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Processing of value added food products from selected low-cost indigenous fruits of Bangladesh

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Abstract

This study reports on processing of some food products such as jam, jelly, squash, nectar, pickles, chutney, preserves, candies, and toffee from selected indigenous fruits. Jelly and jam were processed from carambola (star fruit)), wood apple, elephant apple, and wax jumbo (jamrul); squash, nectar, and toffee from wood apple; preserves and candies from wax jumbo and carambola; pickles from elephant apple and carambola and chutney from elephant apple respectively. The fruits and the developed products were analysed for proximate composition. Keepin quality of the processed products were evaluated at an ambient temperature (27 – 32°C). The acidity, colour, flavour and texture and microbial growth were observed initially at an interval of one month up to two months and then at an interval of two months until the products spoiled. The products were shelf stable up to 12 months with the exception that jam, jelly, pickles and candies having shelf life more than 12 months. The consumer acceptability of all the products developed was satisfactory.

Keywords: Jam, Jelly, Squash, Nectar, Pickles, Chutney, Preserves, Candies, Toffee, Shelf-life, and Sensory evaluation

Introduction

In addition to the immense food value, indigenous fruits contain appreciable quantities of minerals and vitamins which are essential for our nourishment and body building. Fortunately variety of fruits are produced in Bangladesh because of favourable soil and climatic condition. Many of the indigenous fruits which are quite cheaper in the harvesting season are wasted to a great extent. This wastage can be minimized and these products can be consumed by the common people in off-season as well. There are certain periods of glut when the indigenous fruits are available in plenty and these do not fetch a good price in the market. While in the other season these are not available at any price. In spite of great economic importance and wide scope these raw materials has not received the impetus it deserves. Therefore, indigenous fruits of immense economic importance and nutritive value must not be wasted and should be either processed or preserved when these are cheapest in the market. A variety of products such as pickles, chutney, preserves, candies, jams, jellies, dried powder, products in brine and sugar solution may be processed to increase the commercial value of the indigenous fruits.

Materials and Methods

Analysis of indigenous fruits' pulp/juice

Some chemical composition of four indigCarombola (*Averrhoea carambola*) wood apple (*Aegle marmelos*), wax jambu (*Syzygium samarangenes*) and elephant apple (*Dillenia indica*) were selected in this study and analysed for moisture, protein, total soluble solids (TTS), sugar, acidity, ascorbic acid and ash content. Dry, clean and sterile glass pots of different sizes were used for moisture determination by Oven drying method (Karmas, 1980). Total

soluble solid was measured by a Refractometer. Protein and ash content were determined according to AOAC (1984) method. Lane and Eynon method (1923) was used for determination of sugar. Acidity was estimated by titration with standard NaOH solution using phenolphthalein as indicator. Ascorbic acid was determined according to the method summarized by Ranganna (1991). Ascorbic acid by titration method, 2-6-dichlorophenol-indophenol dye was used (Ranganna, 1991).

Extraction of pulp/juice

Extraction of wood apple pulp: The fully ripe healthy and fresh wood apple were washed thoroughly with potable water and then broken to open the fruit. Ripe pulp is scooped along with seed and fiber, mixed with water and then pH is adjusted to 4.3 with citric acid. The mixture is kneaded and heated at 80°C for one minute. The material is sieved through stainless steel sieve to remove seeds and fibers. The extract thus obtained is treated with SO_2 and preserved by freezing or canning for subsequent use.

Extraction of Wax Jumbo juice/pulp: Pulp of wax thus obtained was strained to obtain juice. The pulp and juice thus prepared was ready for preparation of the products.

Extraction of Carambola juice: Fully ripe, sound and greenish yellow carambolas were washed thoroughly in potable water and drained over a bamboo strainer. Rotten, discolored and bruished portions were removed and the fruits were cut into small pieces. The seeds were removed as far as possible. The fruit pieces were boiled for about 20 minutes and blended in a Waring Blender for about 5 minutes. The carambolas pulp thus obtained was strained through muslin cloth to get carambola juice. The pulp and juice were than preserved in deep freeze at –10°C for use in the preparation of products or used directly in the processing of products.

