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RESEARCH PAPER

Studies on standardization of pulp proportion for banana - pineapple blended jam during storage

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SUMMARY :

The present study deals with preparation of blended jam using banana (*Musa paradisiaca* L.) cv. Grand Naine and pineapple (*Annanas comosus*) cv. Queen pulps were mixed in proportions as per treatments and processed into jams in Complete Randomized Design with four repetitions. Physico-chemical as well as organoleptic properties of blended jam were compared with sole banana and pineapple jam. The jams were studied at an interval of two months up to 12 months *i.e.* 0, 2, 4, 6, 8, 10 and 12 months of storage period. An overall results of jam prepared from banana:pineapple, 25:75 as well as 50:50 proportions were equally best in higher level of chemical constituents *viz.*, total soluble solids, total sugars and reducing sugars with lower level of non reducing sugars. While proportion of 0:100 and 25:75 were highest in respect to acidity and ascorbic acid content. All chemical constituents were found increasing up to 12 months except non reducing sugars and ascorbic acid which were decreasing with storage period. The lowest retention was found in sole banana jam. In respect to sensory characters banana:pineapple, 25:75 proportion was found best having higher score pertaining to colour, taste and overall acceptability except texture and flavour which was found best in proportion of 50:50 and 0:100. All sensory characters were found decreasing during storage. The lowest acceptability was found in sole banana jam in respect to all sensory parameters. Considering above chemical constituents as well as sensory characters of the product; proportion of 25:75 and 50:50 were found best than rest of the proportions of jam during storage.

KEY WORDS : Banana, Pineapple, Blended, Jam, Storage

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Banana (*Musa paradisiaca* L.), a fruit of tropics is one of the most important fruit crops of the world as well as India which belongs to family Musaceae. It stands first in production and second in area among the fruit crops grown in India with a production of 29780 thousand MT annually from an area of 830.5 thousand hectares (Anonymous, 2011). The compositions of banana fruit contents are (per 100g of edible portion) water 75 per cent, energy 85 Kcal/mg, protein 1.1 per cent, fat 0.2 per cent and carbohydrate 12.6 per cent. The mineral contents are calcium 8 mg, phosphorus 26 mg, iron 0.7 mg and magnesium 33 mg. Moreover, the vitamin contents are vitamin A 190 IU, thiamine 0.05 mg, nicotinic acid 0.7 mg and ascorbic acid 10 mg (Chundawat and Sen, 2002). Banana is available throughout the year in the growing areas, its short shelf life necessitates its conversion into various value added products *viz.*, banana puree, powder, wafers, flour, wine, figs, jam, canned slices, dehydrated banana slices, flakes, vinegar, ketchup, chutneys, pickles, beverages and fruit bar etc.

It is observed that instead of sole fruit products, the blended products with single as well as two or more fruits have

more preferred by consumers. The innovative value added blended products are definitely increasing the qualitative, sensory and nutritional value. The pineapple is one of the commercial fruit crop of tropical world which is available throughout the year. India produced about 1415 thousand MT of pineapple fruits from 89 thousand hectare area and has a share of 8 per cent in total world production (Anonymous, 2011). Pineapple fruits have characteristic pleasant flavour, distinct aroma, attractive golden yellow colour, exquisite sugar acid blend taste and absence of seeds, which qualifies it as one of the choicest fruit throughout the world.

Looking to the composition of pineapple fruit contents are (per 100g of edible portion) water 85.4 per cent, energy 52 Kcal/ mg, protein 0.4 per cent, fat 0.2 per cent and carbohydrate 13.7 per cent. The mineral contents are calcium 18 mg, phosphorus 8 mg, iron 0.5 mg and the vitamins contents are vitamin B 15 IU, thiamine 0.08 mg, riboflavin 0.04 mg, nicotinic acid 0.2 mg and ascorbic acid 61 mg (Chundawat and Sen, 2002). Pineapple fruits are mainly consumed as fresh or canned slices. Fruits are also processed into products such as juice, syrup, jam, jelly, squash, RTS beverages and dehydrated slices (Man *et al.,* 2007). Pineapple slices and pineapple juice has a major share among the different forms of processing (Shrinivasan *et al.,* 1977).

