ISSN 2821-9074 (Online)
ISSN 2730-2601 (Print)
RICE Journal of Creative Entrepreneurship and Management, Vol. 5, No.2, pp. 67-80,
May-August 2024

doi: 10.14456/rjcm.2024.11
Received 17.10.23/ Revised 12.08.24/ Accepted 20.08 .24

Managing Extended Shelf Life of Thong Yod Snacks in the Modified Condition

Chaowalit Auppathak[1*]
Nion Daocharoenporn[2]
Thanapop Soteyome[3]
Khemanat Yutthavisut[4]
Prassanee Tubbiyam[5]
Sumapar Thedkwanchai[6]
Premraphi Ooaymaweerahirun[7]

[1,5,6,7] Food and Nutrition, Faculty of Home Economics Technology
[2] Home Economics Business Administration, Faculty of Home Economics Technology
[3] Food Science and Technology (FS&T), Faculty of Home Economics Technology
Rajamangala University of Technology Phra Nakhon
[4] Ramathibodi School of Nursing, Faculty of Medicine
Ramathibodi Hospital, Mahidol University
[*] Corresponding author
Email: Chaowalit.a@rmutp.ac.th

Abstract

This research aimed to (1) identify the basic recipe of Thong Yod dessert, (2) analyze microbial properties for shelf life extension of Thong Yod dessert, and (3) find the modified conditions to extend the shelf life of Thong Yod snacks. The researchers involved 30 food and nutrition specialists in tasting Thong Yod dessert formulas, and 100 voluntary consumers in giving their opinions on consuming behavior of Thong Yod snacks. The findings were in three folds: (1) thirty food science specialists evaluated the characteristics the basic formula of Thong Yod as acceptable in Formula 1 in terms of aroma, taste, flavor, texture and overall liking with averages of 8.32, 8.30, 8.40, 8.48 and 8.33, respectively; (2) carbon dioxide has an effect on inhibiting the growth of microorganisms during the log phase and helps delay the lag phase, physically; (3) the use of modified conditions can extend the shelf life of Thong Yod for the longest time by using 100% carbon dioxide, which can preserve for a maximum of 12 days. The shelf life of 10 days had a pH value of 2.99±0.01, a statistically significant difference ($p \leq 0.05$) shown in the experiment under study. Of 100 voluntary consumers, (i) 77% had consumed Thong Yod snacks; (ii) 57% consumed less than 1 time per week; (iii) 75% bought Thong Yod snacks for consumption for reasonable price, good taste and availability; and (iv) 75% preferred extended shelf life by using 100% carbon dioxide. It was expected that the obtained findings can add value to local raw materials that extend shelf life and support small business entrepreneurs of dessert products for the growth of income in the communities concerned.

Keywords: *Thong Yod dessert, shelf life extension, modified condition*

1. Introduction

"Thong Yod" was a dessert dated back to the reign of King Narai the Great of Thailand. The name means a gold drop by its shape; the dessert originated from a recipe of Thao Thong

Kip Ma, a Portuguese woman working as the head of the royal kitchen. She used egg yolk as the main ingredient, typical of Portuguese dessert, as in Foi Thong intertwined with ham and Thong Yib with a plump flower shape (Ban Chom Yut, 2000; Uppathak & Suttha, 2018; Hongpan, Ngernsombat & Rattanapibul, 2019). Thong Yod is now a Thai dessert containing egg yolk, rice flour and syrup. The syrup is clear; otherwise, it will affect the color of the dessert (Sirikhansaeng, Saenkoth & Chumsena, 2020; Praphala, Thongnam & Pannongwa, 2021). The color can be observed from the syrup sponge. If the syrup has an inappropriate concentration, the mixture when dropped into the syrup will not form the desired shape. The good characteristics of Thong Yod dessert are that it is a round drop, yellow-orange in color, with a sweet, juicy syrupy taste. This type of dessert is available in general markets and shoppers buy it for consumption as well as a souvenir. Since it is a sweet dessert and buyers are aware of the harm of sugar, its makers need to adjust how to use sugar or other sweeteners, especially erythritol, for consumers' health concern (Ying, Wang & Hsu, 2006). Therefore, there is an urgent need to research into the production of Thong Yod dessert to reduce the amount of sugar or substitute with coconut sugar. Dessert makers urgently need innovation and technological knowledge for production formulas to suit the body's needs. It is important to keep nutritional value while adding value with extended shelf life. These are for small entrepreneurs in dessert production to sustain their business and income in their local communities.

