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Comparison on Consumer Acceptabilty and Physico-Chemical Content of Spread from White and Red Flesh Dragon Fruit

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ABSTRACT: Fruit spread is a well–liked food product because it contains less sugar and more fruit ingredient. The potential of a nutritious underutilized red (Hylocereus polyrhizus) and white (Hylocereus undatus) dragon fruit flesh and peel is used to formulate a fruit spread which caters to the growing number of health conscious consumers and to minimize the waste produced in dragon fruit processing. This study aims to determine the consumer acceptability and physico–chemical content of the red and white dragon fruit spreads. Sensory acceptability was performed with 50 untrained consumers, wherein both dragon fruit spreads were determined to gain very high scores. There is, however, a significant difference between spreads from white and red flesh dragon fruit. Spread from red flesh dragon fruit has a sensory acceptability comparable to the commercial fruit spread in all sensory attributes. The content of the red and white flesh dragon fruit spread are: water activity (0.82 & 0.85), pH (4.90 & 5.12), soluble solids (^{o}Brix) (38.65 & 37.67), moisture (46.63 & 40.45), ash (0.68 & 1.16), and fat (0.44 & 0.97). Consumer response on the spread from white and red dragon fruit was deemed to be highly acceptable. The physico-chemical composition of the spread is not comparable with the commercially available spread in terms of pH, fat content, and ash content.

KEYWORDS: *Hylocereus polyrhizus*, *Hylocereus undatus*, fruit spread, consumer acceptability, physico-chemical content.

1 INTRODUCTION

Fruit spreads are manufactured similar to jams and jellies, which are made with various fruits preserved by adding sugar and thickened to a certain extent by application of heat. According to Food and Agriculture Organization (FAO) and World Health Organization (WHO), fruit spreads differ in terms of degree of gel formation and ingredient composition, which makes it an excellent alternative for the jams due to its reduced sugar of 25–50°Brix composition and its generally high percentage of fruits containing vitamins and minerals. [5]

Nowadays, more people are inclined to living a healthy lifestyle, which involves healthier food options. As a response to the current trend, the formulation of a fruit spread from red dragon fruit (*Hylocereus polyrhizus*) and white dragon fruit (*Hylocereus undatus*) aims to maximize its utilization by using both of the dragon fruit's flesh and peel to increase the nutritional value of the fruit spread.

The dragon fruit is a perennial, fast-growing, climbing vine cactus specie (Gunasena, Pushpakumara & Kariyawasa, 2006) [6] that belongs to the family of Cactacea and originated in the regions of Mexico and Central & South America (Barthlott & Hunt, 1993) [2]. It has obtained attention during the recent years, mostly in Asian countries. This is due to its color and its nutritional content (Hoa, Clark, Waddell & Woolf, 2006) [7], and its variety of uses.

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Red dragon fruit (*H. polyrhizus*) and white dragon fruit (*H. undatus)* are two varieties commonly known in the market. According to Gunasena, et al. (2006) [6], its flesh is eaten raw or processed into a range of industrial products such as juice, sherbets, ice cream, yogurt, candy and pastries. The peel, which is considered as a by–product in fruit processing, is also useful. Recent studies of Moshfeghi, Mahdavi, Shahhosseini, Malekifar & Taghizadeh (2013) [10] used the peel as a color powder and natural food additive in milk, yoghurt, pastry, juice and rice. In addition, studies show that dragon fruit peel is also used as a raw material in making tea-infused drinks and jams, as well as in producing fruit peel flour (Sari & Hardiyanti, 2013 [13]; Dam, 2013 [3]; Mustafa, et al., 2013 [11]), which have a number of benefits.