In Gujarat, Grand Naine is commercial cultivar of banana which gives higher quality production. Recently people are utilizing jam with bread in breakfast. Considering the nutritional as well as organoleptic value of banana, it was decided to blended with pineapple with comparative study of sole banana and pineapple jam during storage. Keeping these in view, a study was conducted to observe the changes in chemical and organoleptic parameters, standardize proportion and shelf life of banana-pineapple blended jam during storage.

EXPERIMENTAL METHODS

The experiment was conducted at the Post Graduate and Post harvest technology laboratory of the Department of Horticulture, N.M. College of Agriculture, Navsari Agricultural University, Navsari. Selecting uniform sized banana fruits of cv. Grand Naine were collected from Fruit Research Station, Navsari Agricultural University, Gandevi and fully matured ripe pineapple fruits of cv. Queen were collected from local market of Navsari District, Gujarat and brought to the laboratory for experimentation. The experiment was conducted in Complete Randomized Design with four repetitions during the year 2010 and 2011 processed from *Rabi* season fruits.

Banana fruits were peeled by hand and cut into small pieces after removing central portion. Pulp was prepared by homogenized the fruit pieces in blender. Whereas, pineapple fruits were peeled very carefully with sharp stainless steel knife, cut into four halves and central fibrous portion was removed. Then it was homogenized in blender. Clear fruit pulp was obtained by squeezing the fruit pulp through muslin cloth. The jams were prepared as per method described by Lal *et al.* (1986).

Table A : Treatment details under experimentation

Treatments	Blending ratio (Banana:Pineapple)	pulp: sugar ratio	TSS ^{0}Brix	Acidity (%)	Pectin (%)
T_1	25 : 75	1:1	68.5	0.6	0.5
T_2	50 : 50	1:1	68.5	0.6	0.5
T_3	75 : 25	1:1	68.5	0.6	0.5
T_4	100 : 0	1:1	68.5	0.6	0.5
T_5	0 : 100	1:1	68.5	0.6	0.5

The processed products were periodically observed up to 12 months *i.e.* January 2010 and 2011. The products were subsequently used for chemical as well as organoleptic evaluation for a period of 0, 2, 4, 6, 8, 10 and 12 months of storage. Different proportions of jams were analysed for different biochmical parameters *viz.*, TSS (^{0} Brix), titrable acidity (%), ascorbic acid (mg/100 g), total sugars (%), reducing sugars (%) and non reducing sugars (%) according to the procedure described by Ranganna, (1986). The sensory parameters *viz.*, colour, texture, taste, flavour and overall acceptability based on 9 point hedonic scale (Amerine *et al.,* 1965). The data obtained were statistically analysed as per Panse and Sukhatme (1967).

EXPERIMENTAL FINDINGS AND ANALYSIS

It was observed from Table 1, biochemical changes during storage, an overall TSS (^{0}B) of jam was found maximum in T_1 (banana:pineapple, 25:75) which was at par with T_2 (banana:pineapple, 50:50) and the minimum in T_4 (banana:pineapple, 100:0). It was increased rapidly up to 12 months during storage. This pattern of increasing of TSS (^{0}B) during storage might be due to partial hydrolysis of complex polysaccharide and solubilization of pulp constituents during storage. These results are in conformity with the earlier findings by Sawant *et al.* (2009) in kokam + pineapple blended jam and Priya *et al.* (2010) in mixed fruit jam.

An overall acidity (%) of jam (Table 2) was found maximum in T_5 (banana:pineapple, 0:100) which was at par with T_1 (banana:pineapple, 25:75) and the significantly lowest in T_4 (banana:pineapple, 100:0). It was increased rapidly up to 12 months during storage. This pattern of increasing of acidity (%) during storage might be due to formation of organic acids by ascorbic acid degradation and de-esterification of protein molecules. These findings are in accordance with results obtained by Prasad and Mali (2006) in ber jam and Shakir *et al.* (2008) in apple and pear mixed fruit jam.

