Production of Coconut Milk Mixed Whipped Cream for Food Services and Catering

Udomporn Saesue and Yuporn Puechkamu*

Faculty of Agro-Industry, King Mongkut's Institute of Technology, Ladkrabang,

1 Chalongkrung Road, Ladkrabang, Bangkok 10520

*Email: kcyuporn@kmitl.ac.th.

บทคัดย่อ

น้ำมันมะพร้าวประกอบด้วยกรดไขมันอิ่มตัวขนาดปานกลาง ซึ่งไม่ทำปฏิกิริยากับอนุมูลอิสระ และไม่ทำให้เกิดไขมันทรานส์ที่เป็นอันตรายต่อสุขภาพ เพื่อเป็นการส่งเสริมการใช้ประโยชน์ของกะทิ รวมทั้งเพื่อประยุกต์การใช้กะทิในอาหารรูปแบบที่มีการผสมผสานระหว่างวัฒนธรรม 2 แบบ (fusion food) ผู้วิจัยจึงสนใจในการนำกะทิมาพัฒนาให้เป็นผลิตภัณฑ์ใหม่ เพื่อส่งเสริมความเป็นสากลของกะทิไทย โดยการทดลอง พัฒนาผลิตภัณฑ์วิปปิ้งครีมผสมกะทิ ในอัตราส่วนของวิปปิ้งครีม (Non-dairy) และกะทิเท่ากับ 1:1, 1;1.25, 1;1.50 และ 1:1.75 นำส่วนผสมไปต้มจนเดือด เป็นเวลา 15 นาที แล้วนำส่วนผสมมาตีด้วยเครื่องตีไข่แบบมือ เป็นเวลา 5 นาที วิเคราะห์ความสามารถการขึ้นฟูของโฟม (foam capacity) และความคงตัวของโฟม (foam stability) พบว่า ความสามารถการขึ้นฟูและความคงตัวของโฟมมีแนวโน้มลดลง เมื่ออัตรา $p \leq 0.5$ จากนั้น นำวิปปิ้งครีมผสมกะทิในอัตราส่วน 1:1.50 มาพัฒนาคุณภาพ โดยเติมสารไฮโดรคอลลอยด์ 3 ชนิด ได้แก่ คาร์บอกซิลเมทิลเซลลูโลส คาราจีแนน และไฮดรอกซี โพรพิลเมทิลเซลลูโลส เพื่อปรับปรุงคุณภาพของโฟม ผลการทดลองพบว่า การใช้ไฮดรอกซีโพรพิลเมทิลเซลลูโลส ในปริมาณ 0.2 เปอร์เซ็นต์ ทำให้ความสามารถในการขึ้นฟูไม่แตกต่างจากวิปปิ้งครีมที่ไม่เติมกะทิ จากนั้นนำวิปปิ้งครีมผสมกะทิ ที่ได้รับการปรับปรุงแล้ว มาศึกษาอายุการเก็บรักษา โดยเก็บรักษาที่ อุณหภูมิ 4 องศาเซลเซียส นำวิปปิ้งครีมผสมกะทิ มาวัดคุณภาพของโฟม และวิเคราะห์คุณภาพด้านจุลินทรีย์ ผลการทดลองพบว่า วิปปิ้งครีมผสมกะทิ สามารถเก็บได้อย่างน้อย 14 วัน หลังจากนั้นนำวิปปิ้งครีมผสมกะทิ ไปทดสอบกับผู้ประกอบอาหาร เชฟ และผู้เชี่ยวชาญด้านอาหารจำนวน 20 แห่ง พบว่า ผู้ทดสอบในธุรกิจการจัดและบริการอาหารยอมรับวิปปิ้งครีมผสมกะทิ อย่างมีระดับนัยสำคัญทางสถิติ ($p \geq 0.5$)

