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Vishakha
Department of Food and Nutrition, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India

Mamta Singh
Department of Food and Nutrition, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India

Vimla Dunkwal
Department of Food and Nutrition, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India

Corresponding Author:
Vishakha
Department of Food and Nutrition, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India

Formulation of refreshing drink using dragon fruit (*Hylocereus undatus*) as an immunity booster

Vishakha, Mamta Singh and Vimla Dunkwal

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Abstract
Dragon fruit is an exotic fruit loaded with lots of nutrients contributing to therapeutic benefits. It is the chief source of antioxidants including vitamin C, flavonoids and betacyanins. The most common variety (*Hylocereus undatus*) of fruit was processed to develop and standardize a healthy refreshing drink for immune boosting. Pulp and peel of the fruit were utilized and mixed with lemon juice in different proportions until desirable sensory scores were obtained. Nine-point Hedonic Rating Scale was used for assessment of sensory characteristics. Three variations T_1, T_2 and T_3 were developed and compared based on sensory attributes to evaluate consumer acceptability. Nutrient composition and cost calculation were also done together with organoleptic evaluation of products. Sample T_1 made with both pulp and peel mixed together with lemon juice was "liked very much" and secured highest score (8.1). Moreover, the uppermost score (8.6) found in T_1 for colour categorized as "liked extremely". On the other hand, the lowest score (6.5) was found for texture of T_2. Highly significant differences were found between sensory attributes of treatments. The nutritive values found for energy was 87 kcal, carbohydrate 20 g, protein 0.76 g, fat 0.36 g, fibre 1.56 g and vitamin C 44 mg per 100 g having cost ₹26.00 for the same quantity. The drink thus developed was found to be most acceptable having reasonable cost and numerous nutritional benefits.

Keywords: Dragon fruit, organoleptic, refreshing drink, antioxidants, immunity

Introduction
Dragon fruit is a savoury fruit with juicy pulp of creamy and attractive texture having lots of small brittle seeds embedded in it. The presence of tiny and edible black crunchy seeds gives it the resemblance of kiwi fruit. It is a flowering cactus of Cactaceae family which has numerous nomenclatures like 'pitaya', 'pitahaya', 'night blooming cereus', 'belle of the night', 'conderella plant' and 'queen of the night'. But it is mainly famous as 'dragon fruit' all over Asia because of its skin covered with bracts (scales) similar to those of a dragon. *Hylocereus undatus* is the most common variety of dragon fruit. Dragon fruit has many health benefits and thus used for prevention of various diseases such as enhancing eye health, boost functioning of kidney, brain, making bones stronger, lowering the risk of blood sugar, cholesterol and colon cancer (Suryono, 2006) [1]. Its ability of reducing cholesterol level is attributed to the presence of phytochemicals and the plant sterol which control the metabolism of cholesterol. This is due to presence of active units like thiols, polyphenolics, antioxidants and betacyanin. It also aids digestion by nullifying undesirable toxins like heavy metals as well as making body resistant towards cough and asthma. (Wybraniec and Mizrahi, 2002) [2]. Apart from these, it is also known to help in healing wound, preventing oxidation and boosting probiotics growth in the tracts of intestine (Zainoldin and Baba, 2009) [3]. As already stated, it consists of lots of nutrients which are significantly essential to maintain optimum health. Health aware section is getting attracted to it because of its superfood powers, eye-catchy look and nutritious and medicinal properties. Several processed products can be made from dragon fruit including RTS beverage, jam, juice, nectar, squash, smoothies etc. possessing delightful flavours and essences. Soft drinks can also be prepared using its juicy pulp. Studies also suggest that dragon fruit promotes the growth of probiotics, which improves digestibility. It helps lower blood glucose levels in type 2 diabetes. The glucose found in dragon fruit also aids in controlling the blood sugar level for diabetic patients. It is known to boost immune system as it is rich in vitamin C and fibres that help provide an overall healthy body. The presence of high level of vitamin C, minerals and phytoalbumin is regarded as relevant in fighting free radicals and possess antioxidant properties. It helps control cholesterol level. Dragon fruit is also rich in flavonoids that are known to have favourable effects against cardio related disease.

The fruit promotes healing of wounds and cuts. It improves appetite, eyesight, memory and can aid in weight reduction (Esquivel *et al.*, 2007 and Nurliyana *et al.*, 2010) [4, 5]. This study was carried out to develop refreshing drink using dragon fruit and determine its organoleptic acceptability.