An overall ascorbic acid (mg/100g) of jam (Table 3) was found highest in T_5 (banana:pineapple, 0:100) which was at

par with T_1 (banana:pineapple, 25:75) and significantly lowest in T_4 (banana:pineapple, 100:0). It was decreasing rapidly up to 12 months during storage. This pattern of decreasing of ascorbic acid (mg/100g) during storage might be due to increase in temperature level which affect the ascorbic acid due to its thermolabile nature, which was destroyed with temperature during storage period. Moreover, it may probably due to the process of oxidation of ascorbic acid into dehydroascorbic acid by enzyme ascorbinase. This kind of observations were also recorded by Shakir *et al.* (2008) in apple and pear mixed fruit jam and Sawant *et al.* (2009) in kokam + pineapple blended jam.

An overall total sugars (%) of jam (Table 4) was found highest in T_1 (banana:pineapple, 25:75) which was at par with T_2 (banana:pineapple, 50:50) and significantly lowest in T_4 (banana:pineapple, 100:0). It was increasing rapidly up to 12 months during storage. This pattern of increasing of total sugars (%) during storage might be due to the breakdown of insoluble polysaccharides into simple sugars by solubilization of juice constituents during storage and hydrolysis of

Table 1: Changes in TSS (^{0}B) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	68.59	69.03	69.51	69.56	69.66	69.71	69.76	69.40
T_2 (50:50)	68.26	68.98	69.15	69.21	69.30	69.32	69.46	69.10
T_3 (75:25)	68.21	68.28	68.45	68.49	68.60	68.68	68.78	68.50
T_4 (100:0)	68.00	68.05	68.08	68.13	68.17	68.21	68.26	68.13
T_5 (0:100)	68.09	68.15	68.35	68.41	68.49	68.61	68.69	68.40
Mean	68.23	68.50	68.71	68.76	68.84	68.91	68.99	
S. E. ±	0.15	0.15	0.22	0.20	0.23	0.21	0.15	
C.D. (P=0.05)	NS	0.43	0.64	0.57	0.66	0.61	0.43	
CV %	0.64	0.65	0.94	0.84	0.97	0.89	0.61	

NS=Non-significant

Table 2: Changes in titrable acidity (%) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	0.602	0.615	0.620	0.624	0.630	0.638	0.639	0.624
T_2 (50:50)	0.601	0.611	0.616	0.620	0.624	0.632	0.633	0.620
T_3 (75:25)	0.601	0.609	0.614	0.617	0.621	0.625	0.630	0.617
T_4 (100:0)	0.601	0.606	0.610	0.612	0.617	0.620	0.626	0.613
T_5 (0:100)	0.602	0.618	0.621	0.625	0.632	0.639	0.641	0.625
Mean	0.601	0.612	0.616	0.620	0.625	0.631	0.634	
S. Em. ±	0.0002	0.0008	0.0008	0.0008	0.0007	0.0011	0.0008	
C.D. (P=0.05)	NS	0.002	0.002	0.002	0.002	0.004	0.002	
CV %	0.09	0.32	0.38	0.39	0.33	0.20	0.35	

Table 3: Changes in ascorbic acid (mg/100 g) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	22.73	19.69	16.73	15.74	14.80	12.78	12.72	16.46
T_2 (50:50)	21.19	18.67	15.67	14.65	13.76	11.71	11.61	15.32
T_3 (75:25)	20.88	17.88	14.90	13.80	12.86	11.64	11.08	14.72
T_4 (100:0)	8.74	8.69	7.75	6.78	5.77	4.82	3.84	6.63
T_5 (0:100)	22.77	19.74	16.77	15.78	14.87	12.87	12.79	16.51
Mean	19.26	16.94	14.36	13.35	12.41	10.76	10.41	
S. Em. ±	0.13	0.07	0.06	0.07	0.05	0.06	0.05	
C.D. (P=0.05)	0.37	0.20	0.18	0.19	0.15	0.16	0.15	
CV %	2.01	1.19	1.33	1.44	1.22	1.56	1.44	

polysaccharides including pectin, starch, heating process for concentration and higher temperature of ambient storage condition lead to increase in total sugars in jam. Such identical increase in total sugars in various products had been reported by Sawant *et al.* (2009) in kokam + pineapple blended jam and Relekar *et al.* (2011) in sapota jam.

