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Development of value added papaya and pineapple jams

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Though fruits are rich in vitamins and minerals exposure to higher temperature during the preparation of jam results in lowering the nutrient content and makes it energy dense food. There is ample scope to enhance nutritional value of jam both quantitatively and qualitatively by the process of value addition with nutritious food ingredients. Hence, an attempt was made to develop value added papaya and pineapple jams. Papaya and Pineapple jams prepared with incorporation of nutritious ingredients (beet root powder, deoiled soya meal powder (DOSM), milk powder and watermelon powder) were evaluated to find out the most suitable and highly accepted level of incorporation. The most accepted products were assessed for their nutrient content and were stored to evaluate the shelf-life. The organoleptic evaluation indicated that value added papaya and pineapple jam prepared with incorporation of beet root powder, milk powder, watermelon powder and de-oiled soya meal power at the levels of 2, 3, 10 , 10 per cent and 1, 5, 6 and 8 per cent, respectively were significantly higher over the other variations. Due to value addition there was increase in protein (5.41 g/100g), total minerals (0.73 g/100g), calcium (94.93 mg/100g), iron (7.93 mg/100g) and zinc (2.20 mg/100g) content of papaya jam. The incorporation of nutrient rich ingredients to apple jam was helpful in increasing its nutrient content significantly. There was increase in protein (5.4 g/100g), total minerals (1.41 g/100g), calcium (94.2 mg/100g), iron (16.08 mg/100g) and zinc (2.74 mg/100g) content of pineapple jam. It is concluded that nutrient content can be increased by incorporating nutritious ingredient in both the jams.

Key Words : Jam, Beetroot powder, Deoiled soya meal powder, Milk powder, Watermelon powder

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INTRODUCTION

Fruits are edible products of the perennial higher plants with high water content, soft texture, sweet, sour and semi astringent flavours. In botanical terms, fruit is defined as "a ripened ovary" while in horticultural science it is described as "the plant product, which is edible on ripening" (Peter, 2008). The magnitude of production of fruits in India is increasing year by year. Though India is producing huge amount of fruits, about 25 to 30 per cent produce is wasted because of spoilage due to the perishability of fruits. Post harvest losses occur in fruits, owing to the lack of suitable harvesting equipment, collection centers in major producing areas, suitable packing containers, commercial storage facilities, cold chain and proper transportation systems. Storage losses of fruits in India are high also owing to temperature and humidity conditions.

As the fruits are rich source of protective nutrients wastage of a very huge production of fruits result into loss of protective nutrients. Preservation of fruits by different ways may help to minimize the wastage and ultimately will reduce the nutrient and monitory loss. It is a process of keeping food materials in an altered condition for a long time without impairing their quality to the utmost

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extent, with the objectives to preserve fruits and vegetables at the stage of maximum palatability, taste, colour, flavour, quality and nutritive value; to check wastage of local or seasonal surplus; to make the product available for a longer period even in places where it is not produced (Girdhari Lal and Siddappa, 1959). Fruits can be preserved by preparing jam, jelly, syrup, squash, candy, etc. Among all these preparations jam is one in which maximum pulp of fruit is used. Jams are one of the most popular food products because of their low cost, all year long availability and organoleptic properties (Gakowska *et al.*, 2010). Hence, an attempt was made to develop value added papaya and pineapple jams.

METHODOLOGY

Selection of ingredients for value addition :

As fruit jams are poor source of nutrients except for energy, other ingredients rich in protein, iron, minerals, vitamins and antioxidants were selected for value addition to fruit jams. Hence, the selected ingredients were beet root powder (antioxidant rich), deoiled soya meal powder (DOSM) (protein rich), milk powder (protein and calcium rich) and watermelon powder (iron rich).

Collection and processing of ingredients :

The ingredients such as sugar, citric acid, beet root powder, de-oiled soya meal, milk powder and watermelon powder required for development of value added jam were purchased from local market. The purchased ingredients were cleaned. The fruits were purchased as and when required whereas the dry ingredients such as sugar, citric acid, de-oiled soya meal, milk powder and watermelon powder were purchased and stored in refrigerator. De-oiled soya meal was powdered to a sieve size 40 mesh. Beetroots were purchased, cleaned, cut into slices and were dried in mechanical drier at 56^0 C temperature for 5-6 hours. The dried slices were powdered to sieve size of 40 mesh.

