Development of a High Fiber Mango Jam

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The Asian Conference on Sustainability, Energy & the Environmental 2016
Official Conference Proceedings

Abstract
This research was aimed to produce a high fiber mango jam using gel derived from the corm of the konjac that had been recognized by the consumers for sometimes. The product of mango jam was studied and characterized in several ways, i.e., physical and chemical properties, and the determination of the plausible contamination with microorganism. The basic jam's formula was consisted of pectin. Various concentrations of the konjac gel used were 0.5, 1, and 1.5 %. The konjac gel was prepared using konjac flour mixed with warm water in a ratio of 1:30. It was found that the jam that containing konjac gel at the concentration of 1% was the most acceptable product by the consumers with the score was 3.57. In regarding to the physical quality, the appropriate viscosity level was at 4,650 centipoises, where adulterated thing was not observed with naked eyes. The chemical quality of konjac gel was consisted of 67 Brix of total soluble solid, water activity 0.3, and pH at 0.32, with no food coloring. A total concentration of detected microorganism was less than 10 cfu/ml, while yeast and mold were detected less than 100 cfu/ml. Cooperative Women Group in Mueang district carried out the production of high fiber jam mixed with mango in Bang-Pai sub-district, Chachoengsao province in order to use as an alternative way in processing of mango and value added for local agriculture products.

Keywords: High fiber jam, mango-jam.

Introduction

The total area of land in Chachoengsao province is approximately 3,344,375 acres, while only 2,002,798 acres are used for agricultural purposes, which is equivalent to 59.88 percent of the total area. The 70 percent of citizens are agricultures and the agricultural products in Chachoengsao province consist of rice, tapioca, cane, coconut, mango, and betel nut, where many varieties of high quality of mango fruits are produced mainly in Bang Khla, Sanamchaikheat and Thatakeab district (Provincial Development Plans of Chachoengsao 2014 - 2017). However the biggest drawback of the agricultural production is that people are lack of knowledge concerning the process of the agricultural products, which is equivalent to 14.71 % of the total population (Provincial development plans of Chachoengsao 2014 - 2017). The mango fruits are happened to be a major seasonal and agricultural product of Chachoengsao. The preservation and processing practices are one of various methods that can extend the life of mango fruits. The popular practices in processing of mango fruits such as stirring, dehydrating, and pickling are the most popular ones, where the popular processing in foreign countries is the production of jam. The mango products can be stored for a long period of time because of the high sugar content is up to 55 percent according to the finding of the project of technology and community product. Since the pectin is a major content in the product that acts as a stabilizer in the jam product where its content is a gel, which has high sugar content (Chompoo, 2005).

It has been shown that konjac powder is a dietary fiber with very low calories nutrient derived from the corm of Konjac plant. The konjac powder has a Glucomannan that acts as a dietary fiber with no calories food content, which is not digested by enzymes naturally within the human digestive system resulting in a low energy diet (Wisaksomboon, 2006). In this study, the konjac powder is chosen as a mixing content to produce a high fiber mango jam. The supplementation of dietary fiber from the konjac powder will serve as value added mango jam formulation and can promote local fruit production in Chachoengsao to be accepted by the consumer both at national and the international levels. This study was aimed to develop the proper formulation of dietary fiber mango jam from konjac.

Materials and Methods

The production of dietary fiber mango jam was started by mango cv. Nam Dok Mai where all mango allowed to grow for 130 days and maintained the total soluble solid not less than 29ºBrix was studied. Adding the konjac powder into the paste of mango pulp derived from the basic formulation to make three final formulations of mango jam, i.e., 0.5, 1, and 1.5 %, which these three jam mixture were called as the formulation I, II, and III, respectively. The level of sweetness and pH values were controlled at the selected level during the mixing process of the konjac powder with the flesh of mango. The final product of individual formulation was analyzed for its physical, chemical and microbiological components. These three formulations were used for the sense of taste evaluation in order to determine the acceptance of consumers. The participants that served as the tester were recruited from the semi-trained panelists who had the testing experience to a sensory test. They were student from food and business service branch, Faculty of Science and Technology, Rajabhat Rajanagarindra University, Chachoengsao. These 30 students were travel around the Somdej Phrasrinagarindra Baromrajachonnee Park, where they requested a total of

100 people to do the quality test, and the duration of the research was carried out in January 2012 to May 2014. This research is quantitative rules-based experimental research the implementation of research as follows

The basic formulation of mango jam

The production of mango jam, which was modified from the basic formulation of the basic fruit jam recipes that based on concept and theory of related research, where three formulations were set up and applied to the evaluation of various sensory qualities, i.e., color, smell, the stability of the gel to disperse, sour taste, sweetness, and overall likeliness, by using the method to taste preference score of five sequences. Thirty students who participated in the quality test were recruited from the Branch of Food and business service, Faculty of Science and Technology, Rajabhat Rajanagarindra University, Chachoengsao, Thailand. Results of the determination of the test samples were reported, where several items were used, i.e., color of the jam, smell of test sample, stability of gel, fragmentation, sour taste, sweetness, which the jam sample was presented to the tester with bread. Each item was scored in order to determine the average of qualities. All data were used to develop mango jam with an aid of konjac powder.

