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SUITABILITY OF SELECTED FRUIT AND VEGETABLE PULPS FOR JAM PREPARATION

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This study reports on processing of single and mixed-fruit jams from mango, pineapple, jack-fruit, guava, watermelon and carrot pulps. The fruit and vegetable pulps were analysed for moisture, total soluble solids, total sugar, acidity, ascorbic acid and ash contents. Forty eight samples of jams were prepared from single and composite of these fruit and vegetable pulps. Freshly prepared jams were analysed for total soluble solids, acidity and pH and their acceptability were evaluated by a taste panel. The optimum total soluble solids and pH were found around 67.0% and 3.0 respectively. Except watermelon all other fruit and vegetable pulps were suitable for jams preparation. The jams were shelf-stable under ambient temperature upto 12 months.

Key words: Fruit and vegetable pulps, Jams, Processing.

Introduction

Mango, pineapple, jack-fruit, watermelon, guava and carrot are perishable food items. After harvesting these cannot be kept for long unless preserved. Bangladesh does not produce sufficient quantities of these fruits and vegetables to fulfil the requirements. But some of these are available as seasonal surpluses. In the year 1987-88, total production of mango, pineapple, jack-fruit, watermelon and guava were 119665, 33790, 254233, 116000 and 25000 metric tons respectively [1]. These fruits and vegetables are available for 3 - 4 months in a year and during the peak harvesting seasons, are cheap due to glut supply.

Jam is a food made from not less than 45 parts by weight of fruit pulp to each 55 parts by weight of sugar and its microbiological stability depends on acid, high soluble solid levels [2]. It is an important item of product range in fruit processing industry. Second grade fruits and vegetables which contain cosmetic defects are able to be processed to good quality jams.

In this study, the use of mango, pineapple, jack-fruit, guava, watermelon and carrot pulps as well as mixture of these pulps in the preparation of jam was investigated.

Materials and Methods

The experiment was conducted in the Laboratory of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh. Mango (Var. Fazlee), Pineapple (Var. Giant Kew), Guava (Local cultivar), Jack-fruit (Local Cultivar) Carrot (Local cultivar) and Watermelon (Japanese hybrid) were procured from BAU farm and Mymensingh market.

EXTRACTION OF PULPS

Mango. Fully ripe mangoes were washed and peeled. The pulp was extracted from mango by squeezing between the fingers and strained by passing through a bamboo sieve. The pulp was pasteurized at 80-85° for 10 mins. packed in a polyethylene bag and stored.

Pineapple. The crown of washed fruit was separated and the fruit was peeled. After the eyes and damaged portions of the fruit were removed, the fruit was cut into small pieces and passed through a Waring Blender. The pulp thus obtained was pasteurized for 10 mins. at 80-85°, cooled and used in the preparation of jams.

Guava. Sound and rather tart fruits were washed thoroughly in potable water. Soft and over ripe fruits were rejected as far as possible. The fruits were cut into small pieces, boiled with equal quantity of water and crushed the boiled mass with a wooden ladle till it showed stickiness. The seeds were removed by straining through a bamboo sieve. The pulp thus obtained was used for the preparation of jams.

Jack-fruit. From the ripe fruits, the succulent bulbs were separated. The pulp was collected from the bulbs by straining through bamboo sieve and heated for 10 mins. at 80-85°. Hard bulbs were boiled with equal quantity of water and strained in similar way. The pulps thus collected was used in the preparation of jams.

Carrot. Fully mature, fresh, uniform coloured carrots were washed thoroughly and peeled in a mechanical peeler. The carrots were cut into small pieces, cooked in boiling water for 30 mins. and drained off the liquid. The cooked pieces were then blended in a Waring Blender into pulp. This pulp was passed through a sieve (30 mesh) and removed the portions of carrots and fibre from the pulp. The resultant pulp was used in the preparation of jams.

Watermelon. The fruits were cut into pieces. The crimson red edible portion was separated from the white rind. The seeds were removed from the edible portion. It was then blended into pulp in a Waring Blender. The pulp thus obtained

was passed through a sieve and immature seeds and coarse particles were removed. The pulp was pasteurized for 10 min. at 80-85° and used in the preparation of jams.

Analysis of pulps. The pulps of mango, pineapple, guava, jack-fruit, carrot and watermelon were analysed for moisture, total soluble solids (TSS), total sugar (TS), acidity, ascorbic acid (AA), pH and ash content. Vacuum oven drying method [3] was used for moisture determination. Total sugar was determined using standard AOAC Method [1]. Acidity was estimated by titrating against standard NaOH using phenolphthalein as indicator. Ash and ascorbic acid content were determined according to the method given by Rangana [4]. The results are given in Table 1.