Materials and Methods

Formulation of refreshing drink

Three variations of refreshing drink made with different proportions of ingredients depicted as follows:

Table 1: Formulation of refreshing drink

S. No.	Ingredients	Treatment 1	Treatment 2	Treatment 3
1.	Juice (ml)	90	100	90
	Peel (g)	10	-	10
2.	Sugar (g)	15	15	15
3.	Lemon juice (ml)	10	10	-
4.	Aonla juice (ml)	-	-	10

Preparation of refreshing drink

The drink was prepared using both pulp and peel of dragon fruit in three treatments. Washed ripe dragon fruit and peeled to discard outer skin having scales. Separated pulp and inner peel and cut into small pieces. Squeezed pulp to remove seeds and strained juice using muslin cloth. Blended peel with juice, then lemon juice (in treatment 1 and 2), aonla (*Phyllanthus emblica*) juice (in treatment 3) and added sugar to it and mixed well with spoon. Developed refreshing drink filtered using a strainer and served fresh. The method followed is presented in Figure 1 as below:

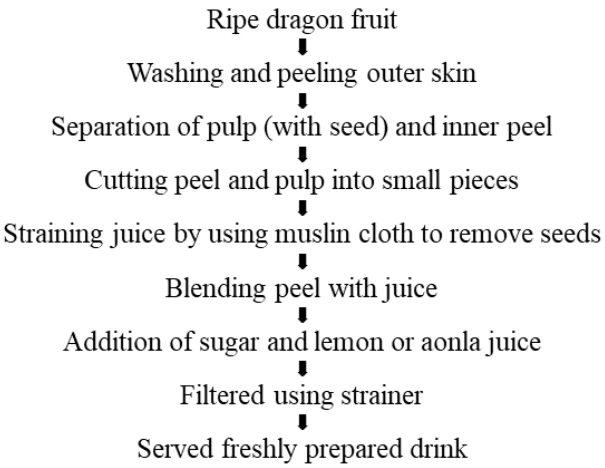

Fig 1: Flow chart of refreshing drink

Organoleptic evaluation

Evaluation was done for sensory attributes like colour, appearance, flavour, texture, taste and overall acceptability using 9 point Hedonic Rating Scale. Ten semi-trained panellists comprising faculty and scholars of Department of Food and Nutrition were selected for the evaluation. The samples were evaluated in triplicate of each using separate score cards for each product (Srilakshmi, B., 2018) [6].

Nutritive value

Nutrient content of the products was estimated using food composition table given by Gopalan *et al.* (1989) [7] for energy, protein, fat, fibre, carbohydrate and ash. The individual ingredient was evaluated as:

$$\text{Nutrient value of the ingredient taken} = \frac{\text{Nutrient content per 100 g}}{100} \text{ x amount of ingredient taken}$$

Cost calculation

Cost of the product per 100 g was calculated on the basis of cost of individual ingredients used (Sethi, 2004) [8].

Statistical analysis

The data obtained were tabulated and processed using software namely Microsoft Excel and SPSS and analysed using appropriate statistical tools to draw meaningful inferences from the study (Gupta, 2002) [9].

Research Findings and Discussion

The findings of the present investigation have been discussed under following headings:

Organoleptic evaluation

Refreshing drink was prepared using juice of dragon fruit blended with and without peel and mixed with lemon and aonla juice separately. The organoleptic scores for each taken separately for evaluation and unrolled in Table 2. The graphical representation of the same was also presented in Figure 2.

Table 2: Organoleptic acceptability of beverage

Product	Treatment	Appearance	Colour	Flavour	Texture	Taste	Overall Acceptability
Refreshing drink	T_1	8.3±0.67	8.6±0.52	8.0±0.67	7.9±0.74	8.2±0.63	8.1±0.57
	T_2	7.5±0.53	6.8±0.63	7.6±0.70	6.5±0.53	8.1±0.57	7.3±0.48
	T_3	6.9±0.99	7.7±1.25	7.5±0.71	7.9±0.74	7.4±0.84	8.0±0.67
	SEM	0.171	0.204	0.128	0.171	0.139	0.121
	"F" value	8.59**	10.88**	1.47 (NS)	14.34**	3.98*	5.7**

*Significant at 5% level, **Significant at 1% level, NS=Non significant at 5% level, Values are mean±SD of 10 panellists, T_1 = Dragon fruit juice + Peel + Lemon juice, T_2 = Dragon fruit juice + Lemon juice, T_3 = Dragon fruit juice + Peel + Aonla juice

