International Journal of GEOMATE, Sept., 2019 Vol.17, Issue 61, pp. 8 - 13
ISSN: 2186-2982 (P), 2186-2990 (O), Japan, DOI: https://doi.org/10.21660/2019.61.4503
Special Issue on Science, Engineering & Environment

OPTIMUM RATIOS OF OKRA AND TANGERINE ON PRODUCTION OF MIXED JUICE WITH LYCOPENE SUPPLEMENTATION

*Wattana Wirivutthikorn[1]

[1]Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi (RMUTT)
2 Phaholyothin 87 Soi 2 Phaholyothin Road Thanyaburi Pathumthani 12130 Thailand

*Corresponding Author, Received: 14 Dec. 2018, Revised: 24 Jan. 2019, Accepted: 06 Feb. 2019

ABSTRACT: The major advantages of Thai herbal plants are that there are good bioactive ingredients and antioxidants that are beneficial to the body are possible when used as a drink. There are research reports related to the production of various Thai herbal drinks and fruits such as okra and tangerine were used as raw materials. The optimum ratios were studied of okra and tangerine with lycopene supplementation on Thai herbal beverage production. There were four experiments: 1) blended okra juice and tangerine juice 50:50 (control); 2) blended okra juice and tangerine juice added with lycopene 60:40; 3) blended okra juice and tangerine juice added with lycopene 70:30; and 4) blended okra juice and tangerine juice added with lycopene 80:20. Physical properties (L*, color as a* and b* and percent of transmittance) were significantly different except for L* and a* value in all experiments. Chemical properties (pH, total acid and total soluble solids) were significantly different ($P \leq 0.05$) in all experiments. The Sensory evaluation used a 9-point hedonic scale. The results indicated that Experiment 1 had the highest scores of overall liking. From the information obtained, the formulation of beverages produced from Thai herbal and fruit can be developed to be accepted by consumers, which has increased steadily and expanded in the large future level in the beverage industry.

Keywords: Okra, Tangerine, Juice, Lycopene, Supplementation

1. INTRODUCTION

Nowadays, health drink products play a greater role in everyday life, with most of the drinks being derived from the ingredients of plants or herbs. Some consumers may not consume vegetables, but they can enjoy the benefits of the various types of Thai herbs that can be processed in the form of health drinks. [1]. Okra is a popular health food due to its high fiber, vitamin C and folate content. It is also known for being high in antioxidants have a good source of calcium and potassium and the mucilage contains soluble fiber. Some people prefer to minimize the sliminess; keeping the pods intact, and brief cooking. Some of the advantages of okra are aids in improving digestion, help to relax blood vessels and arteries and protect the heart against clotting [2]. Tangerine is an orange-colored citrus fruit that is closely related to, or possibly a type of mandarin orange. It is a good source of vitamin C, folate and β-carotene. It also contains some potassium, magnesium, vitamins B1, B2, and B3 [3]. There are some researches about blended okra, gac fruit and passion fruit juice to produce a Thai herbal drink. The results showed that the different ratios of okra, gac fruit and passion fruit had influenced consumer acceptance physical and chemical properties [4]. But there was no information about the formulation of okra mixed with tangerine. For this reason, of okra and tangerine benefits, the researchers are interested in producing water-based okra and tangerine with the healthy drink by studying appropriate amounts of okra and tangerine ratios with lycopene supplementation which help with the quenching of thirst and help relax or make the body. The data obtained from this research was an alternative to make okra and tangerine as raw materials for beverage production to improve the nutritional quality and good health of consumers. The purpose of this research was to study the suitable quantities of okra and tangerine ratios with exact known lycopene concentrations supplementation for the development of Thai herbal beverage products.

2. METHODOLOGY

The research was carried out at the Division of Food Science and Technology, Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi. (RMUTT) Pathum

Thani Province Thailand. The samples used in this study were purchased from Rangsit Market which located in Pathum Thani Province Thailand.

2.1 Okra Preparation

The okra was washed and cut into small pieces and boiled in hot water for 15 minutes. Okra samples were dried by using hot air oven at 75°C for 3 hours [5]. The production process was described as shown in (Fig.1).