คำสำคัญ: กะทิ วิปปิ้งครีม ไฮโดรคอลลอยด์

Abstract

Coconut oil is mainly composed of medium-sized saturated fatty acid which does not make free radical and trans fat that are harmful to health. The objective of this research was to study the production of coconut milk mixed whipped cream to enhance the utilization of coconut milk as an alternative for application in fusion food, a combination of national foods. The cream was prepared by the mixture of non-dairy whipped cream and coconut milk at ratios of 1:0, 1:1, 1:1.25, 1:1.50, and 1:1.75, and boiled for 15 seconds. The mixtures were stirred with a hand-mixer for five minutes prior to evaluations of the foam capacities and foam stabilities. It was found that increased coconut milk in the ratios decreased the foam

capacities and foam stabilities significantly (p<0.05). Various amounts of three kinds of hydrocolloids (carboxyl methylcellulose, carrageenan, and hydroxyl methylcellulose) were added to the mixtures of the creams prepared from non-dairy whipped cream and coconut milk at a ratio of 1:1.50 to improve the quality of the foam. The results showed that the use of 0.2% of hydroxyl methylcellulose significantly improved the quality of the creams. Foam capacities and foam stabilities of the creams were not significantly different from the non-dairy whipped cream. The shelf-life periods of the coconut milk mixed whipped creams were studied by storage at 4^{o}C and the qualities of the foams were evaluated and microbiological tests were completed every two days. It was found that the creams were satisfactory for more than 14 days. Also, the coconut milk mixed whipped creams were given to restaurant owners, chefs, and food professionals in 20 places to assess their satisfaction with their use. The results showed a significant acceptance ($p \leq 0.05$) by these persons.

Keywords: Coconut milk; Whipped cream; Hydrocolloids

Introduction

Thailand is an important exporter of coconut milk, an essential ingredient in Thai and Asian food. It has a high nutritional value because of its enrichment with coconut oil. [4] Coconut oil is saturated with medium-sized fatty acid which does not make free radical and trans fat that are harmful to health. In addition, coconut oil has elements of lauric acid (48-53%), the same type of fatty acids present in breast milk that helps build immunity and inhibits pathogens [3]. This research was interested in the development of a new product involving coconut milk to promote its value and its image internationally. The study developed a coconut milk mixed whipped cream product to be used as decoration in the presentation of Thai food and/or in the production of main courses and desserts as topping cream on cake or ice-cream in the style of fusion food. The research studied appropriate ratios of mixtures of non-dairy whipped cream and coconut milk that would be used to prepare the cream, and investigated the types of hydrocolloids available to improve the quality of the cream. Satisfaction tests by persons in food services and catering regarding their acceptance of coconut milk mixed whipped cream were also completed.

Material and Methods

Materials

Aroy-D (Thai Agri Foods., Co., Ltd) coconut milk was purchased from a supermarket. This coconut milk contained about 17.5%. Vivo (Woodland Sunny Foods PTE, Ltd.) non-dairy whipped cream was also purchased.

Coconut milk mixed whipped cream preparation

Coconut milk mixed whipped creams were prepared in the ratios of non-dairy whipped cream to coconut milk of 1:1, 1:1.25, 1:1.50, and 1:1.75. 500 milliliters of each ratio was prepared and poured into stainless steel bowls (size 20 centimeter). The mixtures were heated until boiling and kept boiling for 15 seconds. The mixtures were then poured into sterilized glass bottles, soaked in water at room temperature to

cool down, and kept in a refrigerator at 4°C prior to use in the following experiments.

Determination of foam capacity and stability

To study the foam capacities and foam stabilities of the creams, 200ml of each of sample was poured into a 1 liter plastic beaker and whipped with a hand-blender (Braun, MR 320, Poland) at a speed level of 3 for 5 minutes. The foam capacities and foam stabilities were measured by observing the heights of the whipped creams in the beakers every 10 minutes for 60 minutes.

Effects of hydrocolloids on the quality of coconut milk mixed whipped creams

Three kinds of hydrocolloids, hydroxyl methyl cellulose, carboxyl methylcellulose, and carrageenan [2] were added (0.1%, 0.15%, and 0.2%). Each hydrocolloid was dissolved in the mixtures of coconut milk mixed whipped creams prior as previously and observations were completed as previously.