Preparation of fruit jams :

The selected jams were prepared by following standard procedures. Five variations of each jam were prepared for organoleptic evaluation. Variation I was basic recipe which was prepared without incorporation of any ingredient selected for value addition and it served as control. Variations II to V were experimental variations with varying levels of incorporation of selected nutritious ingredients.

Beetroot powder, deoiled soya meal powder, milk powder and watermelon powder were incorporated at different levels in the selected fruit jams. The level of incorporation was 1 to 12 per cent. The major ingredients replaced by selected nutritious ingredients were sugar and fruit pulp in the preparation of jams. The ingredients used and procedures followed for the preparation of selected fruit jams by Gopalan and Mohanram (1996).

Organoleptic evaluation of prepared products :

The organoleptic evaluation of prepared fruit jams was conducted to find out the maximum level of incorporation of selected nutritious ingredients such as beet root powder, de-oiled soya meal powder, milk powder and watermelon powder in the selected fruit jams.

Sensory evaluation of prepared fruit jams :

The fruit jams were prepared with different levels of incorporation of selected nutritious ingredients. All the selected panel members were requested to evaluate the developed fruit jams. The judges were requested to score the recipes for different sensory characters namely colour, texture, taste, flavour and overall acceptability by using Nine point Hedonic scale. Highly accepted variations were selected for nutritional analysis and shelf-life study.

Nutrient analysis of selected fruit jams :

All the selected nutritious ingredients and most accepted variation of all selected fruit jams were subjected to chemical analysis in the laboratory. Various parameters considered for nutrient analysis were moisture, protein, fat, total minerals, fibre, calcium, iron and vitamin C.

Shelf-life study of selected fruit jams :

Highly accepted samples of all selected fruit jams were stored in glass bottles for 90 days at room temperature and refrigeration temperature. The acceptability of stored products was assessed by organoleptic evaluation weekly.

Statistical analysis of data :

The collected data was consolidated, tabulated and analyzed statistically (Panse and Sukhatme, 1985).

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation

as well as relevant discussion have been summarized under following heads :

Organoleptic evaluation of value added papaya jam:

Papaya jam was prepared by incorporating beetroot (2 %), watermelon powder (10%), milk powder (10%) and de-oiled soya meal powder (3%) which was evaluated for sensory characteristics. The related data about sensory scores are given in Table 1.

The mean scores for colour of value added papaya jam varied from 7.1 to 8.3. The basic papaya jam (Variation I) recorded highest score for colour (8.3) and variation IV recorded lowest score (7.1). The scores for texture ranged between 6.9 to 8.2 while the scores for taste ranges between 6.8 to 7.9. Flavour scores ranged from 7.2 to 8.0.

In case of taste, incorporation of 2 per cent beetroot powder, 10 per cent watermelon powder, 10 per cent milk powder and 3 per cent de-oiled soya meal powder was most accepted among experimental variation as it acquired maximum score (8.2) which is more than the score obtained by control sample (7.8).

The maximum score (8.0) for flavour was obtained by the control sample and variation IV had highest score for flavour in which beetroot powder, de-oiled soya meal powder, milk powder and watermelon powder were incorporated at the levels of 2, 3, 10 and 10 per cent, respectively. The statistical analysis of the data showed that there was significant increase in the scores acquired by variation IV for colour, texture, taste and overall acceptability. This data indicated that incorporation of two per cent beetroot powder, 10 per cent each watermelon powder and milk powder and 3 per cent deoiled soya meal powder in papaya jam was well accepted by the panelists.

It is evidenced that variation IV of papaya jam scored significantly highest among the variations. The scores for this variation were higher even than basic variation for all the parameters except for flavour. This finding indicated that incorporation of nutritious ingredients helped to elevate the sensory quality of papaya jam. On the whole, it can be said that addition of beetroot powder, watermelon powder, milk powder and de-oiled soya meal powder in value added papaya jam did not affect sensory qualities. Hence, it is concluded that papaya jam can be improved in nutrient content by designing the composition of recipe.

Organoleptic evaluation of value added pineapple jam :

The mean scores for organoleptic characteristics of pineapple jam prepared without and with varying levels of incorporation of beetroot powder, de-oiled soya meal powder, milk powder and watermelon powder are given in Table 2.

The mean sensory scores for colour of value added pineapple jam for I, II, III, IV and V were 8.0, 8.8, 6.7, 6.7 and 7.0, respectively. Among all the variations pineapple jam prepared by addition of functional ingredients *viz.*, beetroot powder, de-oiled soya meal powder, milk powder and watermelon powder at the level of 1, 5, 6, 8, per cent, respectively got maximum score (8.8). Statistical analysis showed that there was significant difference in the colour of value added pineapple jam prepared with varied levels of ingredients selected for value addition. The highest score (8.6) recorded for texture of value added pineapple jam was for variation II followed by basic variation (8.4). Variation III and IV had the scores 7.1 and 7.0, respectively whereas, variation V had scored 7.2. The statistical difference in the sensory scores of texture was significant.