2. Research Methods

The researchers arranged for three stages in conducting this research: (1) Study of the basic recipe of Thong Yod dessert, (2) Analysis of microbial properties, and (3) Identification of the characteristics of modified conditions to extend the shelf life of Thong Yod dessert.

2.1. Study of the Basic Recipe of Thong Yod Dessert

The researchers selected 3 basic recipes for Thong Yod dessert from general dessert information. The next step was sensory quality testing of product samples using the 9-point hedonic scale (Feng, 2010) for acceptance test method with 30 testers who were specialists in the field of food and nutrition, responsible for service industry major and Phetchaburi community entrepreneurs. The test began with a sample of the product being served into a white plastic cup. Covered with aluminum foil and attached with a 3-digit code that was randomly drawn. Each sample was first rinsed with clean water. The testers were to test different features of product characteristics, regarding appearance, color, aroma, taste, flavor, texture and overall liking. It was found that the concentration of syrup had an influence on the physical quality and sensory quality of Thong Yod dessert.

Table 1: Selecting Thong Yod Formula

Ingredients (g.)	Formula		
	1	2	3
Egg yolk	170	-	180
Duck egg yolk	255	120	30
Sugar	2,000	475	475
Jasmine floated water	3,000	475	475
Thong Yod flour	-	135	135

Source: Formula 1, Formula 2, Formula 3

2.2 Analysis of Microbial Properties

2.2.1. Microbial Properties

Microbial quality analysis was performed by taking samples of Thong Yod dessert stored in modified conditions. The total number of microorganisms in the samples were analyzed to determine the total number of microorganisms using the Standard Plate Count (SPC) method (AOAC, 1984)

2.2.2 Physical Properties

The researchers studied physical properties in the internal and external characteristics of Thong Yod dessert. The study of the external appearance is based on the color of Thong Yod dessert using a colorimeter. (Spectrophotometer) This is because the color of the product can indicate the quality of the raw materials used in production (Ying, Wang & Hsu, 2006; Pianthong, Thanthiang, Kaewsrithong & Thanawatchai, 2022). and also affect acceptance by entrepreneurs. As for the study of the internal characteristics, the texture of Thong Yod dessert was studied by using sensory testing or sensory evaluation (Sirikhansaeng, Saenkoth & Chumsena, 2020). The measured characteristics indicate chemical changes occurring within the product.

Color Measurement

- Prepare a sample of Thong Yod dessert that has the longest shelf life. To get a representative example for quality testing, the researchers used modified conditions with the longest shelf life.
- Take a sample of Thong Yod dessert that has the longest shelf life and grind it thoroughly. Then measure the color using Spectrophotometer, KONICA MINOLTA brand, model CM-3500d, followed by measuring the transmission of light (Transmittance). In each sample, the color value L* (brightness value has a value of 0 to 100, where 0 means a dark object is black, 100 means a bright white object) a* (+ means the object is red, - means the object is green) and b* (+ means the object is yellow, - means the object is blue) by measuring each sample 3 times for accuracy in color measurement.

2.2.3 Chemical Properties

The researchers brought Thong Yod dessert under modified conditions with the longest shelf life by the measurement of the acidity-alkalinity (pH) value with a pH meter Satorius AQ model PB-10, and tested every measurement value 3 times to find the average of each test.

3. Identification of the Characteristics of Modified Conditions to Extend the Shelf Life of Thong Yod Dessert

The procedure is in the following stages:

(1) Travel to pick up snacks in Phetchaburi Province.

(2) Adjust the atmosphere using modified conditions.

Normal
Vacuum
N2 100%
CO2 100%
N2 60% : CO2 40%
N2 70% : CO2 30%
N2 80% : CO2 20%

(3) Keep for 15 days.

(4) Analyze microbial quality every day starting from day 0 – 15.