Table 1. The characteristics of 3 formulations of mango jam.

Ingredient	The basic mango jam Weight (gram)		
	First formulation	Second formulation	Third formulation
Mango	400	500	250
Sugar	500	737.5	300
Citric acid	13.87	6.25	-
Lemonade	-	-	50
Pectin	9.25	6.25	5
Total	100	100	100

The first formulation was done following the formulation described by Deepu (2008).
The Second formulation was done following the formulation described by Sinlapanapaporn (1988).
The Third formulation was done following the formulation described by Promprasir & Prasitworakarn (1999).

Evaluation of the jam's quality using sense of taste

Data of sense of taste were recorded using Hedonic Scale with five levels (1=dislike to 4 levels of like). Several items for the sense of taste were used, i.e., color of the test sample, mango's smell, stability of gel, sour taste, sweetness and desirability of the tester. The samples were served with bread for testers. An analysis of variance was done by using ANOVA at statistical confidence level 95 percent, while the different of average was carried out by Duncan's Multiple Range Test. The selection of the best basic formulation was based on results of the most preference from the average score. The selected basic formulation was used as the basic ingredient for the development of dietary fiber mango jam supplemented with konjac powder.

The result of studying and discussion

Table 2 The result of studying the basic mango jam

The sense of taste quality	Preference Scores		
	The first formulation	The second formulation	The third formulation
Color	2.97[a]	3.43[a]	3.33[a]
Smell	3.20[a]	3.30[a]	3.93[b]
The stability of gel	2.13[a]	2.37[a]	2.37[a]
spread ability	2.07[a]	2.47[a]	3.13[b]
Sour taste	1.97[a]	2.43[a]	2.30[a]
Sweetness	3.17[a]	3.90[b]	3.40[ab]
desirability	3.17[a]	3.90[b]	3.40[ab]

* In the horizontal, same alphabet is symbol of same group in duncan method

Results in Table 2 show the quality of mango jam using the sense of taste method, where the basic characteristics of three formulations of mango jam products, i.e., from an assessed in sensory, touching of color, smell, the stability of gel, spreading ability, sour taste, sweetness, and the desirability of testers. It was found that the mango jam in the second formulation was accepted from the testers, where the degrees of sense of taste are the same for color, which was equivalent to 3.43, the stability of jam was equivalent to 2.37, the spread ability was equivalent to 2.47, the sour flavor was equivalent to 2.43, the sweetness was equivalent to 3.90, and the desirability was equivalent to 3.90. Results of testing by Duncan method found that all of 3 formulations were not different in color and smell was different between first and second formulation, whereas there were differences with the third formulation, i.e., there were no different in the part of stability and the spreading ability between the second and third formulation, whereas there were different in the first formulation. The sour flavor was not different between the first and third formulation, but there was different in the second formulation. There were different in sweetness and the desirability among all of 3 formulations with a statistically significant difference at the level of p 95. Therefore, the researcher had chosen the second formulation as an appropriate formulation of the supplemented dietary fiber mango jam made from the konjac powder.

The result appropriate quantity of konjac

Table 3 Results of an appropriate quantity of konjac, by filling konjac in 3 levels, i.e., 0.5, 1.0, and 1.5 percent of all mango pulp for the production of mango jam in 3 formulations.

Ingredient	Konjac powder (gram)		
	First formulation (0.5%)	Second formulation (1%)	Third formulation (1.5%)
Mango	500	500	500
Sugar	737.50	737.50	737.50
Citric acid	6.25	6.25	6.25
Pectin	6.25	6.25	6.25
Konjac powder	2.50	5	7.5

Adding konjac powder in 3 levels 0.5 % 1% and 1.5 % in mango jam. Three different dose levels of the control variables 1. the sweetness 2. pH 3. Total soluble solids

Table 4. Results of the preference scores of the quality test of the three formulations of the test samples using the sense of taste.

The sense quality	Preference Scores		
	The first formulation	The second formulation	The third formulation
Color	3.40^{a}	3.23^{a}	3.60^{a}
Smell	3.27^{b}	3.30^{b}	2.13^{a}
The stability of gel	1.90^{a}	3.37^{b}	2.90^{b}
spreading ability	2.60^{a}	3.53^{b}	3.53^{b}
Sour taste	2.07^{a}	3.80^{b}	2.50^{a}
Sweetness	2.13^{a}	2.93^{b}	3.67^{c}
desirability	2.67^{a}	3.17^{b}	3.73^{c}

* In the horizontal, same alphabet is symbol of same group in duncan method

It was found that the second formulation of mango jam was accepted from the testers, where the Duncan test revealed that all of 3 formulations were not different in color and smell between the first formulation and the second formulation, but there were differences in the stability of the third formulation, whereas the spreading ability was not different between the first and second formulation. It was shown that there were differences in the sour taste, where the first and second formulation, but it was not different between the first formulation and the third formulation. The sweetness was different between the first and second formulation, while the sweetness and desirability were different among all 3 formulation at 95 % significant level. Details of second formaulation was chosen to serve as an appropriate basic formulation to produce the supplemented dietary fiber mango jam.