The organoleptic scores of taste of value added pineapple jam of basic sample and variation II were 8.3

Table 1 : Organoleptic evaluation scores of value added papaya jam

Variations	Level of incorporation (%)				Mean sensory scores				
	Beetroot powder	DOSM	Milk powder	Watermelon powder	Colour	Texture	Taste	Flavour	Overall acceptability
I	0	0	0	0	8.0	7.8	7.8	8.0	7.8
II	1	1	2	5	7.8	7.1	7.9	7.4	7.1
III	1	3	4	9	7.5	7.2	7.3	7.3	7.2
IV	2	3	10	10	8.3	8.2	7.9	7.9	8.2
V	1	9	12	12	7.1	6.9	6.8	7.2	7.0
C.D. (P=0.05)					0.588	0.566	0.513	0.502	0.652
S.E. ±					0.206	0.198	0.180	0.176	0.228
F-value					5.0**	7.4**	6.3**	4.3**	5.14**

** indicates significance of value at P=0.01 NS=Non-significant

and 8.7. Variation III and IV acquired equal score of 7.0. Variation V had the score 7.2. The difference in the scores of taste of pineapple jam was proved to be statistically significant.

The similar trend of sensory scores for the parameters flavour and overall acceptability of basic pineapple jam was noticed (8.4). The incorporation levels of beetroot powder (1 %), milk powder (6 %), de-oiled soya meal powder (5%) and watermelon powder (8%) proved to be better for acceptance by judges. Other levels of incorporation of these ingredients scored relatively less. The statistical comparison of data indicated significant difference in the scores of these two parameters.

It is evidenced from the data regarding the sensory evaluation of value added pineapple jam that the scores allotted for various organoleptic parameters were highest for the variation II which was prepared with ingredients selected for value addition. Hence, it can be concluded that the value addition of pineapple jam by incorporating 1 per cent beet root powder, de-oiled soya meal powder at the level of 5 per cent, 6 per cent milk powder and watermelon powder 8 per cent proved to be successful as the sensory scores given to the samples of value added pineapple jam were more than basic one.

The statistical analysis of the data reveled that the sensory scores of most accepted experimental variations of selected jams were at par with control variations. This finding indicates that very well accepted value added jams can be prepared by incorporating nutritious ingredients.

Alike present study jam was prepared from different varieties of date namely Deglet Nour, Allig and Kentichi and was compared with conventional quince jam. The sensory evaluation indicated that Aling and Kentichi jams were at par with basic quince jam while quince and Deglet Nour jams did not show any significant differences (P > 0.05). The result showed that Aling and Kentichi jams presented a higher overall acceptability (Besbes *et al*., 2009). In another study conducted by Jain *et al.* (2011) organoleptic characters such as colour, flavour, texture, taste, and overall acceptability of guava and papaya fruit pulp blended in different ratios were evaluated

Table 2 : Organoleptic evaluation scores of value added pineapple jam

Variations	Level of incorporation (%)				Mean sensory scores				
	Beetroot powder	DOSM	Milk powder	Watermelon powder	Colour	Texture	Taste	Flavour	Overall acceptability
I	0	0	0	0	8.0	8.4	8.3	8.4	8.4
II	1	5	6	8	8.8	8.6	8.7	8.5	8.7
III	1	2	2	5	6.7	7.1	7.0	6.9	6.9
IV	1	5	12	12	6.7	7.0	7.0	6.7	6.9
V	1	2	5	2	7.0	7.2	7.2	7.4	7.3
C.D. (P=0.05)					0.678	0.777	0.677	0.717	0.707
S.E. ±					0.237	0.272	0.237	0.251	0.248
F-value					15.3**	8.0**	11.4**	11.0**	11.8**

