# **Technology Section**

Pak. j. sci. ind. res., vol. 36, no. 1, January 1993

## SUITABILITY OF SELECTED FRUIT AND VEGETABLE PULPS FOR JAM

PREPARATION

MD. BURHAN UDDIN

Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh, Bangladesh

#### (Received December 19, 1991; revised December 30, 1992)

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 prepartion 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, pincapple, 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/	Moisture	TS	Acidity	AA	Ash	pH
vegetables	%	%	%	mg/100gm	%	
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

Sample	Pineapple %	Jack- fruit%	Mango %	Guava %	Carrot %	Water- melon%
A <sub>1</sub>	100	2 19 <del>101</del> 92 1	set zoal	પ્રતં જાણાં	amo <del>r o</del> d	auone i
A <sub>2</sub>	and the last	100	incon Turfi	000 10	Martin la	anamua
A <sub>3</sub>	de unitidad	the second second	100	and the	non These	il martinete
A4	an Tunam	destron and	11120 DAY 10	100	and a starter	A LOS TRANS
A,	-		_	_	100	o nerone
A <sub>6</sub>	d juonaos:	_		OVOCEL DI		100
A <sub>7</sub>	50	50	144 <u>444</u>	-	R-0 <u>8</u> 98	
A <sub>8</sub>	25	75	1 - <u></u>		N-1 <u>N</u> 0%	
A	75	25		wolad to	10 ( <u>18 </u> 03)	Sec
A <sub>10</sub>	25		75			
A,11	50	or <u>m</u> se	50	11 ,20433	nn <u>- 28</u> 02	2016
A12	75	1015 801	25	gunu <u>n</u> X	IDI <u>CE</u> DI	
A <sub>13</sub>	50	(2 <u>3.</u> 38)	iper <u>at</u> ure	50	t va <u>ba</u> n t	yovr <u>okd</u> o
A14	25	na <u>ny</u> aR	fin <u>n ola</u>	75	ht <u>y of c</u>	th <u>e auto</u>
A	75	_	_beig	25	nali <u>e sa</u> ov	e diverse
A16	50 .		_	_	50	-
A <sub>17</sub>	25	no <del>lee</del> ion	alQ <del>. k</del> an	alumit.	75	
A <sub>18</sub>	75	son <del>iez</del> ) ol	di n <del>i n</del> otu	daav <del>id</del> aa	25	att —
A19	50	onto <del>- un</del> te	ni i <del>ssa</del> n (	I ol <del>da</del> T)	2031200	50
A20	25		ai i <del>sta</del> heli	l sour w	Lary Trees	75
A21	75		1377 B A	D AFFR	uniter Wel	25
A,,	er under der Anter Anter anter anter anter	50	50	dana and an	a la tra	I SDOT NO
A.,		25	75			
A24	100.0c) at	75	25	ion ( <u>a</u> uu	engrance	Contraction of the
A25	ov bns su	50	content	50	om <u>n</u> es	WO13_03
A26	and hid this	25	84.34-9	75	onti <u>ni </u> ori	but same
A <sub>27</sub>	mallih 191	75	program a	25	g a <u>r i</u> ua	lpoo <u>sn</u> ul
A <sub>28</sub>	mar 287 i	50	l oldarone	v bricalio	50	1003227
A <sub>29</sub>	(b. 9 <del>61</del> ° .82	25	ont <del>er</del> m	mit <del>ge</del> d	75	- 60 <u></u> M
A <sub>30</sub>	(新行 <del>生)</del> ) [56]	75	ol e <del>ns</del> vi a	ensi <del>-d</del> ia	25	is th <del>ill</del> is
A <sub>31</sub>	Alexandra and a	50	899000 21	nei o <del>di</del> li	e al-da	50
A <sub>32</sub>			50	50	60 5 <del>13</del> 9	Sart west
A <sub>33</sub>	another a	1. 17 14	25	75	ioen <del>5x</del> m	ma —
A <sub>34</sub>			75	25	i'les <del>an</del> tes	nas Marto
A35		a transfer	50	Land Participan	50	and another
a36	SARING OUR		25	Sort 1 Amer	75	
A 37	al nerve a	CC1_1602	75		25	
A38	ud pan eði	16.01 10.3	50	eviniting	111 1 <u>100</u> 60	50
A39	[_06 <u>1_7</u> 10v0	9/0 <u>11</u> .79	25	1922 <u>10</u> 16	1 93 <u>28</u> A	75
A40	orb <u>or o</u> fdu	idonue y	75	ug n <u>ol</u> og	mat <u>ere</u> b	25
A41	bac craing.	olgacon	iq . <del>oy</del> nsi	50	50	SIT _2121
A42	aco <del>pt</del> able	sto# di	adv <del>_ (</del> ma	25	75	an a <del>d</del> ag
A43	qua <sub>m</sub> olor	mo <del>lin</del> a	lin <del>it a</del> nd	75	25	avil <del>se</del> tiyes
A44	g oil <del>e f</del> lo vi	ite. <del>g.</del> od	i izms, i	50	pinc <del>ar</del> od	50
A45	n and a	11 1 <del>0 1</del> 14	ove <del>lt </del> est	an <del>ur</del> orisi	50	50
A46	on otrae fi	SW TE SU	in the second		25	75
A47	_	thow on	max Too 1	huno pine	25	
A48	25	25	25	25	082012 0	- Fan