Dragon fruits represent a significant source of vitamins B1, B2, B3, and C minerals, namely potassium, sodium, calcium, iron and phosphorus. It also contains nutrients, such as fat, protein, carbohydrate, flavonoid, crude fiber, thiamin, phytoalbumin, niacin, pyridoxine, kobalamin, glucose, betacyanins, phenolic, carotene and polyphenol (Le Bellec, Vaillant, & Imbert, 2006) [8]. In 2007, Davis stated that the dragon fruit has relatively high antioxidant activity in comparison with other subtropical fruits. [4] Moreover, it aids in preventing colon cancer and diabetes, neutralizing toxic substances like heavy metals, reducing cholesterol and high blood pressure, as well as assisting in the development of strong bones, teeth and skin (Gunasena, et al., 2006) [6]. Furthermore, Nurmahani, Osman, Abdul Hamid, Mohamad, & Pak Dek (2012) noted its peel to have antibacterial property [9]. A study by Jamilah, Shu, Kharidah, Dzulkifly, & Noranizan (2011) also detrmined it to be a good source of fiber and pectin, and it is useful as a natural colorant. [12]

The general objective of the study is to determine the consumer acceptability and the physico–chemical content of red (*H. polyrhizus*) and white (*H.undatus*) dragon fruit spreads.

2 MATERIALS AND METHODS

First, the red dragon fruit (*H. polyrhizus*) and the white dragon fruit (*H. undatus*) were sorted and washed thoroughly to eliminate dirt and dust. Withered and hard wooden portions of the peel were trimmed and removed. The dragon fruits were then sliced in half and the flesh was spooned out from the peel. Once the peel and flesh were separated, each underwent individualized prior treatment. After which, the fruit peels were cut in 1x5 cm strips, blanched for two minutes, and then pureed using an osterizer, while the fruit flesh was mashed. Four parts of peel puree and six parts of mashed flesh were then combined. The mixture was transferred in a sauce pan, and then sugar was added, wherein two parts of sugar for every eight parts of dragon fruit flesh and peel mixture were used. The mixture was cooked at 70°C and was stirred continuously until desired smooth texture was obtained. Cinnamon powder and vanilla extract were added next. Finally, with all the ingredients mixed completely, the fruit spreads were packed immediately in a sterilized jar.

2.1 PHYSICO–CHEMICAL ANALYSIS OF DRAGON FRUIT SPREAD

The physico–chemical analysis was performed in triplicate with results expressed as mean ± standard deviation. The fat, ash and moisture analysis was performed based on the standard methods of the Association of Official Analytical Chemists (AOAC, 2012), wherein water activity was determined using a Novasina water activity meter, pH using a Jenway 350 portable laboratory pH meter, and total soluble solids ($^{\circ}$Brix) using Atago refractometer.

2.2 SENSORY EVALUATION OF DRAGON FRUIT SPREAD

Fifty untrained consumers participated in an acceptability test. The 7–point Hedonic scale was used to evaluate the spread with the following parameters: appearance, color, aroma, spreadability and flavor. The scale ranged from excellent (7) to extremely poor (1). The 9–point Hedonic scale was used to evaluate the general acceptability. The scale ranged from like extremely (9) to dislike extremely (1).

3 RESULTS AND DISCUSSION

3.1 CONSUMER SENSORY ACCEPTABILITY OF RED AND WHITE FLESH DRAGON FRUIT SPREAD

Consumer sensory acceptability test of red and white flesh dragon fruit spreads and commercial spread, as shown in Figure 1, was presented to the untrained panelists.

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Figure 1: From left to right – Red flesh dragon fruit spread, white flesh dragon fruit spread, and commercial strawberry spread

Results of sensory acceptability of red and white flesh dragon fruit spread garnered acceptable scores above the 4–point acceptable level of the Hedonic scale for product development as illustrated in Figure 2. Based on the aforesaid sensory data obtained, analysis of variance (ANOVA) was done to determine if the fruit spreads differ significantly from one another.