All Microorganisms

(i) 7 samples of dessert in the modified state, 2 replicates for each.
(ii) Prepare dessert samples.
(iii) Dilute the candy sample to 8 levels.
(iv) Take the diluted food samples and place them on 0.1 ml PCA medium plates, 2 plates per sample.
(v) Cure at 37 degrees Celsius for 24-72 hours.
(vi) Count the colonies that grow in each plate to calculate the average value as CFU/g.

S.aureus

(i) 7 samples of dessert in the modified state, 2 replicates for each.
(ii) Prepare dessert samples.
(iii) Dilute the candy sample to 8 levels.
(iv) Take the diluted food samples and place them on 2 plates of 0.1 ml BPA culture medium, each sample.
(v) Cure at 37 degrees Celsius for 24-72 hours.
(vi) Count the colonies that grow on each plate to calculate the average value as CFU/g.
(vii) Test the detected germs with a test kit. staphylococcus.

(5) When the condition that can extend life as long as possible is achieved, repeat the analysis.

All Microorganisms
S.aureus

(6) Confirm results.

(7) Analyze chemical and physical quality.

(i) pH value
(ii) Color value L* a* b*

The researchers studied the characteristics of extending the shelf life of Thong Yod dessert using modified conditions by packing Thong Yod snacks in plastic bags, sealed on 3 sides, Nylon/PET type, size 25x35 centimeters, half a kilogram per bag. In the modified state, the concentration of gas was changed in the normal room temperature, vacuum (Vacuum), Nitrogen gas (N_2) 100 percent, Carbon dioxide (CO_2) 100 percent, Nitrogen gas to carbon dioxide ($N_2 : CO_2$) at all 3 levels, namely 60:40, 70:30 and 80:20 percent by testing conditions. One replicate was carried out for 15 days by taking samples of Thong Yod dessert stored in modified conditions on days 0 to 15 of storage to analyze their microbial properties. Then the researchers selected the Thong Yod snacks in the modified state with the longest shelf life to analyze the physical and chemical properties.

3. Experimental Results

3.1 The Basic Recipe of Thong Yod Dessert

The appropriate formula was an adapted formula using sensory testing with 30 testers to evaluate by scoring the 9-Point Hedonic Scale. The results are shown in Table 2.

Table 2. The Selection of an Appropriate Formula

Sensory characteristics	Formula		
	1	2	3
Color	8.23±0.83^{ab}	**8.35±0.74^{a}**	8.18±0.78^{ab}
Odor	**8.32±0.76^{a}**	8.18±0.84^{ab}	7.93±0.86^{b}
Taste	**8.30±0.61^{a}**	8.20±0.65^{a}	7.58±1.08^{b}
Flavor	**8.40±0.63^{a}**	8.25±0.63^{a}	7.65±0.92^{b}
Texture	**8.48±0.55^{a}**	8.20±0.69^{b}	7.98±0.77^{bc}
Overall liking	**8.33±0.76^{a}**	8.13±0.65^{a}	7.55±0.90^{b}

Note: Mean with different small letters in the row are significantly difference ($p \leq 0.05$).
Values are presented as mean ± SD.

Table 2 shows the results of evaluating the sensory characteristics of samples of all 3 formulas of Thong Yod products. The average scores in terms of color, aroma, taste, texture (smooth and soft), and overall liking indicated that Formula 1 had the highest average liking score. When analyzing variance and finding statistical differences, the researchers found color, aroma, taste, flavor, texture and overall liking as significantly different at the statistical level ($P<.05$); and Formula 1 was chosen.

3.2. Analysis of Microbial Properties

3.2.1 Results of Microbial Properties

The analysis of microbial properties uses the total Plate Count and the amount of S.aureus by studying the number of days it can be stored for the longest time. The microorganisms will be counted according to the community product standards of Kanom Jeen [rice noodles] with

a total microorganism count not exceeding 1x10-6 and an amount of S.aureus not exceeding 100 colonies per 1 gram of the sample. The experimental results are shown in Table 3.