- 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

sample.	Colour and	Flavour	Absence of	Total score	Remarks
	texture (25)	(50)	defects (25)	(100)	10 10 10 10 10 10 10 10 10 10 10 10 10 1
Α,	22	47	23	92	EP
A,	22	45	24	91	EP
A	24	44	23	91	EP
A	23	45	23	91	EP
A.,	23	45	23	91	EP
A	23	43	22	88	GP
A	23	44	21	88	GP
A	22	45	21	88	GP
A	23	44	20	87	GP
A	21	44	22 0100	87	GP
36 A	21	44	22	87	GP
A A	22	42	22	86	GP
Δ	20	45	21	86	GP
A22	20	43	20	83	FP
Δ	10	42	20	82	FP
A .	19	43	20	82	EP
A33	19	43	20	82	FP
A34	10	43	20	82	FP
A48	17	43	20	81	EP
Δ13	18	44	10	80	NAP
A14	20	44	19	80	NAD
A15	20	41	20	80	NAP
A21	20	40	18	80	NAP
A32	10	42	10	80	NAD
A41	17	40	10	80	NAP
A42	10	44	20	70	NAD
A <sub>4</sub>	10	40	20	70	NAD
A.,	17	33	19	70	NAD
A43	21	45	10	70	NAP
A8	21	26	20	77	NAD
A40	17	20	20	76	NAP
A47	17	39	20	70	NAP
A <sub>6</sub>	20	24	21	15	NAP
A <sub>20</sub>	21	34	20	15	NAP
A <sub>38</sub>	20	34	21	15	NAP
A <sub>19</sub>	18	36	20	74	NAP
A <sub>28</sub>	19	35	20	74	NAP
A <sub>39</sub>	20	34	20	74	NAP
A <sub>2</sub>	17	34	22	73	NAP
A <sub>27</sub>	19	34	20	73	NAP
A45	17	36	20	73	NAP
A29	18	34	20	72	NAP
A <sub>44</sub>	15 00.81	40	16	71	NAP
A <sub>24</sub>	1800.31	32	20	70	NAP
A25	18 18	33	19	70	NAP
A <sub>30</sub>	19	32	19	70	NAP
A26	16	33	20	69	NAP
A <sub>31</sub>	19	32	18	69	NAP
A	17	31	20	68	NAP

\* Sample compositions are given in Table 1.

TABLE 3. SI	ENSORY E	VALUATION	N FOR F	RESHLY	PREPAREI	JAMS.
C 1.* C		E1	1	C To	-1 1	O a una a ul co

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.

Acknowledgement. The financial assistance provided by Bangladesh Agricultural University Research System, BAU, Mymensingh and Bangladesh Agricultural Research Council,

Definition (FIG) photocological (1992) ISBN 971-22-0012-1 (1999 Manila, Bhilippinos, 1992) ISBN 971-22-0012-1 (187000 Britson LDC 10.00 + 5 1.50, shipping surface, (1870 Britson contains the papers and proceedings of the britson (1870 Britson contains the papers and proceedings of the britson (1870 Britson contains the papers)

sonian frantrus and IL SteVenth Athenica at the former venue in Washington, D.C. on 17-18 October, 1990.

It represents the fourth or a series of programs examining new directions in agriculture, food policy and number science. At the collection, eleven distinguished vehalics thand their experience and views and explored research advances in India and China on the materiation - infection complex and on the control of micronum of deficiencies, introvative approaches to nubrition and leature policy and planping in Chilo and in southern Ahrea and successful programs of autorition education, public health and behavioural change at the commany level.

An source version or the transpript of the two-near reprotable discussion is also included in this volume, wherein the experts exchanged ideas in respect of application of motom scientific developments for solution of cross-national food respres Farmgate, Dhaka to conduct this investigation is gratefully acknowledged.

## References

- 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.
- Statistical Year Book of Bangladesh (Ministry of Planning, Statistical Division, Bangladesh, 1990), 11th ed. pp. 181-188.

meterstone. The book provides important and necessary information the user in an easy and comprehensible language and wi ever represeny, the instructions have been it instruction. examples

Water Quality in Yorth American River Systems by C. Dalo Becker and Duare A. Neized. 300 pp. Batelle Press. Weshington, 1992. ISBN 0-93470-50-6. Prece S44.95. The book provides information on twolve modified river actory atoms their fish continuances. Itshery resources, their prosperiptio distribution, marphology and helpitat. The river atoms atoms their fish continuances, fishery resources, their prosperiptio distribution, marphology and helpitat. The river atoms from the Cherna River, a tributary of the Yukon River is marrier. Alaska and the La Grande River in Nonhemia marior. Alaska and the La Grande River in Nonhemguebee, Canada, to Domingo River Basin, a small watershed in neutor data (Domingo River Basin, a small watershed age, castern Gulf of Mexico. West to Bask coverage extends from the Columbia, Pacific Ocean, to the blackwater rivers age, castern Gulf of Mexico. West to Bask coverage extends draming the south-castern covatal plane: From the interior draming the south-castern covatal plane: From the interior Alberta, Canada and Mirseouri, Upper Mississippi, Oho and Mexica and Mirseouri, Upper Mississippi, Oho and Alberta, Canada and Missouri, Upper Mississippi, Oho and Cambedand rivers of the United State. This information is

49