** indicates significance of value at P=0.01 NS=Non-significant

Table 3 : Nutrient content of papaya jam

Nutrients	Basic papaya jam	Value added papaya jam	't' value
	Mean ± SD	Mean ± SD	
Moisture (%)	34.60±3.82	32.21±0.70	1.06 NS
Protein (%)	0.37±0.04	5.77±0.20	48.92**
Fat (%)	0.23±0.317	0.12±0.04	0.62 NS
Total minerals (%)	0.36±0.82	1.77±0.19	290**
Fibre (%)	0.43±0.045	1.32±0.30	4.55*
Carbohydrate (%)	64.01±4.78	58.81±0.40	1.95 NS
Calcium (mg/100g)	15.66±2.17	109.86±82.48	2.01 NS
Iron (mg/100g)	0.34±0.04	16.42±0.28	93.55**
Magnesium	6.56±0.45	6.70±0.12	0.40 NS
Zinc	0.16±0.11	2.90±0.07	67.79**
Vitamin C	2.40±1.04	1.79±1.41	0.50 NS

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant

organoleptically. The results indicated that blending of 40 per cent papaya pulp with guava pulp was well accepted.

Nutrient content of papaya jam :

The values of proximate composition, minerals and vitamin C of papaya jam indicated that protein 5.77 per cent, total minerals 2.45 mg /100 g, fibre 1.32 g /100 g, calcium 109.86 mg /100 g, iron 16.42 mg /100 g, and zinc 2.90 mg /100 g were more in value added papaya jam which was prepared with incorporation of nutritious ingredients *viz.*, beetroot powder, deoiled soya meal powder, milk powder and watermelon powder than the sample of basic papaya jam which contained protein 0.37 g /100 g , total minerals 0.36 mg /100 g , fibre 0.43 g /100 g, calcium 15.66 mg /100 g, iron 0.34 mg /100 g and zinc 0.16 mg /100 g. The contents were significantly increased for protein, total minerals, fibre, calcium, iron, and zinc in value added papaya jam due to addition of beetroot powder (2%), deoiled soya meal powder (3%), milk powder (10%) and watermelon powder (10%). No

Table 4 : Nutrient content of pineapple jam

Nutrients	Basic pineapple jam	Value added pineapple jam	't' value
	Mean ± SD	Mean ± SD	
Moisture (%)	34.40±0.79	31.43±0.61	5.21*
Protein (%)	0.23±0.04	5.64±0.17	44.62**
Fat (%)	0.04±0.01	0.19±0.003	34.71**
Total minerals (%)	0.24±0.03	0.97±0.12	9.72*
Fibre (%)	0.24±0.05	0.45±0.02	6.63*
Carbohydrate (%)	64.85±0.79	61.32±0.49	6.75*
Calcium (mg/100g)	16.00±3.00	110.93±10.80	11.91**
Iron (mg/100g)	1.22±0.05	8.04±0.63	18.68**
Magnesium	15.73±0.80	16.80±0.69	5.41*
Zinc	0.04±0.009	2.24±0.09	42.31**
Vitamin C	0.05±0.04	0.12±0.03	1.70 NS

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant

Table 5 : Effect of storage on shelf-life of value added jams

Sr. No.	Storage periods (days)	Colour (Mean±SD)	Texture (Mean±SD)	Taste (Mean±SD)	Flavour (Mean±SD)	Overall acceptability (Mean±SD)
Refrigerator temperature						
1.	Papaya jam					
	1st day	8.3 ± 0.65	8.2±0.49	7.9±0.0	7.9±0.0	8.2±0.61
	90th day	8.0 ± 0.57	7.5±0.67	7.2±0.41	7.8±0.55	7.6±0.69
	T value	1.18 NS	0.59 NS	4.71**	1.05 NS	0.63 NS
	Papaya jam					
	8.3 ± 0.65	8.2±0.07	7.9±0.51	7.9±0.47	8.2±0.71	8.3 ± 0.65
	7.9±0.31	7.3±0.49	7.3±0.0	7.4±0.5	7.3±0.49	7.9±0.31
	2.48*	5.48**	5.01**	4.91**	4.85**	2.48*
Room temperature						
2.	Pineapple jam					
	1st day	8.8±0.36	8.6±0.49	8.7±0.57	8.5±0.51	8.7±0.44
	90th day	7.4±0.50	7.4±0.50	7.2±0.44	7.4±0.50	7.4±0.51
	t value	10.52**	7.66**	9.00**	7.20**	8.29**
	Pineapple jam					
	8.8±0.37	8.6±0.49	8.7±0.57	8.5±0.51	8.7±0.44	8.8±0.37
	7.2±0.44	7.3±0.47	7.2±0.41	7.2±0.5	7.2±0.41	7.2±0.44
	12.44**	8.55**	9.55**	8.45**	11.15**	12.44**

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant

significant change in the contents of moisture, fat, carbohydrates, magnesium and vitamin C was noticed.