An overall reducing sugars (%) of jam (Table 5) was found maximum in T_1 (banana:pineapple, 25:75) which was at par with T_2 (banana:pineapple, 50:50) and significantly lowest in T_4 (banana:pineapple, 100:0). It was increasing rapidly up to 12 months during storage. This pattern of increasing of reducing sugars (%) during storage might be due to the enhanced acid hydrolysis of polysaccharides and inversion of non-reducing sugars to reducing sugars. This can be attributed to partial acid hydrolysis of starch and disaccharide of pulp into invert sugars and also inversion part of non-reducing sugars into glucose and fructose. Such identical observation on increase in reducing sugars were also recorded by Sawant *et al.* (2009) in kokam + pineapple blended jam and Relekar *et al.* (2011) in sapota jam.

Table 4: Changes in total sugars (%) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	62.47	64.75	66.61	68.41	69.29	69.66	69.71	67.27
T_2 (50:50)	61.69	64.21	65.79	67.54	68.77	69.12	69.33	66.63
T_3 (75:25)	52.81	53.43	54.56	56.07	56.56	56.79	56.81	55.29
T_4 (100:0)	44.51	46.85	47.19	47.56	47.95	48.23	48.29	47.23
T_5 (0:100)	52.07	52.48	53.45	54.49	55.58	55.70	55.86	54.23
Mean	54.71	56.34	57.52	58.81	59.63	59.90	60.00	
S. Em. ±	0.33	0.37	0.38	0.37	0.38	0.33	0.39	
C.D. (P=0.05)	0.94	1.06	1.09	1.07	1.09	0.94	1.11	
CV %	1.76	1.83	1.91	1.76	1.83	1.51	1.88	

Table 5: Changes in reducing sugars (%) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	47.05	49.51	52.41	55.14	56.24	56.73	56.81	53.41
T_2 (50:50)	46.03	48.95	51.34	54.25	55.69	56.13	56.39	52.68
T_3 (75:25)	36.21	37.05	39.17	41.66	42.30	42.72	42.89	40.28
T_4 (100:0)	25.98	28.53	29.87	31.19	31.74	32.29	32.38	30.28
T_5 (0:100)	34.71	35.29	37.29	39.30	40.52	40.77	40.99	38.41
Mean	38.00	39.87	42.02	44.31	45.30	45.73	45.89	
S. Em. ±	0.33	0.38	0.36	0.37	0.38	0.31	0.39	
C.D. (P=0.05)	0.94	1.09	1.05	1.05	1.08	0.89	1.13	
CV %	2.51	2.68	2.50	2.28	2.40	1.86	2.50	

Table 6: Changes in non reducing sugars (%) of banana and pineapple blended jam during storage

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	15.43	15.23	14.20	13.26	13.05	12.93	12.90	13.86
T_2 (50:50)	15.66	15.25	14.45	13.28	13.08	12.98	12.95	13.95
T_3 (75:25)	16.60	16.38	15.40	14.41	14.26	14.07	13.93	15.01
T_4 (100:0)	18.53	18.32	17.32	16.37	16.21	15.95	15.91	16.94
T_5 (0:100)	17.37	17.18	16.17	15.19	15.06	14.93	14.88	15.83
Mean	16.72	16.47	15.51	14.50	14.33	14.17	14.11	
S. Em. ±	0.06	0.06	0.07	0.06	0.06	0.05	0.04	
C.D. (P=0.05)	0.16	0.16	0.21	0.18	0.18	0.15	0.12	
CV %	1.01	1.01	1.45	1.31	1.29	1.10	0.87	

An overall non reducing sugars (%) of jam (Table 6) was found significantly highest in T_4 (banana:pineapple, 100:0) which was followed by T_5 (banana:pineapple, 0:100) and lowest in T_1 (banana:pineapple, 25:75). It was decreasing rapidly up to 12 months during storage. This pattern of decreasing of non reducing sugars (%) during storage might be due to the hydrolysis of polysaccharides and inversion of non reducing into reducing sugars. This can be attributed to partial acid hydrolysis of starch and disaccharide of pulp into invert sugars and also inversion part of non-reducing sugars into glucose and fructose. This result is more or less similar to the study by Mulla (2007) in mixed fruit jam and Shakir *et al.* (2008) in apple and pear mixed fruit jam.