Table 3: The Results on Packaged Thong Yod in Modified Conditions per Amount of Analyzed Microorganisms

Packaging condition	Shelf life (day)	Microbial analysis result	
		Total microbial count (CFU/g.)	*S.aureus* (colony/g.)
Vacuum	0	1.4×10^3	ND
	1	3.3×10^3	< 100
	2	5.2×10^3	< 100
	3	3.4×10^3	ND
	4	2.5×10^6	< 100
Normal	0	1.19×10^3	< 100
	1	2.3×10^3	< 100
	.	.	.
	4	7×10^5	< 100
N_2 80% : CO_2 20%	0	3.3×10^2	< 100
	1	8.6×10^2	< 100
	2	1.4×10^3	< 100
	3	1.7×10^3	< 100
	.	.	.
	.	.	.
	10	2.6×10^6	< 100
N_2 100%	0	1.3×10^3	ND
	1	1.4×10^3	ND
	2	3.8×10^2	ND
	3	1.4×10^3	< 100
	.	.	.
	.	.	.
	11	2.5×10^6	< 100
N_2 60% : CO_2 40%	0	2.7×10^2	< 100
	1	3.0×10^2	< 100
	2	4.0×10^2	< 100
	3	1.6×10^3	< 100
	.	.	.
	11	1.4×10^6	< 100

Packaging condition	Shelf life (day)	Microbial analysis result	
		Total microbial count (CFU/g.)	*S.aureus* (colony/g.)
N_2 70% : CO_2 30%	0	2.8×10^2	< 100
	1	2.7×10^2	< 100
	2	4.1×10^2	< 100
	3	1.5×10^3	< 100
	.	.	.
	.	.	.
	12	3.0×10^6	< 100
CO_2 100%	0	3.5×10^2	ND
	1	6.7×10^2	ND
	2	1.2×10^3	ND
	3	1.0×10^3	ND
	.	.	.
	.	.	.
	13	4.5×10^6	< 100

Note: ND means colony not found, or colony found less than 10.

Table 3 examines the microbial quality of Thong Yod dessert stored in different modified conditions. From days 0-15, it was found that from storage using modified conditions, Vacuum, normal conditions, N_2 80% : CO_2 20%, N_2 100%, N_2 60% : CO_2 40%, N_2 70% : CO_2 30% and CO_2 100%. The study results indicated that the number of days that can be stored and not exceeding the standard value is 2.5x106, 2.4x106, 2.6x106, 2.5x106, 1.4x106, 3.0x106 and 4.5x10-5, respectively. It can be concluded from the experiments that modified conditions in the storage of Thong Yod snacks can extend the shelf life of Thong Yod for the longest time by using 100% CO_2, which can be stored for a maximum of 12 days. This is because of carbon dioxide qualified as Bacteriostatic can inhibit the growth of microorganisms (Phuwarodom, 1995).

3.2.2 Results of Physical Properties

Table 4: The Results of Physical Properties Analysis of Thong Yod in Modified Condition Using 100% CO_2

Modified condition	Duration (day)	Color		
		L*	a*	b*(ns)
CO_2 100%	0	79.05 ± 0.46^{bcd}	-1.53 ± 0.13^{a}	8.11 ± 0.16
	1	80.00 ± 0.80^{bc}	-1.60 ± 0.05^{ab}	8.64 ± 0.03
	2	79.23 ± 0.25^{d}	-1.73 ± 0.06^{abc}	8.26 ± 0.12
	3	80.04 ± 0.81^{bcd}	-1.64 ± 0.05^{abc}	8.44 ± 0.18
	.	.	.	.
	.	.	.	.
	10	84.05 ± 0.19^{a}	-1.66 ± 0.11^{abc}	8.22 ± 0.48

Note: Mean with different letters in the column is significantly different ($p>0.05$); ns is non significantly different ($p>0.05$).

Table 4 reports the analyzed physical properties of Thong Yod dessert using modified conditions of 100% carbon dioxide to extend the shelf life of Thong Yod dessert. It was found that the brightness value (L*) and value (a*) of Thong Yod snacks each day were significantly different ($p>0.05$) by shelf life being extended in 100% carbon dioxide conditions on the 10^{th} day of storage. The brightness value (L*) has increased because carbon dioxide gas has the effect of causing changes in the cell membranes of microorganisms, causing the process of entering and exiting abnormal substances in the cells, followed by reduction in enzyme activity and changes in proteins. Therefore, when microorganisms are slowed down in growth, they affect the brightness value (L*) and value (a*) as the shelf life increases, with the value (b*) throughout the storage period. There are also values that are not significantly different ($p>0.05$).