Determination of shelf-life of coconut milk mixed whipped creams

The samples of the coconut milk mixed whipped creams were placed in sterilized glass bottles, kept in a refrigerator at 4ºC and evaluated by microbiological tests every 2 days for 14 days by determine the total plate count (TPC) [1]

Determination of the satisfaction of persons in food services and catering

The coconut milk mixed whipped creams were given to restaurant owners, chefs, and food professionals in 20 places in Bangkok to evaluate their satisfaction with the creams by completion of a questionnaire.

Statistical analysis

A completely random design (CRD) was used in this study .The results were presented as the mean values of three individual replicates and their standard deviations (S.D.) The significance of the differences between the values was determined at $P \leq 0.05$ using analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT).

Results and Discussion

The various ratios of coconut milk mixed with non-dairy whipped cream were prepared and their foam capacities and foam stabilities are shown in Table 1. High heights of the creams in the beakers at 0 min indicated a good foaming capacities, and high heights of the creams in the beakers at 30 or 60 min indicated a good foaming stabilities. The results showed that increased amounts of coconut milk in the ratios decreased the heights of the creams which decreased the foam capacities and foam stabilities significantly (p<0.05). This may have been due to large amounts of water in the coconut milk. Therefore the ratios of water were increased to make the ratios of fat and protein decrease. It was reported that whipped cream must have more than 30% fat and the whipping process introduced air into the structure and the whey protein acted as the main structure to hold fat globules and air bubbles which increase the foam capacities and stabilities [6].

Table 1 Effects of non-dairy whipped cream and coconut milk ratios on heights of the creams in beakers at various standing times

Non-dairy whipping cream: coconut milk	0min (ml)	30min (ml)	60 min (ml)
1:0	673.33±11.55^{eA}	673.33±11.55^{eA}	650.00±10.00^{eA}
1:1	620.00±34.64^{dA}	620.00±34.64^{dA}	590.00±26.46^{dA}
1:1.25	576.67±5.78^{cB}	576.67±5.77^{cB}	543.33±5.77^{cA}
1:1.50	540.00±0.00^{bC}	533.33±5.77^{bBC}	503.33±5.77^{bA}
1:1.75	506.67±11.55^{aA}	493.33±15.28^{aA}	463.33±15.28^{aA}

* Values are expressed as mean ± standard deviations

* Values followed by different small letters within the same column are significantly different ($p<0.05$)

* Values followed by different capital letters within the same row are significantly different ($p<0.05$)

Coconut milk mixed whipped creams were prepared by using ratios between whipped cream and coconut milk of 1:1, 1:1.25, 1:1.50, and 1:1.75. Then the mixtures of the creams prepared from non-dairy whipped cream and coconut milk in a 1:1.50 ratio were further modified by adding three kinds of hydrocolloids (hydroxyl methylcellulose, carboxyl methylcellulose, and carrageenan) , commonly used as stabilizers and thickeners in food products. The effects of the hydrocolloids on the quality of the coconut milk mixed whipped cream foams were examined as shown in Table 2. The results showed that the addition of the hydrocolloids improved the coconut milk mixed whipped creams' quality significantly. Foaming capacities and foaming stabilities of the creams improved as the amounts of the hydrocolloids increased. Results indicated that the addition of 0.2% hydroxyl methylcellulose greatly improved coconut milk mixed whipping creams' foams because the foam capacities were nearly the same as that from non-dairy whipped cream (Table 1). Moreover, at 30 min, the height of the foam was not significantly different from the freshly prepared one at 0 min. It was reported that the addition of hydroxyl methylcellulose into whipped cream improved the efficiency texture of the whipped cream. Moreover, there was a good whipping quality, shown by measurement of the difference in the top of the cream after whipping for five minutes. An addition of 0.025% hydroxyl methylcellulose increased foam stability and foam capacity [5].