An overall colour acceptability score (out of 9 points) of jam (Table 7) was found highest in T_1 (Banana:Pineapple, 25:75) which was at par with T_5 (Banana:Pineapple, 0:100) due to the maximum concentration of pineapple pulp that have golden yellowish colour and significantly lowest in T_4 (Banana:Pineapple, 100:0). Whereas, it showed decreasing trend during the storage period due to the increased rate of

Table 7: Changes in sensory score for colour of banana and pineapple blended jam during storage (out of 9 point hedonic scale)

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	8.16	8.14	8.12	8.11	8.08	8.06	8.04	8.10
T_2 (50:50)	7.40	7.36	7.33	7.32	7.30	7.28	7.25	7.32
T_3 (75:25)	6.47	6.46	6.43	6.42	6.40	6.38	6.35	6.41
T_4 (100:0)	6.23	6.22	6.19	6.18	6.17	6.10	6.07	6.17
T_5 (0:100)	8.06	8.04	8.03	8.01	7.99	7.97	7.95	8.01
Mean	7.26	7.24	7.22	7.21	7.19	7.16	7.13	
S. Em. ±	0.06	0.06	0.05	0.06	0.06	0.06	0.06	
C.D. (P=0.05)	0.16	0.16	0.15	0.16	0.18	0.17	0.18	
CV %	2.23	2.22	2.04	2.22	2.56	2.34	2.57	

Table 8: Changes in sensory score for texture of banana and pineapple blended jam during storage (out of 9 point hedonic scale)

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	8.08	8.06	8.05	8.03	8.00	7.97	7.94	8.02
T_2 (50:50)	8.15	8.13	8.12	8.10	8.07	8.06	8.04	8.09
T_3 (75:25)	7.77	7.73	7.70	7.68	7.65	7.63	7.59	7.68
T_4 (100:0)	6.21	6.19	6.17	6.15	6.12	6.11	6.08	6.15
T_5 (0:100)	7.42	7.37	7.35	7.32	7.29	7.27	7.25	7.32
Mean	7.52	7.50	7.48	7.45	7.43	7.41	7.38	
S. Em. ±	0.06	0.06	0.05	0.06	0.05	0.06	0.06	
C.D. (P=0.05)	0.17	0.18	0.16	0.16	0.15	0.16	0.18	
CV %	2.26	2.43	2.13	2.18	2.04	2.22	2.53	

Table 9: Changes in sensory score for taste of banana and pineapple blended jam during storage (out of 9 point hedonic scale)

Treatments (Banana : Pineapple)	Storage period (Months)							
	0	2	4	6	8	10	12	Mean
T_1 (25:75)	8.19	8.16	8.13	8.09	8.05	8.01	7.99	8.09
T_2 (50:50)	7.42	7.37	7.32	7.30	7.27	7.24	7.21	7.30
T_3 (75:25)	6.48	6.45	6.42	6.40	6.38	6.35	6.33	6.40
T_4 (100:0)	6.22	6.20	6.18	6.15	6.12	6.10	6.07	6.15
T_5 (0:100)	8.11	8.08	8.06	8.04	8.01	7.98	7.95	8.03
Mean	7.28	7.25	7.22	7.19	7.17	7.14	7.11	
S. Em. ±	0.06	0.05	0.06	0.06	0.05	0.06	0.07	
C.D. (P=0.05)	0.17	0.14	0.16	0.16	0.15	0.16	0.19	
CV %	2.23	1.87	2.22	2.25	2.17	2.25	2.72	

oxidation of phenolic compounds and organic acids, which was responsible for increase the production of black compounds resulting in browning of product. These observations were also similar to finding of Shakir *et al.* (2008) in apple and pear mixed fruit jam and Priya *et al.* (2010) in mixed fruit jam.

