



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2019; 8(3): 3657-3662  
Received: 01-03-2019  
Accepted: 03-04-2019

**Dnyaneshwar P Shekade**  
Department of Food Technology,  
Shivaji University, Kolhapur,  
India

**Pravinkumar D Patil**  
Department of Chemical  
Technology, Shivaji University,  
Kolhapur, India

**Akashy Kumar Sahoo**  
Department of Food Technology,  
Shivaji University, Kolhapur,  
India

**GV Mote**  
Department of Food Technology,  
Shivaji University, Kolhapur,  
India

## Development of functional powder from dragon fruit and taro leaves

**Dnyaneshwar P Shekade, Pravinkumar D Patil, Akashy Kumar Sahoo and GV Mote**

### Abstract

The present work was undertaken with the objective of development of functional (nutritional) powder by using dragon fruit and taro leaves. Taking into consideration therapeutic and nutritional value of dragon fruit and taro leaves were decided into the preparation of functional powder. Dragon fruit powder and taro leaves powder were prepared by freeze drying and tray drying respectively. The level of dragon fruit powder and taro leaves powder was optimized RSM through. The Functional powder containing 80.68% Dragon fruit powder, 7.67% Taro leave powder and 20% Sugar was acceptable on sensory basis and showed a good antioxidant properties. The selected concentration was evaluated for sensory analysis, and physico-chemical. The Functional powder contains vitamin C, minerals, fibers and valuable bioactive compounds. Functional powder has major active constituents like protein (19.34/100g), carbohydrate (74.67/100 g), ash content is 1.16 (w/w), crude fiber (4.98/100g), Vitamin C (8.5mg/100g), polyphenols (178.06 ug/ml), Flavonoids (225.62 ug/ml). These powder possess various activities such as, antioxidant, anticancer, antifungal, curing of various diseases like cancer, cardiovascular disease, Coronary heart disease etc. Thus it can be recommended that Functional powder can be potentially used to improve health condition. It indicates that Functional powder should be further investigated in terms of possible applications in developing functional and nutritional food products.

**Keywords:** Functional powder, taro leaves, dragon fruit, RSM, drying

### Introduction

India is that the world's largest producer of the many contemporary fruits and vegetables. Its vast geographical area coupled with varied climate conditions facilitates to grow a variety of fruits and vegetables. We produced around 81.285 MT fruits in annual (Rais and Sheoran, 2015) [17]. It has been found that 30 – 40 percent of fruits and vegetables are wasted due to post harvest losses. Waste percentages in each step of the food supply chain in India is the cause of low availability of fruits and vegetables for consumers and the need for import of them in spite of Asian nation being second largest producer. Though we are the world's second largest fruit and vegetable producer encounters a waste of close to 25% worth of produce (Rais and Sheoran, 2015) [17].

The health benefits associated with fruit and Vegetables on a daily basis are related to the ingestion of bioactive components. The composition of a fruit and Vegetables depends on the variety, origin and growing conditions of the fruit. There are critical to good health, and certainly good for all age categories as it forms an important portion of a healthy diet. There are well known for their medicinal properties like antihypertensive, antihyperlipidemic, antihyperglycemic, antipyretic, wound healing, antitumor, anticancer, anti-inflammatory, etc. (Jan and Dorcus, 2012).