2.2 Tangerine Preparation

The tangerine was washed with clean water and slice into thin small pieces as 2.1 and peeled theirs to juice with a fruit juice extractor. The blended aliquots were placed in a clean container [6]. This was performed as four experiments (two replications): 1) blended okra and tangerine juice 50:50 (the control); 2) blended okra and tangerine juice 60:40; 3) blended okra and tangerine juice 70:30 and 4) blended okra and tangerine juice 80:20. The ingredients were detailed in Table 1 [5], [6]. The production process was detailed as shown in (Fig.2) and (Fig.3).

2.3 Production of Okra and Tangerine Juice with Lycopene Supplementation

The blended of dried okra and tangerine juice were placed in a stainless steel pot (3 liters of clean water) and heated to 50°C for 15 minutes, then, filtered through a cloth. Addition of some detailed ingredients followed as Table 1 [5],[6]. The picture was shown in (Fig. 4).

2.4 Physical Measurement

Color Brightness (L*), color as red (a*) and yellow (b*) and the clarification value measured as a percentage of transmittance (%T) were recorded as values adapted from [7],[8].

2.5 Chemical Measurement

The pH, percentage of total acidity and the total soluble solids (TSS) were measured as values adapted from [9].

2.6 Sensory Evaluation

The sensory evaluation was carried out by 30 untrained panelists in Rajamangala University of Technology Thanyaburi (RMUTT), Thailand. Panelists were asked to analyze their level of preference for each treatment using a 9-point hedonic scale test based on the attributes of color, odor, taste, sediment and overall liking. A randomized complete block design was used with analysis of variance. Analysis of the mean differences of experiments was performed using Duncan's new multiple range test [10].

3. RESULTS AND DISCUSSION

3.1 Physical Measurement

The results showed that all of L, a* and b* and physical appearance depending on different ratios of okra and tangerine [11]. The results showed that b* and %T value were different ($P \leq 0.05$). For L* and a* and b* values decreased compared to the control samples because of the increased okra juice had a dark brown color. The decrease in tangerine juice resulted in an orange and yellow color. Increasing the amount of okra juice had a greater effect on green color. For the percent of transmittance, clarification value compared to the control samples. Experiment 4 produced the highest value, while Experiment 1 had the lowest value. Possible reasons were that the reduction of tangerine juice contained pulp could have resulted in more turbidity [12] as shown in Table 2.

3.2 Chemical Measurement

The results indicated that the pH depended on the different ratios of okra and tangerine. There was a tendency toward increased pH when compared to the control samples due to the reduction in the amount of tangerine juice. In tangerine juice contains citric acid, it has an increased amount of pH [13]. There was a tendency for the total soluble solid values to decrease compared to the control sample due to the reduction of tangerine juice. Organic acids (citric acid) naturally occurring in many foods including citrus, such as orange and lime. The results indicated a tendency for the percent of total acidity to decrease low values in comparison with the control samples [14] as shown in Table 3.

3.3 Sensory Evaluation

The results of the sensory analysis showed that there were differences in all experiments ($P \leq 0.05$). Based on the color, odor, taste and overall liking values. Experiment 1 had the greatest acceptance from panelists due to the highest amount of

tangerine juice being added. One possible reason might be due to the suitable proportion of okra and tangerine was equal. Sediment values showed that Experiment 2 was the most acceptable. This may have been due to the decreased tangerine juice level resulted in increased acceptance [15] as shown in Table 4.

3.4 Physical Appearance

From the (Fig 5.), the images could be seen that the red color in all experiments was not significantly different. As a result of the ratios of okra juice and tangerine juice. When considering the appearance, it was found that all the experiments were suspended, which is the pulp of tangerine, is derived from tangerine. The color revealed that all the samples were reddish orange as the color result of the lycopene [16]. Sometimes the experiment color is yellow, orange, red and orange-red. Okra and tangerine consist of three pigments (chlorophyll, carotenoid and lycopene) were quite distinct and different chemical compositions and structures as a carotenoid, lycopene in tangerine, chlorophyll in okra and lycopene supplementation. The odor will vary with the amount of increased okra juice and the decreased amount of tangerine juice which compared to the control samples. The taste indicated that all experiments were little sweet and sour. Due to the taste adjustment with the same amount of sugar and citric acid [17],[18].

Table 1 Optimum ratios of okra juice and tangerine juice with lycopene supplementation [17].