An overall texture score (out of 9 points) of jam (Table 8) was found highest in T2 (Banana:Pineapple, 50:50) which was at par with T1 (Banana:Pineapple, 25:75) due to blending effect of both fruits were responsible for gelling and firming of softened finished product. and significantly lowest in T4 (Banana:Pineapple, 100:0). Whereas, it showed decreasing trend during the storage period due to the adverse effect of atmospheric temperature and moisture. Similar observation were found by Priya *et al.* (2010) in mixed fruit jam and Relekar *et al.* (2011) in sapota jam.

An overall taste score (out of 9 points) of jam (Table 9) was found maximum in T_1 (Banana:Pineapple, 25:75) which was at par with T_5 (Banana:Pineapple, 0:100) and significantly lowest in T_4 (Banana:Pineapple, 100:0). Whereas, it showed decreasing trend during the storage period due to the adverse effect of atmospheric moisture and the biochemical changes during storage. Similar observations were also made by Priya *et al.* (2010) in mixed fruit jam and Relekar *et al.* (2008) in sapota jam.

An overall flavour score (out of 9 points) of jam (Table 10) was found highest in T_5 (Banana:Pineapple, 0:100) which was at par with T_1 (Banana:Pineapple, 25:75) due to pineapple fruits have strong pleasant flavour and distinct aroma and significantly lowest in T_4 (Banana:Pineapple, 100:0). Whereas, it has showed decreasing trend during the storage period due to the loss of highly volatile aromatic compound which is very sensitive to high storage temperature as well as enzymatic degradation of phenols and oxidative changes of sugars had taken place which was responsible for loss of flavour during storage. Similar types of results are also in accordance with Priya *et al.* (2010) in mixed fruit jam and Relekar *et al.* (2008) in sapota jam.

An overall acceptability score considering texture, colour, flavour, and taste of jam (Table 11) was found significantly highest in T_1 (Banana:Pineapple, 25:75) which was followed by T_5 (Banana:Pineapple, 0:100) and significantly lowest in T_4 (Banana:Pineapple, 100:0). Whereas, it showed decreasing trend during the storage period due to the decline the colour, texture, taste and flavour with increasing storage period. Such identical findings were also observed by Priya *et al.* (2010) in mixed fruit jam and Relekar *et al.* (2008) in sapota jam.

Table 10: Changes in sensory score for flavour of banana and pineapple blended jam during storage (out of 9 point hedonic scale)

Treatments	Storage period (Months)							
(Banana : Pineapple)	0	2	4	6	8	10	12	Mean
T_1 (25:75)	8.12	8.09	8.07	8.04	8.01	7.98	7.95	8.04
T_2 (50:50)	7.37	7.35	7.29	7.27	7.25	7.22	7.20	7.28
T_3 (75:25)	6.48	6.46	6.41	6.38	6.36	6.33	6.31	6.39
T_4 (100:0)	6.22	6.19	6.17	6.15	6.12	6.10	6.07	6.15
T_5 (0:100)	8.19	8.16	8.13	8.10	8.06	8.04	8.01	8.10
Mean	7.27	7.25	7.21	7.19	7.16	7.13	7.11	
S. Em. ±	0.06	0.09	0.07	0.06	0.07	0.06	0.07	
C.D. (P=0.05)	0.18	0.36	0.21	0.18	0.19	0.18	0.19	
CV %	2.22	2.11	2.74	2.35	2.60	2.35	2.62	

Table 11: Changes in sensory score for overall acceptability of banana and pineapple blended jam during storage (Av. of colour, texture, taste and flavour)

Treatments	Storage period (Months)							
(Banana : Pineapple)	0	2	4	6	8	10	12	Mean
T_1 (25:75)	8.14	8.11	8.09	8.06	8.03	8.00	7.98	8.06
T_2 (50:50)	7.58	7.55	7.52	7.50	7.47	7.45	7.43	7.50
T_3 (75:25)	6.80	6.78	6.74	6.72	6.70	6.67	6.65	6.72
T_4 (100:0)	6.22	6.20	6.18	6.15	6.13	6.10	6.07	6.15
T_5 (0:100)	7.95	7.91	7.89	7.87	7.84	7.81	7.79	7.87
Mean	7.34	7.31	7.28	7.26	7.23	7.21	7.18	
S. Em. ±	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
C.D. (P=0.05)	0.12	0.11	0.12	0.12	0.11	0.11	0.12	
CV %	1.51	1.35	1.53	1.65	1.42	1.39	1.63	