Hence, it can be concluded that, to increase nutrient content of papaya jam with particular reference to protein, total minerals, fibre, calcium, iron and zinc, incorporation of beetroot powder, deoiled soya meal powder, milk powder and watermelon powder can be practiced (Table 3). It resulted in elevation of protein by 5.4 per cent, total minerals by 1.41 per cent, fibre by 0.89 per cent, calcium by 94.2 per cent, iron by 16.08 per cent, and zinc by 2.74 per cent.

Nutrient content of pineapple jam :

The nutritional composition of basic and most accepted pineapple jam (Table 4) showed moisture content 34.40 and 31.43 per cent, protein 0.23 g and 5.64 g/100 g, fat 0.04 g and 0.19 g/100 g, total minerals 0.24 mg and 0.97 mg/100 g, fibre 0.24 g and 0.45 g/100 g, carbohydrate 64.85 g and 61.32 g/100 g, calcium 16.00 mg and 110.93 mg/100 g, iron 1.22 mg and 8.04 mg /100 g, magnesium 15.73 mg and 16.80 mg/100 g, zinc 0.04 mg and 2.24 mg /100 g and vitamin C 0.05 mg and 0.12 mg/100 g. The scrutiny of the data indicates that the values of all the estimated nutrients except for moisture, carbohydrates and vitamin C are significantly higher in the experimental pineapple jam in which value addition is done with beetroot powder (1%), deoiled soya meal powder (5%), milk powder (6%) and watermelon powder (5%). There was significant reduction in moisture and carbohydrate content. These findings conclude that nutrient content of pineapple jam can be increased by using nutrient rich ingredients. There was an elevation of protein by 5.41 per cent, total minerals by 0.73 per cent, fibre by 0.21 per cent, calcium by 94 per cent, iron by 6.82 per cent and zinc by 2.2 per cent due to value addition.

The data with regard to nutrient content of developed value added jams inferred that the fruit jams prepared with incorporation of selected nutrient rich ingredients showed increase in nutrients over the basic ones. This may be due to reason that the ingredients selected for value addition were rich in protein, total minerals, fibre, calcium, ion, magnesium and zinc. Hence, it seems to be simple and successful technology to improve the essential nutrient content with special reference to protein, total minerals, fibre, calcium, iron and zinc.

The findings of the present investigation are in line with the results produced by Ahmed *et al.* (2011) who prepared jam from sapota (*Achras zapota*). The proximate analysis of sapota pulp showed moisture 70.07 per cent, ascorbic acid 8.90 per cent, pH 5.10, TSS 19.4 per cent and total sugar 16.07 per cent. Proximate analysis of the black-plum fruit jam was also studied by Ajenifujah-Solebo and Aina (2011). The nutrient values reported were crude protein 4.23 per cent, crude fibre 1.0 per cent, ash 4.30 per cent, crude lipid 2.43 per cent, carbohydrate 68.1 per cent, sodium 0.28 per cent, potassium 1.42 per cent, calcium 0.97 per cent, moisture 21.65 per cent, dry matter 78.36 per cent. These value are less than value added jams developed in present investigation. It may be because only one fruit pulp was used for preparation of jam.

Eke-Ejiofor and Owano (2013) found that protein content ranged from 0.19-1.12 per cent, ash from 0.27-1.50 per cent, vitamin C from 0.0037-0.0099 mg, total acid from 0.054-0.313 in jack fruit jam. In another study conducted by Shahnawaz *et al*. (2009) it is reported that the studied products of jamun fruits (jam, squash, ready to drink juice, seed powder and pulp powder) had good nutritive values and were quite rich in carbohydrates, protein, ash, crude fibres but were not sufficient in fat composition.

Shelf-life study of developed value added fruit jams:

The mean sensory scores of various organoleptic parameters indicated that there was similar trend in the observations of two types of jams developed under the study. The organoleptic scores of all the sensory attributes *viz.*, colour, texture, taste, flavour and overall acceptability decreased at the end of the storage period. From the data regarding shelf-life of developed value added jams it can be concluded that the prepared value added jams can be stored for 90 days at room temperature and for more than 90 days at refrigerator temperature as they were very well accepted at the end of the storage period (Table 5).

Conclusion :

Accepted value added jams can be prepared by incorporating nutritious ingredients. It is a simple and successful technology to improve the essential nutrient content with special reference to protein, total minerals, fibre, calcium, iron and zinc. The developed value added jams can be stored for 90 days.

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