Ingredients (g)	Experiment			
	1	2	3	4
okra juice	300	360	420	480
tangerine juice	300	240	180	120
lycopene	0.1	0.1	0.1	0.1
sugar	40	40	40	40
salt	1	1	1	1
citric acid	0.3	0.3	0.3	0.3

Table 2 Physical measurement of blended okra juice and tangerine juice

Experiment	Physical values			
	L^{*ns}	a^{*ns}	b^{*}	$\%T^{*}$
1	27.88	9.89	1.79^{a}	15.53^{d}
2	24.74	9.56	0.85^{a}	22.63^{c}
3	23.12	9.26	0.84^{a}	26.47^{b}
4	22.33	7.44	-3.35^{b}	30.67^{a}

Note: a-d The different letters in the same column mean significant difference ($P \leq 0.05$) and ns non significant difference ($P>0.05$)

Table 3 Chemical measurement of blended okra juice and tangerine juice

Experiment	Chemical values		
	pH^{*}	Total acidity (percent)*	Total soluble solid (°Brix)*
1	3.81^{c}	3.41^{a}	13.00^{a}
2	3.97^{b}	2.56^{b}	11.90^{b}
3	3.99^{b}	1.92^{c}	11.00^{c}
4	4.16^{a}	1.28^{d}	10.70^{d}

Note: a-d The different letters in the same column mean significant difference ($P \leq 0.05$)

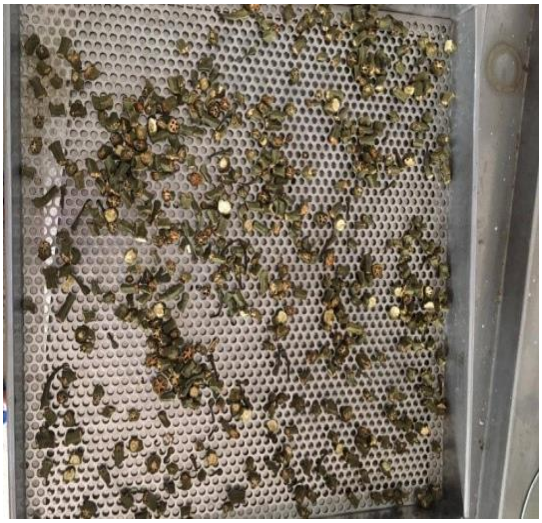
Table 4 Mean score of preference for sensory properties of okra juice and tangerine juice

Experiment	Scores*				
	color*	odor*	taste*	sediment*	overall liking*
1	7.37^{a}	7.40^{a}	7.50^{a}	7.17^{ab}	7.40^{a}
2	6.70^{b}	7.27^{a}	7.50^{a}	7.47^{a}	7.30^{a}
3	6.90^{b}	6.53^{b}	6.43^{b}	6.87^{bc}	6.60^{b}
4	6.73^{b}	6.47^{b}	6.20^{b}	6.63^{c}	6.33^{b}

Note: a-d The different letters in the same column mean significant difference ($P \leq 0.05$)

1a) small pieces of fresh okra

1b) put okra on a stainless tray



1c) dried okra

Fig. 1 (a-c) The step of okra preparation and drying

2a) boil dried okra with water

2b) drained water through a colander

2c) filtered dried okra aliquot

Fig. 2 (a-c) The step of okra heating and cooling processing

3a) halves tangerine

3b) pressed tangerine

3c) filtered tangerine juice

Fig. 3 (a-c) The step of tangerine preparation

Fig. 4 Blended with okra juice and tangerine juice before bottling

E1 E2 E3 E4

Fig. 5 Product of different ratios of okra juice blended with tangerine juice

E1: okra: tangerine juice 50:50 (control experiment)

E2: okra: tangerine juice 60:40

E3: okra: tangerine juice 70:30

E4: okra: tangerine juice 80:20

4. CONCLUSION

1. The uses of different ratios of raw material preparation had effects on the color of mixed okra, tangerine and lycopene supplementation.

2. The results of the physical properties analysis showed that only b^* and percent of transmittance values were statistically significant differences. ($P \leq 0.05$)

3. The results of the chemical analysis showed that all values were significantly different. ($P \leq 0.05$)

4. Experiment 1 involved that gave the most acceptable from the panelists.

5. Based on this research, researchers will be able to launch new beverage products in the future by selecting Thai local herbs that are beneficial for antioxidants, an option for health-conscious consumers.

5. ACKNOWLEDGMENTS

The researchers would like to thank the 4 the grade students and officials of the Division of Food Science and Technology, the Faculty of Agricultural Technology Rajamangala University of Technology Thanyaburi (RMUTT), Pathum Thani Thailand that contributed some parts in the research. The Faculty of Agricultural Technology provided support facilities and budgets for the research and travel expense for this conference.

