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Formulation and Nutritional Analysis of Dragon Fruit Peel Powder Incorporated Mixed Fruit Jam

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ABSTRACT

Mixed fruit jam can be consumed by all age groups as a healthy alternative to commercially available jams. Dragon fruit peel can be used as herbal medicine which has natural antioxidant properties. Standard and three variations of the mixed fruit jam were formulated and subjected to organoleptic evaluation by 25 semi-trained panellists. Variation V1 (5% dragon fruit peel powder) was found to be the best due to its appearance and taste. The physicochemical parameters, minerals, phytochemical components and antioxidant activity of the mixed fruit jam were analysed and the results showed that the formulated mixed fruit jam was rich in fiber, vitamin C and vitamin A and contained phytochemical components such as alkaloids, carbohydrate, protein, glycosides, flavonoids, phenol, steroids and tannin. The antioxidant capacity of the mixed fruit jam was found to be 71.2 µg AAE/g. The main focus of dragon fruit peels processing is to preserve perishable products, which can be stored and marketed throughout the year both at home and global market [1].

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Introduction

Dragon Fruit or Kamalam, an herbaceous perennial climbing cactus widely known as Pitaya, has its origin in Southern Mexico, Central America and South America [2]. Its plant is attractive due to its exotic appearance [3]. Dragon fruit has attracted considerable consumer interest because of its micronutrient content and the vibrant colour of the fruit itself [4]. Dragon fruit peel (DFP), which accounts for more than 20% by weight of the whole fresh fruit, is usually discarded as waste during processing. Recent studies have indicated dragon fruit peel as a potential natural colorant having good antioxidant activities [5]. Dragon fruit has many benefits, one of which is to improve blood circulation, reduce plaque, and also neutralize toxins in the blood. Dragon fruit skin is also very useful, including as a natural dye for food and beverages [6]. The increasing public interest in dragon fruit has led to an increasing trend of dragon fruit cultivation [7].

Materials and Methods

Selection and Screening of Fruits

The raw materials such as apples, banana, orange, ripe papaya, pineapple and lemon were purchased from fruit market in Perundurai.

Preparation of Standard Mixed Fruit Jam

Table 1: Proportion of Ingredients Used for a Standard Mixed Fruit Jam

INGREDIENTS	QUANTITY (g)
Mixed fruit pulp	100
Sugar	100
Lemon juice	1 tsp

Wash the fruits thoroughly and remove the peel and seeds from apple, banana, papaya, orange and pine apple. Cut equal proportion of all the fruits into small uniform pieces. Mash the fruits in a mixer jar and collect the pulp. Boil the fruit pulp for 10minutes and add weighed amount of powdered sugar. Cook till you get the correct consistency and add lemon juice. Pack the hot jam into clean, dry sterilized glass jar. Store under cool and dry conditions.

Preparation of Dragon Fruit Peel Powder

Procurement of dragon fruit ⬇

Washing of dragon fruit ⬇

Cleaning of dragon fruit ⬇

Cut the peels into small pieces
Sun drying (one day) ⬇

Grinding the dried peels and sieving ⬇

Storing in air tight container ⬇

Figure 1: Preparation of Dragon Fruit Peel Powder

The dragon fruits were procured fresh and sorted. Wash the fruits under running water to remove dirt on it. The dragon fruit peel was cut into small pieces and dried under the sun until the moisture content was reduced to 10% in order to prevent mould growth.

Formulation of Dragon Fruit Peel Powder incorporated Mixed Fruit Jam

Table 2: Formulation of Dragon Fruit Peel Powder incorporated Mixed Fruit Jam

S. No.	Ingredients	Standard (V0)	V1 (5%)	V2 (10%)	V3 (15%)
1.	Dragon fruit peel powder (g)	-	5	10	15
2.	Mixed fruit pulp (g)	100	95	90	85
3.	Sugar (g)	100	100	100	100
4.	Lemon juice	1 tsp	1tsp	1 tsp	1 tsp
5	Total weight (g)	200	200	200	200

Organoleptic Evaluation of Formulated Mixed Fruit Jam

The formulated Mixed fruit jam was organoleptically evaluated by 25 semi trained panel members for colour, flavour, taste, texture and overall acceptability. Hedonic rating test was used for the evaluation of overall acceptability.

Physicochemical Parameters of Formulated Mixed Fruit Jam

The ash content, pH, moisture content, Total Soluble Solids (TSS), total sugar and titrable acidity were analysed for formulated Mixed fruit jam using standard procedures.