Dragon fruit or pitaya belongs to the Cactaceae family from the subfamily Cactoidea of the tribe Cactea. In Malaysia, the pitaya or dragon fruit is commonly called as "buah naga". Among the pitaya species (*Hylocereus polyrhizus*) fruits are edible and it has a great source of vitamin C and water soluble fiber. Dragon Fruit is a small fruit climbing cactus that has received world-wide recognition as an ornamental plant for its large, scented night-blooming flowers. The red skin fruit weighed up to 1kg has clear dark-red flesh thought-about as an expensive supply of nutrients and minerals like B-complex vitamin, vitamin B2, vitamin B3 and vitamin C, protein, fat, carbohydrate, crude fiber, flavonoid, thiamin, niacin, pyridoxine, kobalamin, glucose, phenolic, betacyanins, polyphenol, carotene, phosphorus, iron and phytoalbumin. Syukri *et al.*, (2012) [21]. (*Hylocereus polyrhizus*) is wealthy in fibers, vitamin C, minerals and phytoalbumins which are highly valued for their antioxidant properties. The dragon fruit helps the method (biological process) process prevent colon cancer and diabetes, neutralize toxic substances such as heavy metal, reduce cholesterol levels and high blood

**Correspondence**  
**Papori Bora**  
Department of Food Science and  
Nutrition, College of Community  
Science, Assam Agricultural  
University, Jorhat, Assam, India

pressure and consumed regularly the dragon fruit will facilitate against respiratory illness and cough. There is also rich with potassium, protein, fiber, sodium and calcium which are better for health than other fruits life of present-day consumers. (Tonny *et al.*, 2017)

Taro leaves are a rich source of protein, ascorbic acid, dietary fiber, and other important minerals including, thiamin, riboflavin, iron, phosphorus, zinc, vitamin B6, vitamin C, niacin, potassium, copper, and manganese. Some studies have suggested that they also have analgesic and anti-inflammatory properties, antifungal Properties, Reported by Krishnapriya *et al.*, (2017)<sup>[7]</sup>.

Dragon Fruits and Taro leaves contain Vitamin C and B, phytochemicals which are essential to maintain good health. They possess various activities such as, antioxidant, anticancer, antifungal, curing of various diseases like cancer, cardiovascular disease, Coronary heart disease etc. Blending of Dragon fruits Powder and Taro leaves Powder explores the opportunities to prepare the Functional (Nutritive) Powder which are rich in Vitamin C, phytochemicals. Blending of Powder also helps to develop delightful, delicious Functional Powder with excellent Functional and nutritional properties. Which may be also help of Health and reduces some type of Dangerous disease like colon cancer, cardiovascular disease, Coronary heart Disease, These two sources are the great that may act as anti-cancer food because in addition to being a rich source of vitamin C, it is also a storehouse of many different natural antioxidants.

Functional food could be a food given an extra performance (often one associated with health-promotion or sickness prevention) by adding new ingredients or a lot of existing ingredients. Functional foods is also "designed to own physiological advantages and/or scale back the danger of chronic sickness on the far side basic organic process functions, and should be similar in look to traditional food and consumed as part of a regular diet". Moreover, one could think of a new product development through blending in the form of a Functional (Nutritive) Powder, which may also be used as a Nutritive Powder.

### Materials and methods

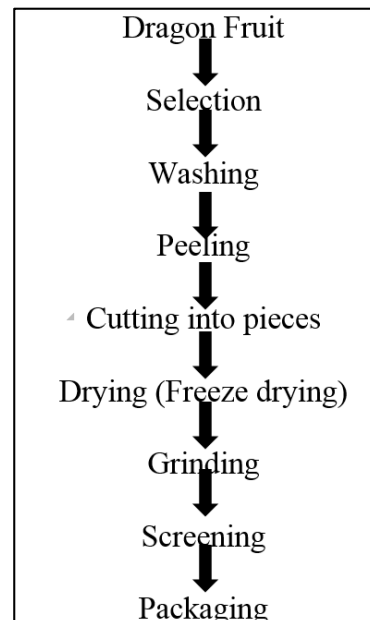
**Materials:** Fresh Red dragon fruit was procured from Local market, Kolhapur. Whereas, Taro leave of local variety were procured from local market of Kolhapur city. Sugar was used as sweetening purpose.

### Methodology

**Preparation of Powder:** The Dragon fruit and Taro leaves will be prepared using method by Tonny *et al.*, (2017) and Alcantara *et al.*, (2013)<sup>[2]</sup> described by process Fig. 1 and Fig. 2 respectively with slight modification.