Processing of jams. Sugar and pectin were weighed separately and mixed with the fruits and vegetable pulps. The ratios of pulps of different fruits and vegetables used are shown in Table 2. The TSS contributed by the pulp and TSS added was approx. in the ratio of 45 : 55. The mixture was cooked slowly with occasional stirring till it had the desired consistency. When the mass became sufficiently thick (about 65° Brix), a spoon was dipped into it and allowed the product to run off the sides of the spoon. If on cooling the product fell off in the form of a sheet, instead of flowing readily in a single stream, it was assumed that the end point had been reached. The product was then ready for filling into the container. Citric acid @ 1% was added at the later stage of concentration. Boiling was continued till the sheet test was satisfactory. At the end of the concentration. The temperature of the mass was 105°. Desrosier in 1975 also reported 104.5-105° as optimum temperature for jam setting. The hot product was filled into the clean, dry glass jar and closed the filled jar immediately. The jar was kept inverted for 5 mins. and then cooled. The jar was stored in a cool and dry place.

Sensory evaluation. A panel of 10 judges tasted the jams. They awarded scores according to ISI (1970) and CAC/RS (1979-80) specifications. The uniformity of the judgement among the judges were ascertained by adding up the scores given by them for individual characteristic. When the difference between the maximum and the minimum of total score

TABLE 1. COMPOSITION OF FRUIT AND VEGETABLE PULPS.

Fruits/ vegetables	Moisture %	T S %	Acidity %	A A mg/100gm	Ash %	pH
Mango	84.93	11.94	0.25	18.00	0.40	3.60
Pineapple	84.34	14.03	0.36	36.00	0.12	4.00
Jack-fruit	76.92	18.22	0.20	10.20	0.15	5.50
Guava	91.17	5.25	0.10	45.27	1.20	5.50
Watermelon	89.92	7.52	0.01	3.60	0.26	6.50
Carrot	88.80	4.30	0.01	4.00	0.36	6.80

TS = Total Sugar; AA = Ascorbic acid.

TABLE 2. THE RATIOS OF FRUIT AND VEGETABLE PULPS USED IN THE JAMS.

Sample	Pineapple %	Jack-fruit%	Mango %	Guava %	Carrot %	Water-melon%
A_1	100	—	—	—	—	—
A_2	—	100	—	—	—	—
A_3	—	—	100	—	—	—
A_4	—	—	—	100	—	—
A_5	—	—	—	—	100	—
A_6	—	—	—	—	—	100
A_7	50	50	—	—	—	—
A_8	25	75	—	—	—	—
A_9	75	25	—	—	—	—
A_{10}	25	—	75	—	—	—
A_{11}	50	—	50	—	—	—
A_{12}	75	—	25	—	—	—
A_{13}	50	—	—	50	—	—
A_{14}	25	—	—	75	—	—
A_{15}	75	—	—	25	—	—
A_{16}	50	—	—	—	50	—
A_{17}	25	—	—	—	75	—
A_{18}	75	—	—	—	25	—
A_{19}	50	—	—	—	—	50
A_{20}	25	—	—	—	—	75
A_{21}	75	—	—	—	—	25
A_{22}	—	50	50	—	—	—
A_{23}	—	25	75	—	—	—
A_{24}	—	75	25	—	—	—
A_{25}	—	50	—	50	—	—
A_{26}	—	25	—	75	—	—
A_{27}	—	75	—	25	—	—
A_{28}	—	50	—	—	50	—
A_{29}	—	25	—	—	75	—
A_{30}	—	75	—	—	25	—
A_{31}	—	50	—	—	—	50
A_{32}	—	—	50	50	—	—
A_{33}	—	—	25	75	—	—
A_{34}	—	—	75	25	—	—
A_{35}	—	—	50	—	50	—
a_{36}	—	—	25	—	75	—
A_{37}	—	—	75	—	25	—
A_{38}	—	—	50	—	—	50
A_{39}	—	—	25	—	—	75
A_{40}	—	—	75	—	—	25
A_{41}	—	—	—	50	50	—
A_{42}	—	—	—	25	75	—
A_{43}	—	—	—	75	25	—
A_{44}	—	—	—	50	—	50
A_{45}	—	—	—	—	50	50
A_{46}	—	—	—	—	25	75
A_{47}	—	—	—	—	25	
A_{48}	25	25	25	25	—	—

— Signs means no juice was used.

obtained did not exceed K + 5, where K is the number of judges, the score was considered as uniform for the container under consideration. If the difference exceeded K + 5, the most out lier score was discarded and examined the uniformity among the remaining judges. The score was arranged on a numerical scale of 100. The acceptability of the jams were determined from the predetermined acceptability classes as shown below:

Score 91 and above	.....	Excellent jams
Score 86-90	.....	Good jams
Score 81-85	.....	Fair jams
Score 80 and below	.....	Not acceptable products

Storage studies. The changes in total soluble solids (TSS) and acidity during 12 months storage of jams were observed under room temperature (23–38°). During storage the stability of colour, taste and flavour and visual fungal growth were also investigated.