3.2.3 Results of Chemical Properties

Table 5: Chemical Properties Analysis of Thong Yod in Modified Condition Using 100% CO_2

Modified condition	Duration (day)	pH
CO_2 100%	0	$4.31^{a} \pm 0.00$
	1	$4.31^{a} \pm 0.00$
	2	$4.06^{b} \pm 0.02$
	3	$4.01^{c} \pm 0.03$
	.	.
	.	.
	10	$2.99^{h} \pm 0.01$

Note: Different letters in vertical line have significant statistical difference ($p \leq 0.05$).

Table 5 shows the analyzed chemical properties of Thong Yod dessert in the modified pH condition of 100% carbon dioxide gas. It was found that Thong Yod dessert varied in chemical properties in the modified conditions:

Shelf life of 1 day has a pH value of 4.31±0.00;
Shelf life of 2 days has a pH value of 4.06±0.02;
Shelf life of 3 days has a pH value of 4.01±0.03;
Shelf life of 4 days has a pH value of 4.01±0.03;
Shelf life of 5 days has a pH value of 3.66±0.06;
Shelf life of 6 days has a pH value of 3.53±0.04;
Shelf life of 7 days has a pH value of 3.53±0.04;
Shelf life of 8 days has a pH value of 2.53±0.02;
Shelf life of 9 days has a pH value of 2.50±0.01; and
Shelf life of 10 has a pH value of 2.99±0.01 with a statistically significant difference ($p \leq 0.05$).

The obtained results from the experiments indicated occurrence of bacteria Lactobacillus sp. and Streptococcus sp. which are acid-producing groups. The yellow substance is caused by Lactobacillus sp. During the fermentation period of 1 day, a slight fermentation odor will occur. Because the fermentation reaction is still in a short period of time, the bacteria are not yet fully grown. When the rice was fermented for another 2 days, the egg yolk, which is the main component, began to have more moisture suitable for bacterial growth, and as a result increased acidity.

3.3 Identification of the Characteristics of Modified Conditions to Extend the Shelf Life of Thong Yod Dessert

The researchers assessed consumers' acceptance of the use of modified conditions using 100% carbon dioxide by sending a survey questionnaire to 100 respondents. This section reports their positive responses to the use of 100% CO_2 in extending the shelf life of packaged Thong Yod. Table 6 shows the demographic variables of the respondents.

Table 6: Demographic Variables of the Respondents Assessing Acceptability of Thong Yod Using 100% CO_2 in Extending Shelf Life

Demographic variables	Percentage
Gender	
Male	47
Female	53
Age	
15-24	69
25-34	28
35+	3

Demographic variables	Percentage
Educational level	
High school	9
Graduate	79
Postgraduate	12

Table 6 shows the majority of the respondents as female (53%), with male at 47%. The age group of 15-24 appears dominant at 69%; most have graduate education at 79%.

Table 7 reports the respondents' consumption behavior of Thong Yod dessert in a modified condition using 100% carbon dioxide to extend shelf life.

Table 7: Consumption Behavior of the Respondents Assessing Acceptability of Thong Yod Using 100% CO_2 in Extending Shelf Life

Consumption behavior	Percentage
Have you ever eaten Thong Yod?	
Yes	77
No	23
Frequency eating Thong Yod	
Less than 1 time/week	57
1-2 time/week	30
3-4 time/week	8
More than 3-4 time/week	5
If 100% CO_2 is used for extending Thong Yod's shelf life, would you be interested?	
Yes	75
No	25
Where do you usually buy Thong Yod from?	
Shophouse	17
Restaurant	28
Market	55
What is the reason why you buy Thong Yod to eat? (You can chose more than 1 answer.)	
Good taste	35
Good price	45
Easy to come by	28

Consumption behavior	Percentage
The problem found when you buy Thong Yod.	
Strong fermented odor	42
Short shelf life	28
Too sour	20
Fermented rice flour	10
Do you have diarrhea or gastrointestinal tract disease when you eat Thong Yod?	
Yes	38
No	62

As seen in Table 7, those who had previously consumed Thong Yod were 77%, and 57% accounted for the frequency of less than 1 time per week in consuming it. The respondents at 75% accepted Thong Yod snacks using 100% carbon dioxide in extending shelf life. The buyers were positive to reasonable price (45%), good taste (35%) and availability (28%). Two major problems the buyers have encountered were fermenting odor (42%) and short shelf life (28%); 62% reported no gastrointestinal effect on eating Thong Yod.