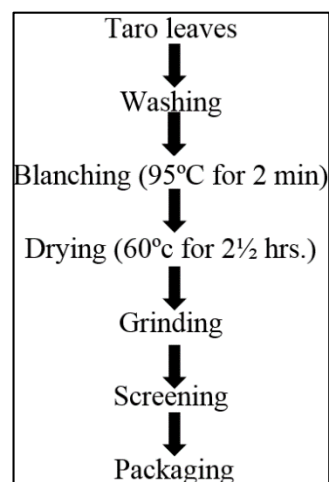
### Preparation of Dragon fruit Powder

Dragon fruit Powder was prepared as per the method suggested by Tonny *et al.*, (2017) for the preparation of powder by freeze drying through (Fig.1).

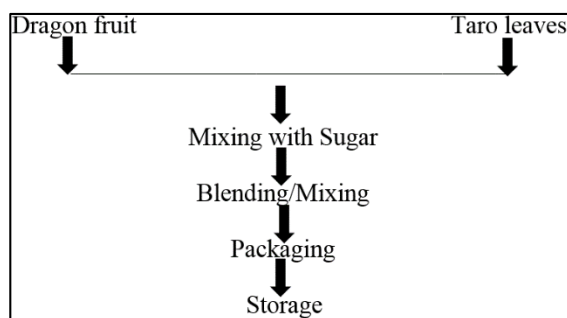


### Preparation of Taro leaves Powder

Taro leaves Powder was prepared as per the method suggested by Alcantara *et al.*, (2013)<sup>[2]</sup> for the prepared of powder by oven drying through (Fig.2).



**Development of Functional Powder:** The Mixing Functional Powder will be prepared by Taro Leaves Powder and Dragon fruit Powder according to method described below with slight modifications.



### Process optimization

#### Selection of level of Dragon fruit and Taro leaves for preparation of functional powder

The most commonly used Red Dragon fruit and local variety of Taro leaves was procured from local market. The dragon fruit and taro leaves powder was made functional powder and termed as dragon fruit and taro leaves powder. The Dragon fruit and taro leaves powder @ (T<sub>1</sub>)95:5, (T<sub>2</sub>)90:10, (T<sub>3</sub>)85:15, (T<sub>4</sub>)80:20 per cent of dragon fruit powder and taro leaves compared and containing sugar as same but without Taro leaves (T<sub>0</sub>) (like moderately) on 9-point hedonic scale. These levels of dragon fruit and taro leaves powder were considered for RSM experiment.

#### Selection level of Sugar from preparation of functional powder

The treatment included control i.e. Sugar without (T<sub>0</sub>), Sugar with Dragon fruit and Taro leaves powder (T<sub>1</sub>)90:10:4, (T<sub>2</sub>) 90:10:8, (T<sub>3</sub>)90:10:12, (T<sub>4</sub>)90:10:16, (T<sub>5</sub>) 90:10:20, The Dragon fruit and Taro Leaves was kept constant at 90 per cent and 10 per cent and Sugar are optimize.

### Analytical Work

#### Physico-chemical analysis

The product was analyzed for fat, protein, minerals, ash, carbohydrate, Crude fiber, acidity, Vitamin C, sugar content by AOAC (2000)<sup>[1]</sup> method.

### Sensory evaluation

Sensory evaluation of Dragon fruit and Taro leaves powder were carried out by a semi-trained panel of judges from the staff of the Division of Department of technology, Shivaji University, Kolhapur, by using 9- point Hedonic scale (Appendix -I) as described by (Hue, 1993). for color and appearance, taste and flavor, consistency, and overall acceptability.

### Statistical analysis

Data generated during selection of variety of Dragon fruit and Taro leaves were analyzed by employing CRD technique (Snedecor and Cochran, 1967). Whereas the level of Dragon fruit and Taro leaves was optimized using Stat-Ease Design Expert 7.0.0 package procured from stat ease Inc., USA (www.statease.com).