Nutrient Analysis of Formulated Mixed Fruit Jam

The nutrient content and antioxidant capacity were analysed for the organoleptically accepted Mixed fruit jam (Energy, carbohydrates, protein, crude fiber, fat, vitamin A and vitamin C) using standard procedures.

Phytochemical Analysis of Formulated Mixed Fruit Jam

The phytochemicals such as flavonoids, alkaloids, protein, glycosides, carbohydrate, phenol, steroids, and tannin were analysed for formulated Mixed fruit jam using standard procedures.

Table 3: Method of Analysing Phytochemicals

Phytochemicals	Method of analysis
Alkaloids	Wagner's test
Carbohydrate	Molisch test
Flavonoids	Lead acetate test
Phenol	Lead acetate test
Steroids	Sals Kauski test
Tannin	Ferric chloride test
Glycosides	Glycoside test
Protein	Biuret test

Shelf-life Analysis of Formulated Mixed Fruit Jam

The prepared Mixed fruit jam was stored in room temperature for 30 days. The microbial loads were assessed on the 1st, 15th and 30th day of storage in glass jar.

Results and Discussion

Yield of Dragon Fruit Peel Powder

100g of fresh dragon fruit peel cut into small pieces was dried under sun for one day and the amount of yield after drying was 35g. The percentage of moisture loss for dragon fruit peel powder after processing was found to be 65%.

Overall Acceptability of Mixed Fruit Jam

The mean score for the acceptability of both standard and dragon fruit peel powder incorporated mixed fruit jam variations (5%, 10% and 15%) through hedonic rating test are given in Table 4.

Table 4: Mean Acceptability of Mixed Fruit Jam

Criteria	Mean± Standard deviation			
	Standard (V_0)	V1 (5% DFPP)	V2 (10% DFPP)	V3 (15% DFPP)
Appearance	8.28 ± 0.66	8.32± 0.73	8.30± 0.61	8.26± 0.72
Colour	8.16± 0.67	8.20± 0.74	8.18± 0.74	8.28± 0.64
Texture	7.88± 0.71	8.04± 0.72	7.84± 0.67	7.96± 0.82
Flavour	8.00± 0.56	8.04± 0.77	7.88± 0.76	8.02± 0.87
Taste	8.04± 0.71	8.12± 1.07	7.96± 0.59	7.92± 0.97
Overall acceptability	8.07± 0.44	8.14± 0.63	8.03± 0.51	8.08± 0.40
Groups compared		V0 & V1	V0& V2	V0 & V3
't' value		1.263 ^{NS}	1.117^{NS}	1.079^{NS}

^{NS} - Not significant, DFPP – Dragon fruit peel powder

Among the three variations, 5% (V_1) dragon fruit peel powder incorporated mixed fruit jam received the highest overall acceptability score when compared to standard (V_0), 10% (V_2) dragon fruit peel powder and 15% (V_3) dragon fruit peel powder incorporated mixed fruit jam because it received the maximum score for appearance, texture, flavour, taste and overall acceptability.

Physico-Chemical Parameters of Commercial Mixed Fruit Jam and Formulated Mixed Fruit Jam

The physicochemical parameters such as ash, moisture, pH, Total Soluble Solids (TSS), Total sugar, reducing sugar and titrable acidity were analysed and the values are given in Table 5.

Table 5: Physicochemical Parameters of Commercial Fruit Jam and Formulated Fruit Jam

Parameters	Commercial Fruit Jam (# [8])	Formulated Mixed Fruit Jam
Ash (%)	2.79	1.28
pH at 25°C	3.63	3.43
Moisture content (%)	13.3	16.5
Total Soluble Solids (TSS) (%)	68.5	67.6
Total sugar (%)	3.94	9.2
Reducing sugar (%)	17.2	23.1
Titrable acidity (%)	0.3	0.42

Table 5 clearly showed that the ash content of commercial fruit jam was 2.79 % and ash content for formulated fruit jam was 1.28%, pH of the commercial fruit jam was 3.63 at 25°C and pH of the formulated fruit jam was 3.43 at 25°C and the moisture content of commercial fruit jam was found to be 13.3% and the moisture content of the formulated fruit jam was found to be 16.5%.

The Total Soluble Solids (TSS) of commercial fruit jam was 68.5% and the Total Soluble Solids (TSS) of the formulated fruit jam was 67.6%. The Total sugar of the commercial fruit jam was 3.94% and the Total sugar of the formulated fruit jam was 9.2%.