4. Discussion and Conclusion

The results of the evaluation of the sensory characteristics of the 3 formulas of Thong Yod products in terms of color, aroma, taste, texture and overall liking indicated that Formula 1 had the highest average liking score. The variance and statistical differences in color, aroma, taste, flavor, texture and overall liking, were significant at the statistical level ($p<.05$). In fact, Formula 1 was chosen in line with the earlier research by Mongkolwan, Chaengchad &Wongthong (2002a, 2002b) and Netsawang, & Niyaboon (2021). It was also evident that the concentration of syrup had an influence on the physical quality and sensory quality of Thong Yod dessert, statistically significant ($p<.05$). When the syrup concentration increased from 68+1 to 71+1 degrees Brix, the hardness of Thong Yod dessert decreased and then increased. It should be noted that with the syrup concentration increased from 71+1 to 74+1 degrees Brix, Thong Yib dessert decreased its hardness value, while Foi Thong increased its stickiness. In this regard, the appropriate syrup concentration for producing Thong Yod [and also Foi Thong and Thong Yip] is 71+1, 74+1, and 68+1 degrees Brix, respectively. However, the researchers recorded the average total liking score at the moderate liking level. It should be noted that the obtained results appeared to agree with the findings by Mongkhonwan, Chaengchad & Wongthong (2002a, 2002b), and Netsawang & Niyaboon (2021).

As for the inspection of the microbial quality of Thong Yod dessert stored in different modified conditions for a period of 15 days, the researchers found Thong Yod stored in vacuum conditions had the lowest shelf life of 3 days. The total amount of microorganisms was detected at 2.5×106 CFU/g on day 4, which exceeded the standard criteria. When

Thong Yod was stored in 100% carbon dioxide, the longest shelf life was 12 days, with a total microorganism count of 4.5×106 CFU/g detected on the 13th day, which exceeded the standard set by the Thai Authority of Medical Sciences (Phuwarodom, 1995). It should also be noted that the samples in both conditions had S.aureus amounts not exceeding 100 colonies/gram.

The analysis of the physical properties of Thong Yod dessert using modified conditions of 100% carbon dioxide to extend the shelf life revealed the brightness values (L*) and values (a*) of Thong Yod snacks each day as significantly different ($p>0.05$). The values (b*) of Thong Yod each day was consistent throughout. The color values that appear to affect consumer preferences and acceptance, in fact, show the deterioration stages of food (Muhoro, 2022).

The chemical properties of Thong Yod with extended shelf life in 100% carbon dioxide condition showed the shelf life of 1 day with a pH value of 4.31±0.00. When the shelf life reached the 10th day, the pH value was equal to 2.99±0.01. It can be seen that the pH value decreased with longer shelf life because microorganisms produced lactic acid in just 1 day, with a slight fermentation odor. As time passed, the microorganisms increased in size, and caused more of lactic acid, followed by a decrease in pH value (Phuwarodom, 1995; Praphala, Thongnam & Pannongwa, 2021).

The researchers assessed consumers' acceptance of extending the shelf life of Thong Yod with 100% CO_2. Such information is vitally important to Thong Yod entrepreneurs in producing this type of dessert for buyers (Nuwongsri, 2019; Netsawang & Niyaboon, 2021). It was found that most consumers accept the Thong Yod under 100% CO_2 condition. The obtained findings in this study were expected to generate practical implications for entrepreneurs of dessert products in adding value to local raw materials that extend shelf life and support dessert production for the growth of income and communities' sustainability as concerned.

5. Acknowledgements

This research received funding from Faculty of Home Economics Technology Rajamangala University of Technology Phra Nakhon. The researchers would like to thank Rajamangala University of Technology Phra Nakhon and all those involved in helping Let this research be completed successfully.

6. The Authors

Chaowalit Auppathak, Prassanee Tubbiyam, Sumapar Thedkwanchai, and Premraphi Ooaymaweerahirun are lecturers in the Department of Food and Nutrition, Faculty of Home Economics Technology, Rajamangala University of Technology Phra Nakhon.