### Results and discussion

#### Selection of varieties of Dragon fruit and Taro leaves for preparation of functional powder

The functional powder prepared from dragon fruit and taro leaves significant highest score for color and appearance (7.90), taste and flavor (8.00) consistency (7.80) and overall acceptability (7.90).

Scores for sensory attributes

| Treatments     | Scores for sensory attributes |         |                    |                |                       |
|----------------|-------------------------------|---------|--------------------|----------------|-----------------------|
|                | Consistency                   | Texture | Color & appearance | Taste & Flavor | Overall acceptability |
| T <sub>0</sub> | 6.9                           | 6.7     | 6.9                | 6.7            | 6.8                   |
| T <sub>1</sub> | 7.1                           | 7.4     | 7.5                | 7.4            | 7.5                   |
| T <sub>2</sub> | 7.8                           | 7.7     | 7.9                | 8.0            | 7.9                   |
| T <sub>3</sub> | 7.4                           | 7.3     | 7.8                | 7.7            | 7.6                   |
| T <sub>4</sub> | 7.0                           | 7.3     | 7.5                | 7.4            | 7.4                   |

From the above Table it is clear that the color and appearance score of functional powder was significantly affected by the level of Dragon fruit. The maximum score was obtained to the functional powder containing 90 per cent Dragon fruit (Table 1). It was found that as the level of Dragon fruit increased the score of color and appearance decreased. The panel of judges comments that the functional powder containing 90 per cent dragon fruit had pink color whereas sample containing high concentration

The taste & flavor score for functional powder containing 80, 85, 90, 95, and 100 per cent Dragon fruit 6.70, 7.40, 8.00, 7.70, and 7.40, respectively (Fig). The maximum score (8.0) was recorded to the sample containing 90 per cent Dragon fruit powder and minimum score (6.70 per cent) was to the product prepared by without Taro leaves powder.

From the Table it is revealed that the consistency score of product was more or less similar for all the samples. It means that the level of Dragon fruit powder do not exerted any significant effect on consistency score of functional powder. Further, it was found that with increasing the level of taro leaves powder the consistency score was slightly decreased from 7.4 to 7.10.

The effect of level of dragon fruit on overall acceptability score was also depicted in Table 1. The data reveals that the overall acceptability score of functional powder was significantly

affected by the level of Dragon fruit powder. The overall acceptability score for product T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> were 6.80, 7.50, 7.90, 7.60, and 7.40 respectively. The maximum score for the functional powder containing 90 per cent Dragon fruit powder was 7.90.

From the above Table 1, it was observed that, the Taro leaves powder rated score 7.9 and above for overall acceptability (like moderately) when it was added at 0, 5, 10, 15, and 20 per cent. Hence these five levels were used for optimization experiment.

#### Optimization of level of Dragon fruit and Taro leaves through RSM

Response Surface Methodology experiment was conducted including two factors i.e. Dragon fruit powder used at 75 to 90 per cent and Taro leave powder used at 5 to 20 per cent. In total 13 formulations were prepared using different levels of the ingredients as per Design Expert 7.0.0 version software. The level of ingredients of the design matrix for the experiment was presented in Table (2). The data generated were analyzed using Design-Expert Software and a generalized polynomial equation was obtained for each response. The response measured for the Functional Powder was sensory score and physico-chemical parameters