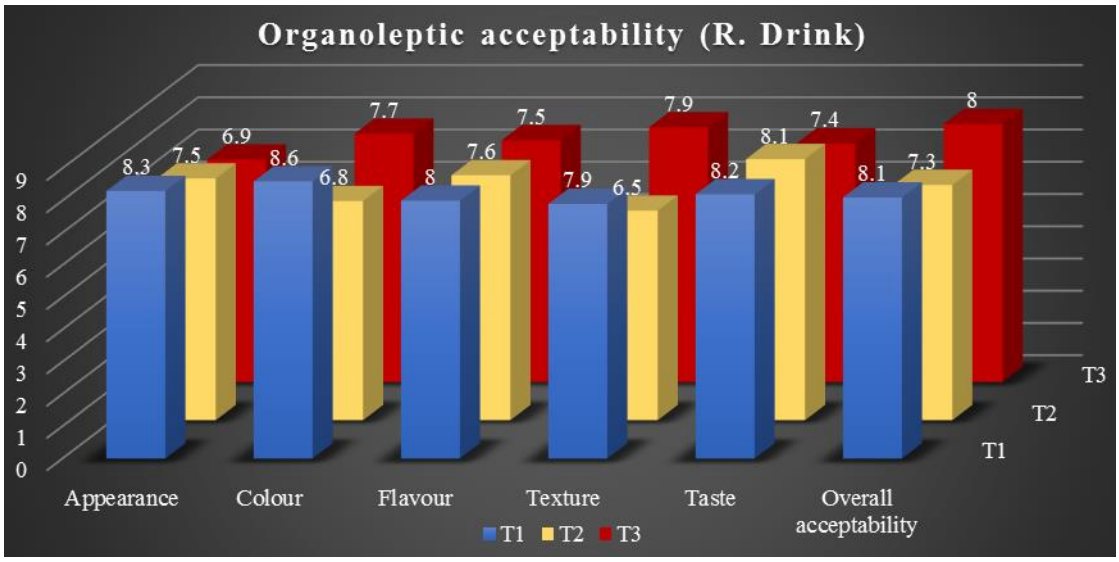

Fig 2: Organoleptic acceptability of beverage

Sample T_1 was "liked very much" secured highest score (8.1) and thus being the best of three, chosen for further study. Moreover, the uppermost score (8.6) was found in T_1 for colour which fell in the category of "liked extremely". On the other hand, the lowest score (6.5) was found for texture of T_2 depicting "like moderately". Highly significant differences were found in average of appearance, colour, texture and overall acceptability at 1 per cent level. While the average scores in taste were found significant followed by non-significant in flavour at 5 per cent level of significance.

Nutritive value

The nutritional profile of beverage was calculated on the basis of proximate analysis of dragon fruit and food composition table given by Gopalan *et al*. (1989) [7]. Vitamin C content of dragon fruit estimated as per the values recorded by Sari and Hardiyanti (2013) [10]. The values found per 100 g for energy 87 kcal, carbohydrate 20 g, protein 0.76 g, fat 0.36 g, fibre 1.56 g and vitamin C 44 mg as illustrated in Figure 3.

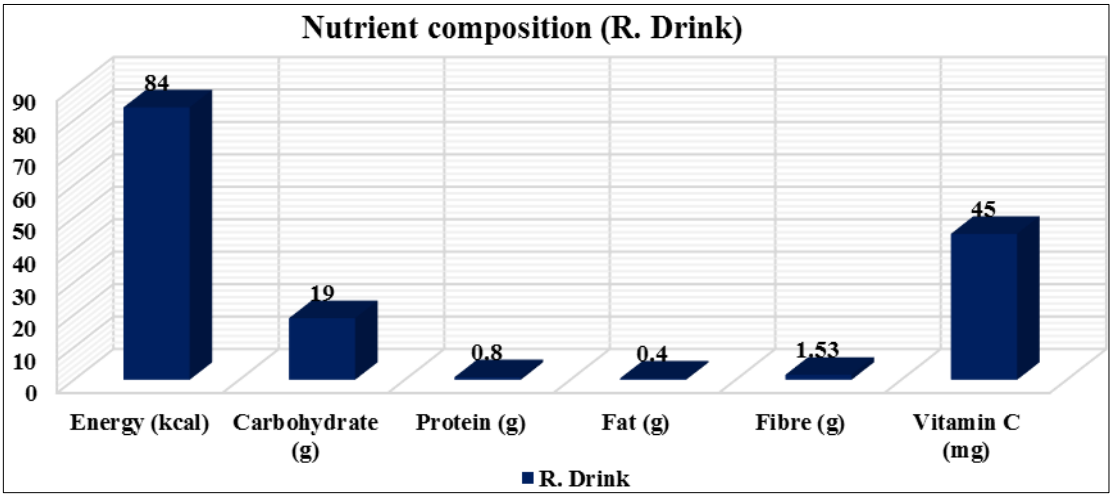

Fig 3: Nutritive value of beverage (refreshing drink) per 100 g

Cost calculation

The cost of refreshing drink was found to be ₹26.00per 100g.

Conclusion

It can be concluded that refreshing drink developed during the study has highly acceptable sensory qualities, affordable cost and good nutritional properties having immense health benefits. Though dragon fruit is also rich source of antioxidants, but inclusion of lemon juice in developed drink further makes it rich in vitamin C. Refreshing drink made from dragon fruit being rich in antioxidants can help improve lifestyle by boosting immunity to fight against various diseases. Consumption of the fruit in raw form is promoted to preserve nutrient contents of fruit.

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