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Development of value added fruit jams

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Fruits can be preserved by preparing jam, jelly, 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. Hence, an attempt was made to develop value added fruit jams. Amala and apple jam 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 amala and apple jam prepared with incorporation of beet root powder, milk powder, watermelon powder and de-oiled soya meal power at the levels of 1, 8, 6 , 5 per cent and 1, 12, 12 and 9 per cent, respectively were significantly higher over the other variations. Due to value addition there was increase in protein (5.85 g/100g), total minerals (0.71 g/100g), calcium (111.5 mg/100g), iron (7.93 mg/100g) and zinc (1.37 mg/100g) content of amala jam. The incorporation of nutrient rich ingredients to apple jam was helpful in increasing its nutrient content significantly. There was increase in protein (10.36 g/100g), total minerals (1.35 g/100g), fibre (0.49g/100g) calcium (175.73 mg/100g), iron (16.68 mg/100g) and zinc (3.57 mg/100g) content of apple 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

An apple a day, keeps the doctor away' is a well known phrase indicating significance of fruits in human diet. The word fruit is derived from the Latin word "*fructus*" means to enjoy the produce (Coombe, 1976). Fruits are inseparable part of human diet. Man has kept these commodities in his diet to provide variety, taste, interest, aesthetic appeal and to meet certain nutritional requirements. Historically, jams and jellies may have originated as an early effort to preserve fruit for consumption in the off-season. As sugar for their manufacture became more affordable, the popularity and availability of these fruit products increased (Anonymous, 1983). 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 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 (Lal and Siddappa, 1959). The jam preparations require the natural pectin

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present in the fruit itself or commercial pectin as a gelling agent (Madhav and Pushpalatha, 2002). There is ample scope to enhance nutritional value of jam both quantitatively and qualitatively by the process of value addition with nutritious food ingredients. 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). Therefore, the present investigation is planned to develop value added jams to study the nutritive value, sensory evaluation and storage study.

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. The methods used for estimation of these components are given in.

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 amala jam:

The mean scores for organoleptic characteristic of value added amala jam prepared without and with incorporation of varying levels of beet root powder, de-oiled soya meal power,milk powder and watermelon powder are given in Table 1.

Value added amala jam was prepared incorporating four different proportions of selected functional ingredients apart from basic recipe. The prepared jam samples were evaluated to assess the acceptability. The sensory scores of colour, texture, taste except flavour were highest (8.8, 8.8, 8.7 and 8.8, respectively) for variation V where in there was value addition. The sensory scores for these parameters of value added amala jam prepared with incorporation of beet root powder, de-oiled soya meal power milk powder, watermelon powder and at the levels of 1, 5, 8 and 6 per cent, respectively were significantly higher over the other variations.The calculated 'F' values indicated that the sensory scores of all the parameters were significant at 1 per cent level of significance.

It can be concluded that the highly acceptable value added amala jam can be prepared by incorporating beet root powder, de-oiled soya meal power, milk powder and watermelon powder.

Organoleptic evaluation of value added apple jam:

Value added apple jam was prepared by incorporating beet root powder, milk powder, de-oiled soya meal powder watermelon powder at different levels such as variation I (1, 4, 5,8); variation II (1, 9,12, 12); variation III (1, 6, 9, 10) and variation IV (2, 4, 6, 6) per cent, respectively. The prepared apple jams were evaluated for various sensory characteristics. The data which gives clear idea about sensory scores of apple jam is presented in Table 2.

The sensory scores for colour of apple jam for studied variations varied from 7.3 to 7.8. The apple jam prepared without incorporation of any other ingredients than basic ones and the variation III recorded highest score (7.8) for colour. Minimum score (7.8) was obtained by apple jam with 1, 4, 5, and 8 per cent addition of beet root powder, de-oiled soya meal powder, milk powder and watermelon powder, respectively. Statistical analysis showed that the difference in the score of colour was significant. The mean scores for texture obtained by apple jam for variation I, II, III, IV and V were 8.0, 7.1, 8.1, 7.2, and 7.4, respectively.

Significantly highest (8.1) score for texture was obtained by variation III whereas significantly lower score (7.1) was acquired by variation II (7.1) The score allotted for basic variation (first variation) and III experimental variation were at par.

The highest score of taste of value added apple jam was 8.5 which was given to variation III. The minimum score of 6.9 was allotted to variation II. The statistical analysis of data revealed that there was significant different in scores of taste of value added apple jam. There was significant increase in the score of taste with incorporation of 1 per cent beetroot powder, 12 per cent each watermelon powder and milk powder and 9 per cent of DOSM.