**Table 2:** Experimental level of Independent variables in RSM

| Std | Run | Dragon fruit powder (%) | Taro leaves powder (%) |
|-----|-----|-------------------------|------------------------|
| 10  | 1   | 82.5                    | 12.5                   |
| 11  | 2   | 82.5                    | 12.5                   |
| 7   | 3   | 82.5                    | 1.89                   |
| 9   | 4   | 82.5                    | 12.5                   |
| 5   | 5   | 71.89                   | 12.5                   |
| 2   | 6   | 90                      | 5                      |
| 6   | 7   | 93.10                   | 12.5                   |
| 12  | 8   | 82.15                   | 12.5                   |
| 4   | 9   | 90                      | 20                     |
| 1   | 10  | 75                      | 5                      |
| 3   | 11  | 75                      | 20                     |
| 8   | 12  | 82.5                    | 23.10                  |
| 13  | 13  | 82.5                    | 12.5                   |

**Table 3:** Effect of ingredient levels on sensory attributes (score \*) of Functional powder.

| Run | Ingredients             |                        | Sensory Score |         |                    |                 |                       |
|-----|-------------------------|------------------------|---------------|---------|--------------------|-----------------|-----------------------|
|     | Dragon fruit powder (%) | Taro leaves Powder (%) | Consistency   | Texture | Color & appearance | Taste & Flavour | Overall acceptability |
| 1   | 82.5                    | 12.5                   | 7.60          | 7.70    | 7.75               | 7.80            | 7.65                  |
| 2   | 82.5                    | 12.5                   | 7.70          | 7.72    | 7.60               | 7.65            | 7.70                  |
| 3   | 82.5                    | 1.89                   | 7.50          | 7.55    | 7.60               | 7.50            | 7.55                  |
| 4   | 82.5                    | 12.5                   | 7.75          | 7.60    | 7.70               | 7.70            | 7.69                  |
| 5   | 71.89                   | 12.5                   | 7.40          | 7.45    | 7.45               | 7.55            | 7.48                  |
| 6   | 90                      | 5                      | 7.50          | 7.65    | 7.55               | 7.50            | 7.60                  |
| 7   | 93.10                   | 12.5                   | 7.70          | 7.60    | 7.50               | 7.30            | 7.45                  |
| 8   | 82.15                   | 12.5                   | 7.65          | 7.50    | 7.75               | 7.80            | 7.73                  |
| 9   | 90                      | 20                     | 7.80          | 7.60    | 7.60               | 7.45            | 7.60                  |
| 10  | 75                      | 5                      | 7.45          | 7.45    | 7.50               | 7.40            | 7.40                  |
| 11  | 75                      | 20                     | 7.40          | 7.35    | 7.30               | 7.30            | 7.35                  |
| 12  | 82.5                    | 23.10                  | 7.60          | 7.70    | 7.60               | 7.55            | 7.55                  |
| 13  | 82.5                    | 12.5                   | 7.70          | 7.65    | 7.75               | 7.65            | 7.70                  |

**Table 4:** Coefficients of Quadratic polynomial model for coded sensory score attributes. (\*Significant at 5%)

| Factor           | Consistency | Color & appearance | Taste & Flavour | Overall acceptability |
|------------------|-------------|--------------------|-----------------|-----------------------|
| Intercept        | 7.68        | 7.71               | 7.72            | 7.69                  |
| Dragon Fruit (A) | 0.069*      | 0.070              | 0.135           | 0.774                 |
| Taro leaves (B)  | 0.0089      | -0.018*            | -0.009          | -0.0625               |
| AB               | 0.0075      | -0.0625*           | 0.0125          | 0.125                 |
| A <sup>2</sup>   | -0.088*     | -0.1112*           | -0.135          | -0.091                |
| B <sup>2</sup>   | -0.088*     | -0.073*            | -12.25          | -0.086                |
| R <sup>2</sup>   | 0.7495      | 0.8347             | 0.7525          | 0.8494                |
| F-value          | 4.06        | 7.07*              | 4.26            | 10.20                 |
| Mean             | 7.57        | 7.60               | 7.56            | 7.58                  |
| SD               | 0.08        | 0.069              | 0.0987          | 0.0535                |
| Adeq Precision   | 4.95        | 7.16               | 4.3753          | 8.0361                |