Nion Daocharoenporn (Home Economics Business Administration), Thanapop Soteyome (Food Science and Technology) are also staff members of the Faculty of Home Economics Technology, Rajamangala University of Technology Phra Nakhon.

Khemanat Yutthavisut is working for Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

These seven researchers have collaborated their efforts in research on the current issues of home economics in Thailand. They share academic and research interest in the areas of food and nutrition, production management of local snacks and desserts, and heath related to food consumption.

7. References

Ban Chom Yut. (2000). *Thai Desserts in Various Ceremonies*. (Online). https://www.baanjomyut.com/, October 15, 2019.

Feng, Y.B.S. (2010). *A Critical Appraisal: The 9-point Hedonic Scale and Hedonic Ranking as an Alternative*. Department of Food Science and Technology of the University of California. (Online). https://www.proquest.com/, May 4, 2023.

Hongpan, N., Ngernsombat, K. & Rattanapibul, I. (2019). *Research Article in Food Science and Technology: Development of Khanom Alua from Riceberry Flour*. Bangkok: Faculty of Science and Technology Bansomdejchaopraya Rajabhat University, 782-793.

Mongkhonwan, K., Chaengchad, K. & Wongthong, O. (2002a). Effects of Syrup Concentration on the Qualities of Kha-nom Tongyod, Tongyib and Foytong. A Research Report. Bangkok: Kasetsart University. (Online). https://kukr.lib.ku.ac.th/kukr_es/kukr/search_detail/result/8130, July 16, 2023.

Mongkhonwan, K., Chaengchad, K. & Wongthong, O. (2002b). The Influence of water concentration on the quality of thongyod, thongyib, and foithong. *The 40th Academic Conference of Kasetsart University: Agro-Industry Branch*, 454-456.

Muhoro. (2022). *Khanom Thong Yod*. (Online). https://muhoro.net/, October 14, 2019.

Netsawang, P. & Niyaboon, C. (2021). Inheriting the wisdom of making Thai desserts(Thong Yod, Foi Thong and Seed Jackfruit) to develop into a business for the housewives of Ban Chin Community, Wat Yom Subdistrict, Bang Ban District, Phra Nakhon Si Ayutthaya Province. *Academic Journal of Ayutthaya Studies I, Phra Nakhon Si Ayutthaya Rajabhat University, 2021*, 14(1), 87-100.

Nuwongsri, S. (2019). Research and innovation for sustainable development. *The 29th National Academic Conference of Thaksin University. Research and Development Institute Thaksin University, Hat Yai District, Songkhla Province*, 1016-1017.

Phuwarodom, N. (1995). Gases and Food Product Packaging. A Research Report. Kasetsart University Faculty of Agro-Industry Department of Packaging Technology. (Online). https://kukr.lib.ku.ac.th/kukr_es/index.php?/kukr/search_detail/result/215256, July 22, 2023.

Pianthong, J., Thanthiang, O., Kaewsrithong, J. & Thanawatchai, A. (2022). Product development of baking powder fortified with centella asiatica Juice. *The 2nd National Academic Conference, Research and Development Institute, Kamphaeng PhetRajabhat University*, 808-814.

Praphala, N., Thongnam, K. & Pannongwa, V. (2021). Effects of pregelatinization on physical and chemical properties of purple Japanese sweet potato starch. *Journal of Agriculture and Technology*. (Online). https://li01.tci-thaijo.org/index.php/atj/article/view/251550, June 8, 2023.

Sirikhansaeng, P., Saenkoth, N. & Chumsena, L. (2020). Chemical and sensory studies of okra and roselle wine mixed with mulberry. *Research Journal, Faculty of Science Buriram Rajabhat University*, 2020, 13(1), 111-118.

Uppathak, C. & Suttha, W. (2018). Potential Development of Thai Dessert Products with Durian Shell Flour. A Research Report. Bangkok: Faculty of Home Economics Technology, Rajamangala University of Technology Phra Nakhon.

Ying, C., Wang, H-T. & Hsu, J-T. (2006). Biochemical evaluation of ice-cream samples. Journal of Dairying, Food and Home Sciences. (Online). https://www.indianjournals.com/, May 25, 2023.