Conclusion :

Looking to the chemical composition of jam T_1 (banana:pineapple, 25:75) having higher level of the TSS, total sugars and reducing sugars with lower level of non reducing sugars. However T_2 (banana:pineapple, 50:50) was equally best. Considering acidity and ascorbic acid level of the product T_5 (banana:pineapple, 0:100) was best for nutritive value. While T_1 (banana:pineapple, 25:75) was at par in respect to acidity and ascorbic acid. However, the majority of chemical constituents were maximum in T_1 (banana:pineapple, 25:75). According to the sensory evaluation T_1 (banana:pineapple, 25:75) having highest acceptability of jam in respect to colour, taste and overall acceptability except texture and flavour which were in T_2 (banana : pineapple, 50 : 50) and T_5 (banana : pineapple, 0:100), respectively. However, in respect to texture and flavour, T_1 (banana:pineapple, 25:75) was equally best treatment. Considering chemical constituents as well as sensory attributes T_1 (banana:pineapple, 25:75) and T_2 (banana:pineapple, 50:50) were found best for jam preparation.

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LITERATURE CITED

Amerine, M.A., Pangborn, R.M. and Roessles, E.B. (1965). *Principles of sensory evaluation of foods*. Academic Press, New York, 349 pp.

Anonymus (2011). Area and production of fruit crops in India. *Indian J. Hort.,* Data base-2010.

Chundawat, B.S. and Sen, N.L. (2002). *Principles of fruit culture*. Pub. Agrotech publishing Acadamy, Udaipur, pp: 15-16

Lal, G., Siddappa, G.S. and Tandon, G.L. (1986). *Preservation of fruits and vegetables*. ICAR publication, pp: 192-193.

Man, L.V., Chavan, J.K., Kotecha, P.M. and Lande, S.B. (2007). Standardization of process for preparation of pineapple wine. *Beverage & Fd. World*, **34**(1): 84 and 86.

Mulla, A.M. (2007). Standrdization of mixed fruit jam technology based on sapota [*Manilkara achras* (Mill.) Fosberg] fruits. M.Sc. Thesis Navsari Agricultural University, NAVSARI, GUJARAT (INDIA).

Panse, V.G. and Sukhatme, P.V. (1967). Statistical methods for agricultural workers, ICAR Publication, New Delhi, pp. 167-174.

Prasad, R.N. and Mali, P.C. (2006). Changes in physico-chemical characteristics of ber jam during storage. *Indian J. Hort.,* **63**(1): 86-87.

Priya, B., Shankar and Murari, R. (2010). Optimization of process for mixed fruit jam using sweeteners. *Beverage & Fd. World*, **37**(7): 56-58.

Ranganna, S. (1986). *Manual of analysis of fruit and vegetable products*. Published by Tata Mc Graw Hill publishing Co. Ltd., NEW DELHI (INDIA).

Relekar, P.P., Naik, A.G. and Padhiar, B.V. (2011). Qualitative changes in value added product of sapota (*Manilkara achras* (MILL) FOSBERG) cv. Kalipatti during storage. *Indian J. Hort.,* **68**(3): 413-418.

Sawant, A.A., Kad, V.P. and Thakor, N.J. (2009). Preparation of kokum-pineapple blended jam. *Beverage & Fd. World*, **36**(12): 28-30.

Shakir, I., Durrani, Y., Hussain, I., Mabood Qazi, I. and Zeb, A. (2008). Physicochemical analysis of apple and pear mixed fruit jam prepared from varieties grown in Azad Jammu and Kashmir. *Pakistan J. Nutri.,* **7**(1): 177-180.

Shrinivasan, P.S., Sundaram, G. and Oberoi, V.B. (1977). Study on pineapples. *Indian Fd. Pack.,* **31** (6) : 33-49.