The Reducing sugar of the commercial fruit jam was 17.2% and the Reducing sugar of the formulated fruit jam was 23.1%. In preparing jams and jellies the acidity should be controlled and remain between 0.3 and 0.8%. The Titrable acidity of commercial fruit jam was 0.3% and the Titrable acidity of the formulated fruit jam was 0.42%.

Table 6: Nutrient Content of Commercial Fruit Jam and Formulated Mixed Fruit Jam

Nutrients	Nutrient content per 100 g	
	Commercial fruit jam (# [8])	Formulated fruit jam (5% DFPP)
Energy (kcal)	278	328.93
Carbohydrate (g)	69	79.65
Protein (g)	4.11	2.56
Fat (g)	0.1	0.01
Fiber (g)	1.1	1.36
Pectin (g)	0.75	1.01
Vitamin A (mcg)	12.7	17.3
Vitamin C (mg)	37	53.6
Potassium (mg)	32	123

Table 6 revealed the composition of nutrients present in 100g of commercial fruit jam and formulated mixed fruit jam. The Total energy in formulated fruit jam (328.93 kcal) is higher when compared to commercial fruit jam (278 kcal). Formulated fruit jam (79.65 g) contains higher amount of carbohydrate than commercial fruit jam (69 g). The dietary fiber content of formulated fruit jam is slightly higher (1.36 g) than the commercial fruit jam (1.1g). The pectin content in formulated fruit jam (1.01 g) is also higher than the commercial fruit jam (0.75 g).

Vitamin A (17.3 mcg) and vitamin C (23.6 mg) contents of the formulated fruit jam are found to be higher than commercial fruit jam (12.7 mcg and14 mg respectively). The potassium content of the formulated fruit jam (123 mg) is also higher when compared to commercial fruit jam (32 mg).

Phytochemicals Present in Mixed Fruit Jam

Phytochemicals present in mixed fruit jam were analysed in aqueous extract and the results are represented in the Table 7.

Table 7: Phytochemicals Present in Mixed Fruit Jam

Phytochemicals	Aqueous extract
Carbohydrate	+
Alkaloids	+
Flavonoids	+
Protein	+
Steroids	+
Glycosides	+
Tannin	+
Phenol	+

+ Presence

Table 7 revealed the presence of phytochemical components such as alkaloids, carbohydrate, flavonoids, phenol, protein, steroids, glycosides and tannin in aqueous extract.

Antioxidant Capacity of Commercial Fruit Jam and Formulated Fruit Jam

The antioxidants capacity of commercial fruit jam and formulated fruit jam are represented in Table 8.

Table 8: Antioxidant Capacity of Commercial Fruit Jam and Formulated Fruit Jam

Total Antioxidants Capacity	Value
Commercial fruit jam (mg AAE/g)(#)[9]	43.52 ± 1.28
Formulated fruit jam (mg AAE /g)	71.2

#[9] Source: [8]

From the Table 7, it is evident that antioxidant capacity of commercial fruit jam was found to be 43.52 ± 1.28 mg AAE/g whereas the antioxidant capacity of formulated fruit jam was found to be 71.2 mg AAE /g. Therefore, the antioxidant capacity of formulated fruit jam was high when compared to commercial fruit jam.

Shelf- Life Analysis of Mixed Fruit Jam

The formulated mixed fruit jam was stored in air tight glass jars at room temperature for 30 days. The microbial loads were assessed on the 1st, 15th and 30th day of storage. The total plate count of mixed fruit jam is given in Table 9.

Table 9: Shelf -Life Analysis of Mixed Fruit Jam

DAY	Total Plate Count (per gram)
1	0 CFU
15	2×10^2 CFU
30	4×10^4 CFU

From the Table 9, it is noted that the total plate count of mixed fruit jam on 1st day was 0 CFU, 15th day was 2×10^2 CFU and 30th day was 4×10^4 CFU. The microbial count increased as the days of storage increased.

Mixed fruit jam was in good condition when stored at refrigerator for 35 days without any spoilage and it can be stored at room temperature for 25 days without spoilage. It shows that fruit jam can be stored at room temperature for about 25 days without spoilage as the microbial count was in safe level [9].

Conclusion

From the above study, it is concluded that 5% (V_1) dragon fruit peel powder incorporated mixed fruit jam received maximum scores in overall acceptability and it was accepted by the panel members due to the appearance, flavour and taste. From the nutrient analysis, it is noted that the mixed fruit jam contains high amount of fiber, pectin, vitamin C, vitamin A and potassium. Thus, it is evident that Dragon fruit peel which is otherwise a waste can be used in preparation of mixed fruit jam and can be consumed by people of all age groups.

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