The organoleptic evaluation with regard to flavour of value added apple jam indicated that highest score (7.9) was given to variation III followed by basic variation (7.8). The minimum score (7.1) was secured by variation II. There was statistically significant difference in the scores of experimental variations whereas the score for flavour of basic variation (I) and variation III where at par.

Overall acceptability scores ranged between 7.0 and 8.2 like other sensory parameters the significantly highest score (8.2) was acquired by variation III. Overall acceptability score of basic variation was at par with variation III.

On the whole, it can be said that addition of beetroot powder, deoiled soya meal powder,milk powder and watermelon powder at the rate of 1, 9, 12 and 12 per cent, respectively in apple jam exhibited better acceptability than other variations. Hence, such combination of ingredients for preparation of value added apple jam stands better.

Nutrient content of amala jam :

The proximate composition, minerals and vitamin C content of amala jam prepared with and without incorporation of nutrient rich ingredients is given in Table 3.

The values for basic and value added amala jam were moisture 34.87 and 30.33 per cent, protein 0.38 and 6.23 per cent, fat 0.45and 0.71 per cent, total minerals 0.26 and 0.97 per cent, fibre 2.06 and 1.1 per cent,

carbohydrate 62.98 and 60.67 per cent, calcium 28.73 mg and 140.23 mg /100 g, iron 0.66 mg and 8.59 mg /100 g, magnesium 0.96 mg and 1.10 mg /100 g, zinc 1.76 mg and 3.13 mg /100 g and vitamin C 54 mg and 51.13 mg / 100 g. It can be noticed that the values were significantly increased for protein, total minerals, fibre, calcium, iron, magnesium and zinc content in value added amala jam prepared with 1 : 5 : 8 : 6 per cent level of beetroot powder, deoiled soya meal powder, milk powder and watermelon powder, respectively whereas, there was no significant change in the contents of moisture, fat, carbohydrates and vitamin C.

On the whole, it can be said that incorporation of beetroot powder, deoiled soya meal powder, milk powder and watermelon powder to amala jam could help to elevate the protein (5.85 %), total minerals (0.71%), calcium (111.5 %), iron (7.93 %) and zinc (1.37 %) content.

Nutrient content of apple jam :

The nutrient content of apple jam prepared with and

Table 1 : Organoleptic evaluation of value added amala jam

Variations	Level of incorporation (%)				Mean sensory scores				
	Beet root powder	DOSM	Milk powder	Watermelon powder	Colour	Texture	Taste	Flavour	Overall acceptability
I	0	0	0	0	8.6	8.6	8.7	8.3	8.6
II	1	6	5	8	7.4	7.5	7.3	7.3	7.2
III	2	6	10	12	7.7	6.8	6.8	6.7	6.7
IV	1	2	2	5	7.0	6.8	7.0	7.2	6.9
V	1	5	8	6	8.8	8.8	8.7	8.3	8.8
C.D. (P=0.05)					0.509	0.637	0.550	0.512	0.566
S.E. ±					0.178	0.223	0.193	0.179	0.198
F-value					18.4**	18.9**	23.4**	15.5**	24.7**

** indicates signification of value at P=0.01

Table 2 : Organoleptic evaluation of value added apple jam

Variations	Level of incorporation (%)				Mean sensory scores				
	Beet root powder	DOSM	Milk powder	Watermelon powder	Colour	Texture	Taste	Flavour	Overall acceptability
I	0	0	0	0	7.8	8.0	8.1	7.8	8.1
II	1	4	5	8	7.3	7.1	6.9	7.1	7.0
III	1	9	12	12	7.8	8.1	8.5	7.9	8.2
IV	1	6	9	10	7.5	7.2	7.4	7.3	7.1
V	2	4	6	6	7.6	7.4	7.2	7.5	7.3
C.D. (P=0.05)					0.266	0.331	0.327	0.263	0.313
S.E. ±					0.093	0.116	0.114	0.092	0.109
F-value					4.9**	14.8**	32.5**	13.6**	26.9**

** indicates significance of value at P=0.01

Table 3 : Nutrient content of amala jam

Nutrients	Basic amala jam	Value added amala jam	't' value
	Mean ± SD	Mean ± SD	
Moisture (%)	34.87 ± 3.28	30.33 ± 1.42	2.20^{NS}
Protein (%)	0.38 ± 0.07	6.23 ± 0.26	29.86**
Fat (%)	0.45 ± 0.42	0.71 ± 0.03	1.01^{NS}
Total minerals (%)	0.26 ± 0.04	0.97 ± 0.03	59.63**
Fibre (%)	1.06 ± 0.04	1.09 ± 0.08	3.00^{NS}
Carbohydrate (%)	62.98 ± 4.11	60.67 ± 1.34	0.92^{NS}
Calcium (mg/100g)	28.73 ± 6.98	140.23 ± 5.80	91.35**
Iron (mg/100g)	0.66 ± 0.02	8.59 ± 0.18	70.15**
Magnesium	0.96 ± 0.05	1.10 ± 0.10	4.93*
Zinc	1.76 ± 0.41	3.13 ± 0.14	4.16**
Vitamin C	54.0 ± 5.56	51.13 ± 2.14	0.94^{NS}

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

without incorporation of beetroot powder, deoiled soya meal powder, milk powder and watermelon powder is presented in Table 4.