Processing of fruit products

Processing of wood apple Nectar: The pasteurized, strained and homogenized pulp was fed into formulation tanks where sugar (sucrose), water and citric acid were added. Anti-oxidant (Butylated Hydroxy Anesloe) may be added to avoid oxidation of ascorbic acid. The Brix and pH of the nectar were adjusted to 18 – 20% and 4.0 using sugar and citric acid respectively. The formulated nectars are continuously sterilized at 95°C for 20 minutes. The nectar was filled into glass bottles at temperature of 85°C. After filling, the bottles are immediately sealed with crown corks.

Processing of wood apple squash: Strained juice containing moderate quantities of fruit pulp used for squash processing. Sugar and citric acid were dissolved in measured quantity of water; heated, filtered through a cloth and cooled. Syrup thus prepared was mixed with wood apple juice, TSS and acidity were adjusted 40% and 0.75% respectively. KMS (@ 350mg%) was dissolved in small quantity of juice and added to the squash, filled into sterilized glass bottle, sealed and pasteurized at 80°C for 10 minutes.

Processing of wood apple toffee: The pulp/juice (1000g) were concentrate in an aluminum pan to about one third of its original volume. Then sugar 566g, glucose 75g, skim milk power 151g and hydrogenated fat 49g were than mixed and cooking continued until final weight-equal to a 1-1/5 times that of the pulp/ juice. The cooked mass was spread onto a stainless steel tray previously smeared lightly with fat and the product spread into a thin sheet 1/2"-3/4" thick. It was then allowed to cool and set. The solid sheet was cut into toffees and wrapped in tissue paper and packed in air tight-jars or tins.

Processing of elephant apple pickles: Elephant apple were washed, peeled and blanched in boiling water for 10-15 minutes. Drained the Chulta and tied in a clean cloth. Mustard seeds, cinnamon, panchforon, joyfall and joyatri, postadana were pounded. Garlic and ginger were ground separately in vinegar. The mustard oil was heated till smoking and put all the spices and continued heating, until the materials become brown colour. Then blanched chulta fried in oil for 5 minutes, sugar and vinegar were added and cooked till oil floated on top, allowed to cool and added the preservative. Finally filled into sterilized bottles and sealed airtight. Usually one month is required for pickle to mellow. The ingredients of elephant apple pickles are given in Table 1.

Table 1. Ingredients used for elephant apple pickle

Ingredients	Quantity	Ingredients	Quantity
Elephant apple	1000 g	Cardamon	1 g
Red chili powder	10 g	Ginger paste	40 g
Turmeric	2.5 g	Garlic paste	25 g
Cinnamon	2.5 g	Salt	20 g
Pachforon	2 g	Sugar	60 g
Mustard seed	5 g	Vinegar	75 ml
Joyfall and joyatri	5 g	Mustard oil	250 ml
Postadana	10 g	Na-benzoate	0.70 g

Processing of elephant apple chutney: Elephant apples were cut into pieces and blanched in boiling water for 10-15 minutes and remove the adhering water. All the spices were ground in little vinegar. Mustard oil was heated till smoking, then ground along with salt were added to it. Cooked again adding elephant apple pieces on slow fire for half an hour. Make syrup of sugar, add the vinegar and add the ground mixture and cooked 10 minutes. The products cooked to *65* percent TSS, cooled, addition of preservative and filled in sterilized glass jars. Ingredients used for elephant apple chutney is given in Table 2.

Table 2. Ingredients of elephant apple Chutney

Ingredients	**Quantity**	**Ingredients**	**Quantity**
Chulta	1000 g	Green chili	5 g
Mustard oil	250 ml	Zinger	5 g
Sugar	500 g	Garlic	5 g
Salt	30 g	Turmeric	0.1 g
Spices	20g	Sodium-benzoate	500 mg/kg

Processing of jelly/jam: Juices/pulps of different fruits were used for processing of jelly/jam. The juice and sugar was in the ratio of (45:55). The mixture was boiled slowly with occasional stirring till the cooking mass approached desired consistency (about 65^0 Brix). Pectin was added at the later stage of concentration. Boiling was continued till the sheet test was satisfactory. The warm product was filled into the clean dry glass bottle/jar, immediately sealed and then cooled, labeled and stored in a cool and dry place. Ingredients of jelly/jam is given in Table 3.