The shelf-life of the coconut milk mixed whipped cream prepared by using 0.2% of hydroxyl methyl cellulose was examined by keeping it in a refrigerator at 4ºC and the quality of the foam and numbers of total plate counts were completed every 2 days for 14 days. It was found that the foam capacity and stability of the cream in these 14 days were not significantly different (Table 4).. Microbiological tests showed no evidence of microbes (colony/gram) in the cream during storage (Table 3), indicating that the experimental coconut milk mixed whipped cream could be kept more than 14 days.

Table 2 Effects of hydrocolloids on heights of the creams prepared from non-dairy whipped cream and coconut milk at a ratio of 1:1.50 at various standing times

Hydrocolloids	0min (ml)	30min (ml)	60 min (ml)
0%	540.00 ± 0.00^{aC}	533.33 ± 5.77^{aBC}	503.33 ± 5.77^{aA}
HPMC 0.1%	550.00 ± 0.00^{bC}	553.00 ± 5.78^{aB}	503.33 ± 5.77^{aA}
HPMC 0.15%	593.33 ± 11.55^{eB}	593.33 ± 11.55^{cB}	550.00 ± 17.32^{fA}
HPMC 0.2%	676.67 ± 5.77^{gB}	676.67 ± 5.77^{eB}	653.33 ± 5.77^{fA}
CMC 0.1%	570.00 ± 17.32^{cdA}	560.00 ± 17.32^{bA}	523.33 ± 23.09^{abA}
CMC 0.15%	583.33 ± 20.82^{efA}	583.33 ± 20.82^{cA}	533.33 ± 20.82^{bcA}
CMC 0.2 %	596.67 ± 5.77^{fB}	596.67 ± 5.77^{cB}	583.33 ± 5.77^{eA}
CARRAGEENAN 0.1%	556.67 ± 5.77^{bcA}	543.33 ± 20.82^{abA}	526.67 ± 15.28^{abA}
CARAGEENAN 0.15%	600.00 ± 0.00^{eC}	590.00 ± 10.00^{cBC}	570.00 ± 10.00^{deA}
CARRAGEENAN 0.2%	643.33 ± 5.77^{fA}	640.00 ± 10.00^{dA}	630.00 ± 10.00^{fA}

* Values are expressed as mean ± standard deviations (n=3)

* Values followed by different small letters within the same column are significantly different ($p<0.05$)

* Values followed by different capital letters within the same row are significantly different ($p<0.05$

Table 3 Results of microbiological examination in coconut milk mixed whipped cream

Storage time (days)	Amount microbe (colony/g,)
0	Not found
2	Not found
4	Not found
6	Not found
8	Not found
10	Not found
12	Not found
14	Not found

Remark: Stored for 14 days

Table 4 Results of foam capacity and stability of the cream in 14 days

Time (days)	0 min (ml)	30min (ml)	60min (ml)
0	673.33±5.77^{aC}	656.67±5.77^{bC}	650.00±0.00^{aA}
2	670.00±10.00^{aB}	670.00±10.00^{abB}	646.67±5.77^{aA}
3	673.33±5.77^{aB}	670.00±10.00^{abB}	646.67±5.77^{aA}
4	676.67±5.77^{aC}	670.00±0.00^{abC}	643.33±5.77^{aA}
5	670.00±10.00^{aB}	656.67±5.77^{aAB}	646.67±5.77^{aA}
6	663.33±5.77^{aB}	663.33±5.77^{abB}	650.00±10.00^{aA}
7	670.00±10.00^{aB}	666.67±5.77^{abB}	650.00±0.00^{aA}
8	663.33±5.77^{aB}	663.33±5.77^{abB}	643.33±5.77^{aA}
9	673.33±5.77^{aB}	673.33±5.77^{bB}	646.67±5.77^{aA}
10	670.00±10.00^{aB}	670.00±10.00^{abB}	643.33±5.77^{aA}
11	673.33±5.77^{aC}	670.00±10.00^{abB}	643.33±5.77^{aA}
12	666.67±5.77^{aD}	673.33±5.77^{bC}	653.33±5.77^{aA}
13	670.00±10.00^{aC}	660.00±0.00^{abCD}	643.33±5.77^{aA}
14	673.33±5.77^{aC}	663.33±/11.54^{abBC}	643.33±11.54^{aA}