The moisture, protein, fat, total mineral, fibre, carbohydrate, calcium, iron, magnesium, zinc and vitamin C content of control and most accepted apple jam prepared with incorporation of beetroot powder, deoiled soya meal powder, milk powder and watermelon powder were 35.65 and 34.60 per cent, 0.16 g and 10.52 g /100 g, 0.26 g and 0.55 g /100 g, 0.22 mg and 1.57 mg /100 g, 0.43 g and 0.92 g /100 g, 63.28 g and 51.84 g /100 g, 9.60 mg and 185.33 mg /100 g, 0.45 mg and 17.13 mg / 100 g, 4.64 mg and 2.30mg /100 g, 0.03 mg and 3.60 mg /100 g, 0.63 mg and 0.32 mg /100 g, respectively. From the results it can be inferred that there was significant increase in the contents of protein, total minerals, fibre, calcium, iron, magnesium and zinc and significant decrease in moisture and vitamin C content in value added amala jam which was prepared with incorporation of nutrient rich ingredients.

The incorporation of nutrient rich ingredients to apple jam was helpful in increasing its nutrient content

Table 4 : Nutrient content of apple jam

Nutrients	Basic apple jam	Value added apple jam	't' value
	Mean ± SD	Mean ± SD	
Moisture (%)	35.65 ± 3.49	34.60±0.41	0.51 NS
Protein (%)	0.16 ± 0.04	10.52±0.49	34.02**
Fat (%)	0.26 ± 0.07	0.55±0.07	10.75**
Total minerals (%)	0.22 ± 0.06	1.57±0.13	11.64**
Fibre (%)	0.43 ± 0.15	0.92±0.03	6.001*
Carbohydrate (%)	63.28 ± 4.15	51.84±0.31	4.76*
Calcium (mg/100g)	9.60 ± 1.08	185.33±7.09	37.57**
Iron (mg/100g)	0.45± 0.03	17.13±0.10	21.22**
Magnesium	4.64 ± 0.41	2.30±0.17	13.06**
Zinc	0.03±0.003	3.60±0.26	23.51**
Vitamin C	0.63±0.15	0.32±0.04	4.51*

* 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						
Amala jam						
1.	1st day	8.8±0.76	8.8±0.81	8.7±0.64	8.3±0.49	8.8±0.41
2.	90th day	7.94±0.80	8.0±0.44	7.91±0.80	7.8±0.68	8.1±0.84
3.	t value	0.68NS	1.36NS	1.09NS	2.556*	3.35**
Apple jam						
4.	1st day	7.8±0.41	8.1±0.31	8.5±0.51	7.9±0.72	8.2±0.64
5.	90th day	7.4±0.5	7.6±0.58	7.8±0.48	7.2±0.44	7.7±0.66
6.	t value	2.76**	3.33**	4.15**	3.44**	0.82NS
Room temperature						
Amala jam						
7.	8.8±0.41	8.8±0.41	8.8±0.41	8.8±0.41	8.8±0.41	8.8±0.41
8.	72±0.41	72±0.41	72±0.41	72±0.41	72±0.41	72±0.41
9.	12.34**	12.34**	12.34**	12.34**	12.34**	12.34**
Apple jam						
10.	7.8±0.41	7.8±0.41	7.8±0.41	7.8±0.41	7.8±0.41	7.8±0.41
11.	7.3± 0.49	7.3± 0.49	7.3± 0.49	7.3± 0.49	7.3± 0.49	7.3± 0.49
12.	3.40**	3.40**	3.40**	3.40**	3.40**	3.40**

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

significantly. There was increase in protein (10.36 %), total minerals (1.35%), fibre (0.49%) calcium (175.73 %), iron (16.68 %) and zinc (3.57 %) content of apple jam.

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).

Shahnawaz *et al*. (2009) observed that nutritional values varied at different packaging and storage temperature. The glass package among the packages and refrigerator temperature among the storage temperatures showed good results in terms of retaining good quality nutritive values and extensive shelf-life of the products.

Conclusion :

Very well 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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