Studying the result of accepting in consumer.

Table 4. The average scores of acceptance for the quality of mango jam using the sense of taste results of the supplemented dietary fiber mango jam.

The quality of sense	$\bar{X}$	S.D.	Level of acceptance
1.color	3.26	0.93	Medium
2.Mango's smell	3.23	1.17	Medium
3.The stability of gel	3.50	0.73	Much
4. spreading ability	3.58	0.94	Much
5.Sour tase	4.02	0.87	Much
6 Sweetness	3.59	0.96	Much
7.The desirability	3.86	0.91	Much
Average	3.57	0.93	Much

Results in the Table 4 show that almost testers and consumers were accepted with the sour product in a high average at 4.02, while the acceptance in the desirability, sweetness, spreading ability, and stability of gel were accepted by the consumers. The average scores of color and smell were at the medium range at 3.26 and 3.23. However the researcher increased the ingredient up, where the consumers still accepted the test sample of supplemented dietary fiber mango jam at a high average score at 3.57.

The study result quality of products

Table 5. Results of the testing of the quality of products

Testing of Quality		The basic mango jam with formulation	Supplemented dietary fiber mango with konjac
Physical	The viscosity	3900 centipoise	4650 centipoise
	Adulterated thing cannot observed with the naked eyes	Not found	Not found
Chemical	Water activity	0.48	0.35
	pH	0.32	0.32
	Total fiber	3.62 g/100g	4.12g/100g
	Total soluble solid	65 °Brix	67 °Brix
Microorganism	Total microorganism	< 10 cfu/g	< 10 cfu/g
	Yeast and mold	<100 est cfu/g	<100 est cfu/g

Results in Table 5 show that the physical quality of the mango jam in the basic mango formulation in viciousness is 3,900 centipoise, where the supplemented dietary fiber mango jam with konjac has viciousness at 4,650 centipoise. All of the 2 mango jam formulations where adulterated things could not observed with the naked eyes. The chemical quality of the mango jam in the basic mango formulation in water activity is 0.48, pH 0.32, Total fiber 3.52g/100g and total soluble solid 65 °Brix where the supplemented dietary fiber mango jam with konjac has 0.35, pH 0.32, Total fiber 4.12g/100g and total soluble solid 67 °Brix .The microorganism quality . All of the 2

mango jam formulations where total microorganism less than 10 cfu/g and yeast and mole less than 100 est cfu/g

Conclusion and discussion

Results of the supplementary of konjac powder to make a dietary fiber mango jam are summarized with mango 5oo g, sugar 737.50 g, citric acid 6.25 g, pectin 6.25 g, and Konjac powder 7.5 g. The ingredient of mango jam in the basic formulation in all of 3 formulations regarding to the assessment of quality in color, smell, stability of gel, spreading ability, sour taste, sweetness, and the desirability using Hedonic Scaling to five levels, as shown in Table 1. It was found that testers did not find any different in color, stability, sour taste, and sweetness because the quality of ingredients in the selected test sample was controlled by the mango cv. Nam Dok Mai where all mango allowed to grow for 130 days and maintained the total soluble solid not less than 29ºBrix. The controlled quality of raw materials was agreed with the research of Sinlapanapaporn (1988). Noparatana et al. (1991) found that testers gave different scores in stability, sour, and desirability, which all of 3 formulations had used lemonade instead of citric acid that resulted in its good smelling in lemonade where the testers could differentiate it in the second formulation of mango jam. The researcher has found that the testers are accepted the sense of taste of several items, i.e., color, stability of gel, sour taste, sweetness and the desirability. The quality of the second formulation of mango jam has less proportion of citric acid than the first formulation. It was shown that konjac powder makes the mango jam become stickier and jelly, which agreed with results of other studies (Promtongdee et al., 2007; Deepu, 2008; Nitimongkonchai, 2001). It was shown that konjac contained inflatable water, so the jam would become sticky when too much amount of konjac was added (Wisaksomboon, 2006). The concentration of konjac in this study is maintained at one percent of a total weight of mango pulp, and the tester accepted the sense of taste of the test sample with a statistically significant at the 95 % confidence level. Konjac will become jelly when the substance is heated during the food processing. If the mango jams were added with sugar, the product would appear in a dark color (Caramelization) jam with bad smell too. This will lead to a less acceptance from the consumers. It was found that filling the mango jam with konjac could make fiber to increase from 3.62g/100 g to be 4.11g/100 g, which was equivalent to 11.38 %, where the ability to dissolve in water was still remaining. This characteristic of dietary jam will help the digesting of food getting better with low calories (Wisaksomboon, 2006).

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