (%)

(B1: 0.5%, B2: 1.0%, B3: 1.5%, and B4: 2.0%)

Fermentation is an important step; for steamed buns to be porous, the dough must rise. Investigating the appropriate yeast ratio will help the buns have the best flavor after steaming. The results in Table 7 show that as the yeast ratio added to the product increased from 0.5 to 2%, the flavor and texture indices of the product also changed and there was a statistically significant difference between the samples. Specifically, the higher the yeast ratio, the more porous the bun's texture, but it also had an alcoholic smell and a sour taste.

Table 7. Effect of added yeast ratio on the sensory value of the product

Yeast ratio (%)	Product characteristics	Flavor	Texture
0.5	Good flavor, dense and sticky bun texture	3[a]	4[ab]
1.0	Good flavor, less expanded and porous bun	4[bc]	4[ab]
1.5	Characteristic aroma, highly expanded and evenly stretched bun surface	4.67[c]	4.67[b]
2.0	Alcoholic smell, cracks on the bun surface	3.33[ab]	3[a]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

3.3 Effect of added sugar ratio on product quality

The results in Table 8 show that when the sugar ratio added to the product increased from 8 to 14%, the color, flavor, and texture indices of the product also changed and there was a statistically significant difference between the samples. Specifically, with an appropriate amount of added sugar, the bun will be soft and porous, but if the sugar content is high, the bun will be sticky and change color.

Table 8. Effect of sugar ratio on the sensory value of the product

Sugar ratio (%)	Product characteristics	Color	Flavor	Texture

8	Characteristic color, fragrant, slightly sweet, expanded and slightly porous bun.	3.67[a]	3.33[a]	4[b]
10	Characteristic color, fragrant, slightly sweet, moderately expanded and porous bun.	4[a]	4[ab]	4[b]
12	Characteristic color and aroma, harmonious sweetness, well-expanded and porous bun.	5[b]	4.67[b]	5[c]
14	Bun turns yellow, strong sugar aroma, overly sweet, sticky and not much expanded.	3.33[a]	3.67[a]	3[a]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

The higher the sugar ratio added during kneading, the more the total sugar content increased in the steamed bun product (Table 9 and Figure 3). With a reasonable added sugar ratio, the bun will have a softer and more porous texture. However, adding too much sugar can lead to the bun becoming sticky, which negatively affects its texture. The texture and total sugar indices of the product also changed and showed a statistically significant difference between the samples.

Table 9. Effect of sugar ratio on texture and total sugar

Sugar ratio (%)	Texture (g force)	Total sugar (%)
8	2440[bc]	13.57[a]
10	2361.67[b]	14.78[b]
12	2140[a]	15.80[c]
14	2562[c]	16.07[c]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

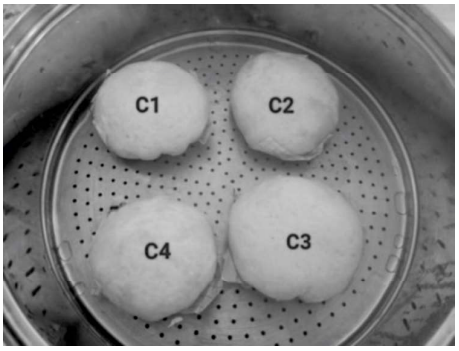


Figure 3. Breadfruit steamed buns with different added sugar ratios (%)

(C1: 8%, C2: 10%, C3: 12%, and C4: 14%)

3.4 Effect of incubation time on breadfruit steamed bun quality

The results in Table 10, Table 11, and Figure 4 show that the dough incubation time greatly affects the product's texture. With appropriate incubation time, the bun will be soft, porous, and have a harmonious taste. Conversely, if not incubated for enough time, the steamed bun will be hard and chewy. Additionally, the longer the incubation time, the larger the volume. If the incubation time is too short, the bun will not rise. Conversely, if incubated for too long, the bun will become dry.

Table 10. Effect of incubation time on sensory value and texture of the product

Incubation time (minutes)	Product description	Sensory texture	Sensory texture
40	Bun expands little, hard and chewy	3[a]	2430[b]
50	Bun expands moderately, slightly	4[ab]	2336[b]

	porous		
60	Bun expands well, soft and porous	4.67[c]	2030[a]
70	Bun expands large and then deflates when cooled	4[ab]	2096[a]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

Table 11. Effect of incubation time on volume before and after incubation

Incubation time (minutes)	Volume before incubation (cm^3)	Volume after incubation (cm^3)
40	36.28[a]	54.88[a]
50	37.25[b]	62.58[b]
60	37.9[c]	65.59[c]
70	36.43[a]	66.23[c]

Note: Different letters in the same column indicate a statistically significant difference at 5% level

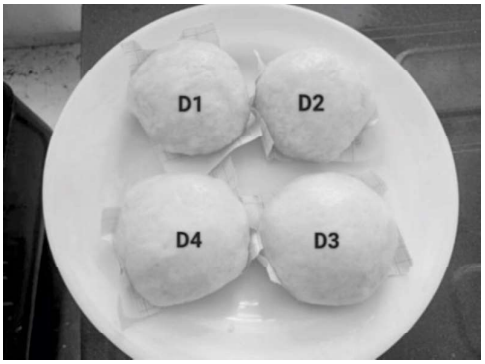


Figure 4. Breadfruit steamed buns processed at different dough incubation times (minutes)

(D1: 40 minutes, D2: 50 minutes, D3: 60 minutes, and D4: 70 minutes)

4. CONCLUSION

The breadfruit-added steamed bun product with a breadfruit ratio of 35% shows the best sensory qualities. Yeast was added to the product at a ratio of 1.5%. At this ratio, the product had a characteristic aroma, is not excessively yeasty, and has high porosity, resulting in good product quality. The optimal sugar ratio added to the product is 12%, creating a harmonious sweetness and soft, elastic texture. The appropriate incubation time to maintain the original texture of the product after cooling is 60 minutes.

REFERENCES

Buell, P. D., Anderson, E., de Pablo Moya, M., & Oskenbay, M. (2020). *Contemporary food*. In Crossroads of Cuisine (pp. 180-203). Brill.

Christina, E. T., Ying, L., Diane, R., & Susan, J. M. (2015). Breadfruit (*Artocarpus altilis* and hybrids): A traditional crop with the potential to prevent hunger and mitigate diabetes in Oceania. *Trends in Food Science & Technology*, *45*: 264-272. DOI: 10.1016/j.tifs.2015.07.014

Moin, A., Ali, T.M., & Hasnain, A. (2019). Effect of basmati and irri acetylated rice starches on textural and sensorial characteristics of dumpling wrappers. *Journal of Food Measurement and Characterization, 13*: 2594-2602. DOI: 10.1007/s11694-019-00179-4