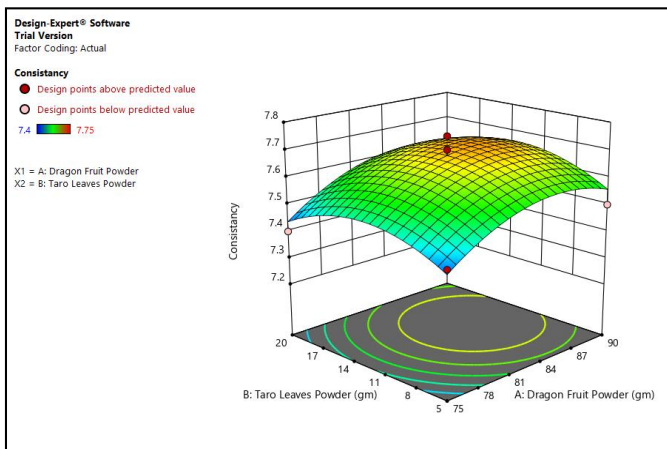
**Table 5:** Predicted and actual sensory score of suggested formulation by Design Expert 7.0.0 package

| Sr. no | Ingredients (%)               | Score     | Sensory parameters |                 |             |                       |
|--------|-------------------------------|-----------|--------------------|-----------------|-------------|-----------------------|
|        |                               |           | Color & appearance | Taste & Flavour | Consistency | Overall acceptability |
| 1      | Dragon fruit powder<br>80.686 | Predicted | 7.61               | 7.67            | 7.66        | 7.64                  |
| 2      | Taro leaves powder<br>7.679   | Actual    | 7.55               | 7.60            | 7.68        | 7.5                   |

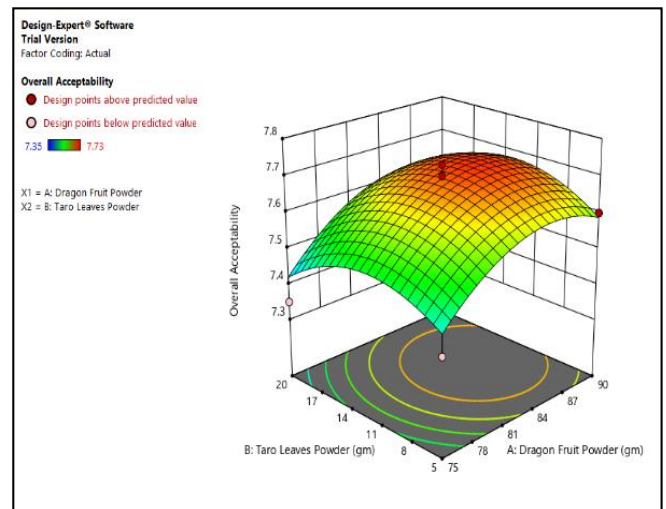
**Table 6:** Physicochemical Analysis of Functional powder

| Sr. No | Parameters          | Functional (Nutritional) Powder |
|--------|---------------------|---------------------------------|
| 1      | Moisture (%)        | 8.56±0.50                       |
| 2      | Crude Fat (%)       | 2.80±0.2                        |
| 3      | Crude fiber (%)     | 4.98±0.9                        |
| 4      | Protein (gm.)       | 19.34±0.40                      |
| 5      | Ash (%)             | 1.16±0.5                        |
| 6      | Carbohydrate (gm.)  | 74.67±2.05                      |
| 7      | Total energy (Kcal) | 390.12                          |
| 8      | pH                  | 5-5.5                           |

