

Antioxidant Activity in Red Dragon Fruit Jelly

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Abstract Red dragon fruits are very high in fiber, low in calorie, and rich in vitamin C, minerals, and chlorophyll. Red pulp and skin produce the betalain that contains high level of antioxidant activity. This experimental study aimed to investigate antioxidants of the red dragon pulp jelly and the red dragon juice jelly mixing at the temperature 60°C, 70°C and 80°C, using the DPPH assay. Antioxidant levels between the red dragon pulp jelly and the red dragon juice jelly were compared at the same temperature. Consequently, the sensory testing of the product was conducted. The results revealed that, at the temperature 60°C, 70°C and 80°C, the antioxidants in red dragon pulp jelly were 79.19%, 78.40%, and 72.77%, respectively, and the antioxidants in red dragon juice jelly were 57.59%, 57.12%, and 54.30%, respectively. Comparing at the same temperature, the red dragon pulp jelly contained higher antioxidants than the red dragon juice jelly statistically significant ($p < 0.05$). The highest antioxidant of each formula was the jelly mixed at the temperature 60°C. The results of sensory evaluation including color, smell, flavor and overall acceptability were at moderate level. Thus, the optimum temperature used to make the red dragon jelly is 60°C because red dragon jelly will be contained highly antioxidant activity.

Keywords Red dragon fruit, Antioxidant, Fruit jelly

1. Introduction

Colors play an important role in enhancing the aesthetic appeal of food products. Many food products are suffered color loss, due to some food processing procedures such as heat treatment, pH changes, light exposure and storage condition. Therefore, synthetic food colorants are incorporated to recover color loss and to enhance the appearance of food products. Unfortunately, some synthetic colorants has been report to be health hazardous [1]. As a result, natural pigment from biological sources came into consideration especially plant pigments which include betalain, anthocyanins, and other flavonoids, carotenoids and chlorophylls [2]. Betalains are commercially used as food colorant in the food industry. Unlike synthetic coloring agents, betalains are also easily degraded, heat-labile and low in stability due to their natural structure. Besides, betalains possess antioxidation properties which are prone to oxidation. Thus, prevention of oxidation which occurs during extraction and storage is crucial. Stability improvement by employing suitable additives may expand the applicability of natural food colorants [3, 4].

Purple pitaya is well known as red dragon fruit due to its deep bluish red appearance. Red dragon fruits or Pitaya (*Hylocereus spp.*) are very high in fiber, low in calorie, and rich in vitamin C, minerals, and chlorophyll. Red dragon

fruit weighs up to 1 kg and is a rich source of nutrients and minerals such as vitamin B1, vitamin B2, vitamin B3 and vitamin C [5]. The reddish pigment in the dragon fruit seed oil is also rich in polyunsaturated fats which benefit health on excretion and body weight control. Red pulp and skin produce the betalain that contains high level of antioxidant activity. Antioxidant is a molecule that capable of slowing or preventing the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Consequently, oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions by being oxidized themselves [6]. Currently red dragon fruit become popular since people know about the nutritious value inside fruit. With high level of antioxidant content and lower price in market, this fruit is potential as a good alternative for natural antioxidant [7]. Jelly is commonly served as Thai desserts and is often flavored with fruit juices or extracts. Jelly is strictly defined as semisolid food made from not less than 45 parts by weight of fruit juice ingredient to each 55 parts by weight of sugar. This mixture is concentrated to not less than 65 percent soluble solids [8]. The additions of fruits to jelly do not only enhance the taste of the jelly itself, but also the healthy values of jelly [9]. Red dragon fruit represent a significant source of oxidants which could be beneficial if mix red dragon fruit in jelly. Therefore, this study aimed to investigate antioxidants of the red dragon pulp jelly and the red dragon juice jelly mixing at the temperature 60°C, 70°C and 80°C, using the DPPH assay.

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2. Materials and Methods

The anti-radical power measured using 2, 2-diphenyl-1-picryl hydrazyl (DPPH). DPPH radical scavenging activity assay is a widely used method to evaluate antioxidant activities in a relatively short time compared with other methods. This assay measures the ability of a sample to donate hydrogen to DPPH radical. The increased amount of antioxidant in a given volume of fruit extract is responsible for the increased reduction of the DPPH solution [5].

The experiment was conducted in the laboratory of the Faculty of Public Health, Mahasarakham University. The Dragon fruit (*Hylocereus undatus*) was collected from the local market. The fully ripe healthy and fresh dragon fruit was washed thoroughly with potable water and the skin was removed by a knife. Then dragon fruit was blended by a blending machine [10].

Processing of dragon fruit jelly

The jelly was prepared from red dragon pulp and red dragon juice with standard formulation. Two jelly formulas were mixed with equal amount 200 g sugar, 30 g agar, and 1000 ml water. Boiled water in a stainless pot, and then added agar and sugar. The mixture was stirred until sugar and agar completely dissolved. The heat was reduced at the temperature 60°C, then stirred 480 g red dragon pulp puree into the jelly mixture. Poured the mixture into a jelly mold and allowed to cool down, and then chill in a fridge for 20 minutes. Red dragon pulp jelly had been conducted the same process for the temperature 70°C and 80°C. Processing of red dragon juice jelly had been conducted similarly at the three point temperature.