Results and Discussion

There was wide variation in the composition of fruit and vegetable pulps (Table 1) used in the preparation of jams. Total sugar content was highest in jack-fruit pulp (18.22%) followed by pineapple (14.03%) and lowest in carrot pulp (4.30%). While the ascorbic acid content was highest in guava pulp (45.27 mg/100 g) followed by pineapple (36.00 mg/100 g). However the moisture content in the fruit and vegetable pulps were in the range of 84.34–91.17% with highest moisture content in guava pulp. Instead of greater differences in TSS contents in fruit and vegetable pulps, the TSS range in jam was 66–67% with optimum value at 67.5%. The optimum acidity and pH for the jams were found around 0.75% and 3.0 respectively. In all the jams processed, firm and uniform gel structure were observed.

From sensory evaluation (Table 3), it is evident that out of 48 samples of jams, only 40% samples were accepted by the panelists. The taste panelists classified and marked 10% samples as excellent, 17% as good and 13% as fair products. Jams prepared from individual pulps of mango and pineapple and carrot were of excellent quality. However, the jams of guava and watermelon pulp was not acceptable to the panelists. The combination of mango, pineapple, guava and carrot pulps resulted in quality jams which were acceptable to the panelists. But when jack-fruit and watermelon pulps were used in the composition of jams, the quality of the product declined. The characteristics flavour of the jack- fruit was disliked by the panelists. The flavour as well as the colour of the watermelon jams could not score well.

From storage studies it was concluded that the processed jams were shelf-stable upto 12 months in ambient temperature. No notable change could be observed in total soluble

TABLE 3. SENSORY EVALUATION FOR FRESHLY PREPARED JAMS.

Sample*	Colour and texture (25)	Flavour (50)	Absence of defects (25)	Total score (100)	Remarks
A_3	22	47	23	92	EP
A_1	22	45	24	91	EP
A_5	24	44	23	91	EP
A_{10}	23	45	23	91	EP
A_{11}	23	45	23	91	EP
A_{12}	23	43	22	88	GP
A_{16}	23	44	21	88	GP
A_{35}	22	45	21	88	GP
A_{17}	23	44	20	87	GP
A_{36}	21	44	22	87	GP
A_{37}	21	44	22	87	GP
A_{18}	22	42	22	86	GP
A_{22}	20	45	21	86	GP
A_{23}	20	43	20	83	EP
A_9	19	42	21	82	EP
A_{33}	19	43	20	82	EP
A_{34}	19	43	20	82	EP
A_{48}	19	43	20	82	EP
A_{13}	17	44	20	81	EP
A_{14}	18	44	19	80	NAP
A_{15}	20	41	19	80	NAP
A_{21}	20	40	20	80	NAP
A_{32}	20	42	18	80	NAP
A_{41}	19	40	21	80	NAP
A_{42}	17	44	19	80	NAP
A_4	18	40	20	78	NAP
A_7	22	35	21	78	NAP
A_{43}	17	43	18	78	NAP
A_8	21	36	20	77	NAP
A_{40}	21	36	20	77	NAP
A_{47}	17	39	20	76	NAP
A_6	20	34	21	75	NAP
A_{20}	21	34	20	75	NAP
A_{38}	20	34	21	75	NAP
A_{19}	18	36	20	74	NAP
A_{28}	19	35	20	74	NAP
A_{39}	20	34	20	74	NAP
A_2	17	34	22	73	NAP
A_{27}	19	34	20	73	NAP
A_{45}	17	36	20	73	NAP
A_{29}	18	34	20	72	NAP
A_{44}	15	40	16	71	NAP
A_{24}	18	32	20	70	NAP
A_{25}	18	33	19	70	NAP
A_{30}	19	32	19	70	NAP
A_{26}	16	33	20	69	NAP
A_{31}	19	32	18	69	NAP
A_{46}	17	31	20	68	NAP

* Sample compositions are given in Table 1.

solids and acidity. Stable TSS indicated that no fermentation took place during the storage. During 12 months storage of the jams, the colour remained natural while the taste and flavour were good. No fungal growth was observed in the jams.

Conclusion

This study indicated a good prospect of good quality jams from mango, pineapple, jack-fruit and carrot pulps alone and in combination of one or more of these fruit and vegetable pulps. The acceptability of these jams to the taste panelists were good. The jams were shelf-stable upto 12 months under ambient temperaure. The process is recommended for use by the home processors, catering institutions and food industries.

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References

1. AOAC, *Official Method of Analysis* (Association of Official Analytical Chemists, Washington D.C., 1975), 12th ed., pp. 405-411.
2. CAC/RS, Specification for Jams, Jellies and Marmalades, Indian Standard Institution No. 5861, India (1970).
3. E. Karmas, J. Fd. Technol., **34** (4), 52 (1980).
4. S. Rangana, *Manual of Analysis of Fruit and Vegetable Products* (Tata McGraw Hill Publishing Company Limited, New Delhi, India, 1979), pp. 5 and 94.
5. *Statistical Year Book of Bangladesh* (Ministry of Planning, Statistical Division, Bangladesh, 1990), 11th ed. pp. 181-188.