6. REFERENCES

[1] Nguyen, T.H. and Gizaw, A., Factors that influence consumer purchasing decisions of

Private Label Food Products, School of Business, Society and Engineering Bachelor thesis in Business Administration, 2014, 92 p.

[2] Singh, P., Chauhana, V., Tiwaria, B.K., Chauhan, S.S., Simon, S., Bilal, S. B. and Abidi, A.B., An overview on okra (*Abelmoschus esculentus*) and it's importance as a nutritive vegetable in the world, International Journal of Pharmacy and Biological Sciences, Vol. 4, 2014, pp. 227-233.

[3] Obasi, B.C., Whong C.M.Z. and Ameh, J.B., Nutritional and sensory qualities of commercially and laboratory prepared orange juice, African Journal of Food Science, Vol. 11, 2017, pp. 189-199.

[4] Wirivutthikorn, W., Effect of ratio of okra gac fruit and passion fruit on color and preferences of mixed juice, International Journal of Food Engineering, Vol 4, 2018, pp. 212-215.

[5] Mak, S. and Engwongtrakoon, A., The optimum temperature on dried okra for a phenolic compound of green tea mixed with okra by tray drying, B.Sc. Senior Project, Division of Food Science and Technology Faculty of the Agricultural Technology Rajamangala University of Technology Thanyaburi. Thailand, 2013, 97 p.

[6] Rapeesak, S., Effect of Pasteurization storage and food additive on capable of antioxidant in tangerine Juice, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang, 2004.

[7] Pomeranz, Y. and Meloan, C.E., Food Analysis: Theory and practice, 3 rd edition. Van Nostrand Reinhold, 1994.

[8] Lozano, J.E., Fruit manufacturing: Scientific: basis, engineering properties, and deteriorative reactions of technological importance, Springer Science & Business Media, LLC, USA, 2006.

[9] AOAC, Official Method of analysis. Verginia: The Association of Official Analytical Chemists, 2000.

[10] Anprung, P., Principle of food analysis by sensory evaluation, Bangkok.: Chulalongkorn University Press., 2004.

[11] Wirivutthikorn, W. and Jenkunawatt, S., Preference colors of gac fruit blended with pineapple juice, Tien-Rein LEE (Editor-in-Chief), The 2nd Conference of Asia Color Association URBAN COLOR FOR LIFE 4-7 September 2014, Taipei, Taiwan, 2014, pp. 304-307.

[12] Wirivutthikorn, W. and Jenkunawatt, S., Study of color preferences of gac fruit blended with mixed mushroom juice, Hirohisa Yaguchi et al. (Editor) AIC 2015 Tokyo Color and Image. Midterm Meeting of the International Colour Association (AIC) 19-22 May 2015, Tokyo, Japan, 2015, pp. 820-823.

[13] Rebecca, L. J., Sharmila, S., Das, M.P. and Seshiah, C., Extraction and purification of carotenoids from vegetables, Journal of Chemical and Pharmaceutical Research, Vol. 6, 2014, pp. 594-598.

[14] Wirivutthikorn, W. and Jenkunawatt, S., Color differences of okra blended with green tea powder on consumer acceptabilities, ACA 2016 The 3 rd International Conference of Asia Color Association, 21-22 May 2016, Changshu, China, 2016, pp. 89-92.

[15] Wirivutthikorn, W. and Jenkunawatt, S., Factors affecting on drying of okra and gac fruit in okra blended with gac fruit powdered beverage production, Research Report. Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi, 2017, pp. 1-44.

[16] Vuong, L.T., Franke, A.A., Custer, L.J. and Murphy, S.P., *Momordica cochinchinensis* Spreng. (gac) fruit carotenoids reevaluated, Journal of Food Composition and Analysis, Vol. 19, 2006, pp. 664-668.

[17] Wirivutthikorn, W., Effect of lemongrass and pandan leaf ratios on the production of mixed juice with lycopene supplementation, International Conference of Agriculture and Natural Resources 26-28 April 2018, Proceedings ANRES 2018, Bangkok, 2018, pp. 378-381.

[18] Wirivutthikorn, W., Effect of Passion Fruit Juice and Sugarcane Juice Ratios on Blended Passion Fruit juice and Sugarcane Juice Production, Agricultural Sci. J. 49, No.3 (Suppl), 2018: pp. 229-235.