* Values are expressed as mean ± standard deviations (n=3)

* Values followed by different small letters within the same column are significantly different ($p<0.05$)

* Values followed by different capital letters within the same row are significantly different ($p<0.05$)

Table 5 Panelists' satisfaction scores after testing product

Attribute	Satisfaction score
Convenience	7.40±0.99
Whip ability	7.05±0.60
Foam stability	6.95±0.76
Flavor	7.25±1.33
Texture	7.05±1.00
Overall liking	7.20±0.77

Remark: Panelists 20 persons

Testing of the satisfaction with and opinions about the coconut milk mixed whipped cream product was completed by home use testing by restaurant owners, chefs, and food professionals in 20 places. A questionnaire was issued covering general information about the panelists, work experience in the food industry, education, aptitude in food, experience in using

whipped cream, acceptance after panelists tested the coconut milk mixed whipped cream product for cooking, possibility for the product in the market, and convenience. The product and questionnaire were given to the panelists. A nine-point hedonic scale was used to evaluate the acceptance (9 = like extremely, 1 = dislike extremely). The results from the questionnaire showed that 45% of the respondents were male and 55% female, 30% were less than 30 years, 55% aged 31-40 years, and 15% aged more than 51 years. Restaurant owners were 40% of the respondents, 30% were chefs, and 30% food professionals. Regarding work experience in the food industry, 30% had less than 10 years, 55% had 10-20 years, and 15% had more than 20 years. Responses about aptitude in food showed results of 45% Thai dessert, 25% international dessert, and 30% Thai and international desserts. All had experience in using whipped cream. The menus in which the panelists used coconut milk mixed whipped cream were mousses (25%), cream decoration on cake (25%), ice-cream topping (30%), and Thai dessert topping (20%). The results of satisfaction after panelist tested the cream for cooking by home use testing are shown in table 5. The liking scores of all the attributes were around 'like moderately.' All the panelists accepted the coconut milk mixed whipped cream product.

Conclusion

In this study, coconut milk mixed whipped cream was prepared by a mixture of non-dairy whipped cream and coconut milk at the ratio of 1:1.5. The results found that foam capacity and foam stability of the cream significantly increased in the presence of 0.2% of hydroxyl methylcellulose. The shelf-life of the coconut milk mixed whipped cream was satisfactory in a refrigerator at 4ºC for more than 14 days. The results of home use testing showed that persons in food service and catering accepted the coconut milk mixed whipped cream.

References

[1] AOAC. 2000. **Official Method of Analysis of AOAC International**. 17th ed. Washington, D.C., U.S.A.

[2] Astray, G., Gonzalez-Barreiro, C., Mejuto, J.C., Rial-Otero, R. and Simal-Gándara, J. 2009. "A review on the use of cyclodextrin in foods". **Food Hydrocolloids**. 23(7): 1631-1640.

[3] Jaruwan, S., C. Naphaporn and T. Ampawan. 2004. "Effects of fat content and temperature on the apparent viscosity of coconut milk". **J. Food Engineering**. 64:193–197.

[4] Marina, A. M., Che Man, Y. B., Nazimah, S. A. H. and Amin, I. 2009. "Chemical properties of virgin coconut oil". **J. of the American Oil Chemists' Society**. 86(4): 301-307.

[5] Qiangzhong ,Z., Mouming Z., Bao Yang and C. Chun. 2009. "Effect of hydroxypropyl methylcellulose on the textural and whipping properties of whipped cream". **Food Hydrocolloids**. 23: 2168-2173.

[6] Tamime, A.Y. 2007. **Structure of Dairy Product.** Singapore: Blackwell. p.75