Sensory testing of red dragon fruit jelly

Red dragon fruit jellies were analyzed for sensory characteristics. Sensory quality characteristics were evaluated by 42 participants using a 9-point Hedonic scale. The red dragon fruit jellies were evaluated for the color, taste, smell, and overall favor acceptability.

3. Results and Discussion

Antioxidant analyses of red dragon fruit pulp and red dragon fruit juice

The experiment revealed that antioxidant content in red dragon fruit pulp was found to be higher than in red dragon fruit juice. The jelly without red dragon fruit was used to be a control sample in this experiment which was contained the lowest level of antioxidants. The result of this study was similar to the additional of white and red dragon fruit into yogurt enhanced the milk fermentation rate and antioxidant activity [9]. (Table 1)

Antioxidant analyses of red dragon pulp and red dragon juice jellies at different temperature

Antioxidant content in both red dragon pulp and red dragon juice jellies were found to be further reduced at increased temperature. Red dragon pulp jelly and red dragon juice jelly mixing at 60°C contained antioxidant activities higher than mixing at 70°C and 80°C. The result for each of the sample, the mean result and SD values at the temperature 60°C, 70°C and 80°C are shown in Table 2. Mean percentages of antioxidants between red dragon pulp and red dragon juice jellies at the same temperature were compared. It appears that antioxidant of red dragon pulp jellies were significantly higher than antioxidant of red dragon juice jellies at all temperature.

Table 1. Antioxidants of red dragon fruit pulp and red dragon fruit juice

Type of jelly	Percentages of antioxidants				
	Sample 1	Sample 2	Sample 3	Mean	S.D
Jelly without red dragon	48.8	50.7	49.3	49.6	0.9
Red dragon fruit pulp	92.0	94.4	92.5	92.9	1.2
Red dragon fruit juice	68.5	65.7	65.7	66.7	1.6

Table 2. Antioxidant of red dragon pulp and juice jellies at different temperature

Type of jellies	Percentages of antioxidants		
	60°C	70°C	80°C
Red dragon pulp jelly			
Sample 1	84.9	74.7	69.0
Sample 2	78.8	80.3	74.2
Sample 3	73.7	80.3	75.1
Mean (S.D)	79.2 (5.6)	78.4 (3.3)	72.8 (3.3)
Red dragon juice jelly			
Sample 1	49.3	55.9	51.6
Sample 2	60.6	57.3	55.9
Sample 3	62.9	58.2	55.4
Mean (S.D)	57.6 (7.3)	57.12 (1.2)	54.30 (2.3)

Table 3. The comparison of mean percentages of antioxidants between red dragon pulp and juice jellies

Temperature	Mean percentages of antioxidants		t-test	p-value	Mean difference	95% CI of difference
	Red dragon pulp jelly	Red dragon juice jelly				
60°C	79.2	57.6	4.1	0.025	21.6	6.8-36.4
70°C	72.8	57.1	10.7	< 0.001	21.3	15.7-26.8
80°C	72.8	54.3	7.9	0.001	18.5	12.0-24.9

Table 4.

	Red dragon pulp jelly		Red dragon juice jelly		p-value
	Mean	S.D	Mean	S.D	
Color	6.9	1.7	6.9	1.6	0.89
Smell	6.7	1.3	6.7	1.7	0.94
Flavor	6.9	1.6	6.7	1.3	0.61
Overall acceptability	7.1	1.7	6.7	1.4	0.29

In similar fashion, vitamin-C content in red dragon fruit was further reduced in jellies prepared from dragon fruit juice because most of the vitamin-C present in the pulp was destroyed during long heating at high temperature [10]. During processing of dragon fruit jelly, heating temperature was shown the important factor on betalain stability and the half-life of betacyanin extracts were decreased at higher temperature [11-12]. (Table 3)

Sensory evaluation of the red dragon fruit jelly

The samples of red dragon fruit jelly were subjected to sensory evaluation using the 9 point Hedonic scales. Thirty judges evaluated the color, smell, flavor and overall acceptability of different formula are presented in table 4. There was no significant difference in scales between red dragon pulp and red dragon juice jellies for all sensory aspects.

4. Conclusions

Antioxidant content in both red dragon pulp and red dragon juice jellies were lower than red dragon fresh pulp and red dragon fresh juice. However, it is clear that the addition of red dragon pulp and red dragon juice into jelly enhanced the antioxidant activity in jelly compared to the antioxidant activity in plain jelly. The appropriate temperature for adding red dragon pulp puree or juice into the jelly mixture was recommended at the temperature 60°C, because the jellies contained antioxidant activities higher than mixing at 70°C and 80°C. The current study indicates that consuming red dragon fruit jelly as part of healthy desserts would increase nutritious rather than eat plain jelly.

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