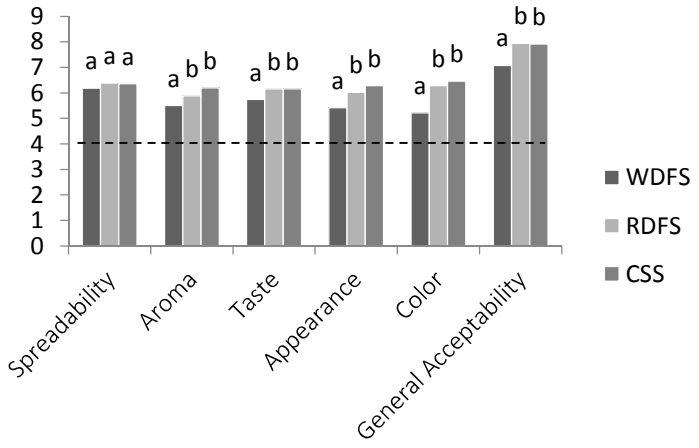

Figure 2: Consumer acceptability scores of two variations of dragon fruit spreads and control with 7–point Hedonic scale, except for the parameter general acceptability with 9–point Hedonic scale. The broken line was fitted to indicate the acceptable level of sensory analysis. A different letter on the same attribute showed the significant difference ($p < 0.05$).

Results showed that the white dragon fruit spread (WDFS), the red dragon fruit spread (RDFS) and the commercial strawberry spread (CSS) were comparable to one another in terms of spreadability, with noted scores ranging from 6.18 to 6.38.

Aroma, taste, appearance, color and general acceptability of the RDFS garnered the following scores: 5.88, 6.16, 6.02, 6.28 and 7.94 respectively. On the other hand, the CSS noted the following scores: 6.2, 6.16, 6.28, 6.46 and 7.92 respectively. There were similarities in the scores shown for both spreads, whereas WDFS, (with the following scores: 5.5, 5.74, 5.42, 5.22 and 7.08 respectively) showed significantly lower results as compared to aforementioned spreads. The high scores achieved from the sensory evaluation of RDFS confirm its very high acceptability to consumers when contrasted with WDFS results.

3.2 Physico-Chemical Content Of Red And White Flesh Dragon Fruit Spread

The soluble solid (^{o}Brix) of WDFS (37.67), RDFS (38.65), and CSS (37.13) were comparable to one other as seen in Table 1.

Table 1: Physico–Chemical Content of Dragon Fruit Spread

Physico–Chemical Composition	SPREAD		
	White Dragon Fruit	Red Dragon Fruit	Commercial Strawberry
Aw	0.85^{a}± 0.01	0.82^{b} ± 0.01	0.82^{b}± 0.01
pH	5.12^{a}± 0.13	4.90^{b} ± 0.10	3.93^{c}± 0.02
Soluble Solids (°B)	37.67^{a}± 1.53	38.65^{a} ± 0.31	37.13^{a}±0.23
Moisture Content%	53.17^{a}± 0.43	55.42^{b} ± 0.33	55.50^{b}± 0.64
Ash Content%	1.16^{a}± 0.02	0.68^{b}±0.04	0.21^{c}± 0.002
Fat Content%	0.97^{a}± 0.27	0.44^{b}±0.09	0^{c}

**Mean values ± standard deviation of three trials. A different letter on the same attribute showed the significant difference ($p < 0.05$).*

Water activity and moisture content of WDFS (0.85 & 53.17) were significantly different from RDFS (0.82 & 55.42) and CSS (0.82 & 55.50), whereas RDFS and CSS were equal to each other. RDFS, WDFS and CSS were notably different from one another in terms of pH, with values ranging from 3.93 to 5.12; ash content, with values ranging from 0.21 to 1.16; and fat content, with values ranging from 0 to 0.97.

4 CONCLUSION

The red flesh dragon fruit spread was more accepted and preferred by the consumers than the white flesh dragon fruit spread based on the following parameters: appearance, color, aroma, spreadability, flavor and general acceptability. The bright red violet color and natural sweetness of the red flesh dragon fruit contributed to its high preference. The red flesh dragon fruit spread, therefore, has greater potential for development and a larger scope for market value once produced.

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