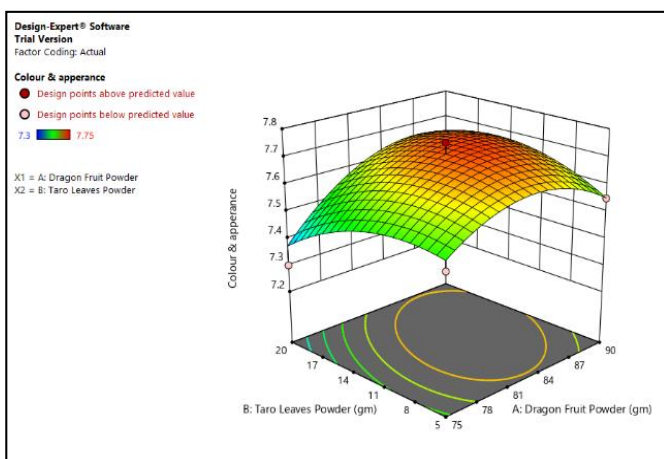
|    |                           |          |
|----|---------------------------|----------|
| 9  | Acidity                   | 0.20±0.5 |
| 10 | Vitamin C (mg/100ml)      | 8.5±0.3  |
| 11 | Flavonoids (µg/ml)        | 225.62   |
| 12 | Phenolic Compound (µg/ml) | 178.06   |
| 13 | Magnesium(Mg) (mg/100ml)  | 9.218    |
| 14 | Iron (Fe) (mg/100ml)      | 10.502   |
| 15 | Potassium (K) (mg/100ml)  | 15.6     |
| 16 | Calcium (Ca) (mg/100ml)   | 8.8      |



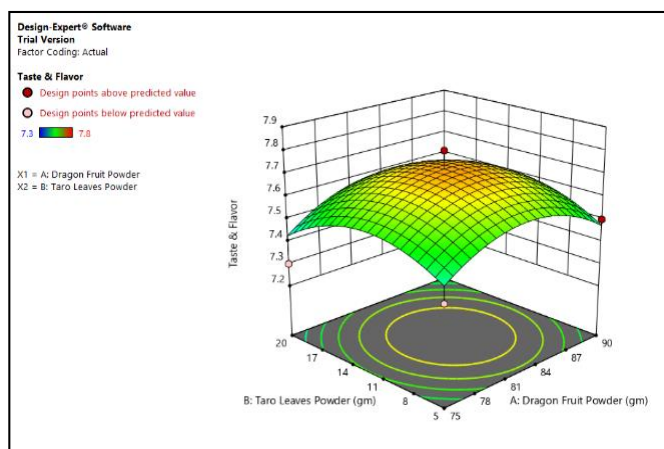
**Fig 1:** Effect of level of Dragon fruit and Taro leaves on Consistency score of functional powder



**Fig 4:** Effect of level of Dragon fruit and Taro leaves on overall acceptability score of functional powder



**Fig 2:** Effect of level of Dragon fruit and Taro leaves on color and appearance score of functional powder



**Fig 3:** Effect of level of Dragon fruit and Taro leaves on tastes and flavour score of functional powder

## 5. Conclusion

In this study Functional powder was developed using the combination of Dragon fruit, Taro leaves, and sugar. Analytical results showed that Dragon fruit are good source of various different bioactive molecules like polyphenols, protein, minerals, vitamin C. Also the (antioxidant) and minerals and Taro leaves is good source of ascorbic acid, phytochemicals and minerals like iron. Raw material (Dragon fruit and Taro leaves) good source of nutritional value due to it provides various different health benefiting properties such as cancer, colon cancer, cardiovascular disease, heart related disease. etc. The Functional powder containing 80.68% Dragon fruit powder, 7.67% Taro leave powder and 20% Sugar was acceptable on sensory basis and showed a good antioxidant properties. It is also a good source of protein (19.34%), minerals (such as calcium, iron, magnesium) Vitamin C (8.5 mg/100ml). The shelf life study indicated that the Functional powder showed a good shelf life of more than 90 days at room temperature. Thus it can be recommended that Functional powder can be potentially used to improve health condition. This can be a good for patient which will provide health benefits. It indicates that Functional powder should be further investigated in terms of possible applications in developing functional and nutritional food products.

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