Table 3. Ingredients for processing of jelly/jam

Ingredients	Quantity
Juice/pulp	450 g
Sugar	550 g
Pectin	5g
Citric acid	5 g

Processing of Preserves: Smalll peices of Wax Jumbo were immersed in 2% sodium chloride solution with 500mg/kg KMS. Then after another washing steeped in a solution of 3% calcium lactate and 1% KMS or a mixed solution of 1% calcium chloride and 0.1% KMS for 24 hours, blanched in boiling water for 10-15 minutes and rinsed with tape water. After pricked with the pieces were dipped in 25^0 Brix syrup and heated until temperature reached to 100.5^0C in first day, 102^0C in 2^{nd} day and 103^0C in 3^{rd} and 104^0C in 5^{th} day respectively. When the Brix reached to 50^0B added 0.05% citirc acid on the basis of syrup 7^{th} day cooked to $105.5\text{-}107.0^0$C. Kept the preserves for 4-5 days in syrup and checked the Brix of the syrup. If there was any fall in Brix, cooked again to $105.5\text{-}107^0$C. Until constant Brix was achieved, the preserves were filled into clean and dry container and sealed.

Processing of jumbo Candies: The preserves as prepared above were drained and dipped in water for a moment to remove the adhering syrup. The product was then dried in a cabinet drier at 70^0C for about 10 hours. Then kept at 37^0C for 1 hour and finally brought to room temperature (27 ± 1^0C) and packed in a high density polyethylene bag and stored at room temperature.

Results and Discussion

Food value of selected fruits and their developed products: Carombola, wood apple, elephant apple, wax jumbo (red and white) were analyzed for proximate composition, calcium, iron, vitamin C and Calorie (Table 4). Carbohydrates, fibre and calcium contents were highest in wood apple. The calcium content in other three fruits was almost similar. Vitamin C content was highest in carom bola (61.00mg %) which was followed by elephant apple (22.00mg %).

The products developed from selected fruits were jam, jelly, candies, preserves, nectar, pickle, chutney and toffee. The products were analyzed for moisture, TSS, reducing sugar, non-reducing sugar, total sugar, pH, acidity and ash content and the results are shown in Table 5.

Sensory Evaluation: The Hedonic rating test (Ranganna, 1991) was used to measure the consumer acceptability of the processed products. Samples were served to the panelists at one session and were asked to the pleasurable or acceptability of the products on a scale of 9 points ranging from "Like extremely" to "Dislike extremely". The score assigned to each sample were then averaged and compared with the average score received by other sample in the series (Table 6). The consumer acceptability of all the products according to ISI and Hedonic rating test was found to be satisfactory.

Table 4 Food value of selected indigenous fruits

Fruit	Calorie (Kcal)	Moisture (%)	Carbo-hydrate (%)	Protein (%)	Fat (%)	Calcium (mg/100g)	Iron (mg/100g)	Vitamin-C (mg/100g)	Fiber (%)	Ash (%)
Carombola	50.00	88.60	9.50	0.50	1.00	11.00	1.20	61.00	1.00	0.40
Wood apple	77.50	87.00	18.80	2.60	0.20	38.00	0.60	9.00	2.90	0.90
Elephant apple	32.00	91.33	8.05	0.70	0.10	10.00	0.70	22.00	1.30	.23
Wax jambu (White)	39.00	89.10	8.50	0.50	0.20	10.00	0.50	1.00	1.20	0.30
Wax jambu (Red)	-	91.97	6.19	0.52	0.15	11.00	0.45	6.00	1.12	0.25

Table 5. Food value of selected indigenous fruits' products

Product	Fruit	Moisture %	pH	TSS (%)	Ash (%)	Reducing sugar %	Non-reducing sugar %	Total sugar %	Acidity (%)
Jam	A	30.75	2.95	65	0.21	25.5	38.5	64.0	1.04
Jelly	B	28.53	2.95	67	0.19	24.86	41.14	66.0	1.07
Preserve	C	64.85	2.90	-	0.30	12.85	17.08	29.93	0.17
	D	63.75	2.90	-	0.28	13.25	15.60	28.85	0.15
Candies	E	15.85	3.70	-	0.27	28.55	54.12	82.67	0.38
	F	14.67	3.70	-	0.27	27.65	53.12	80.87	0.36
Squash	G	60.88	3.75	40.00	0.20	15.16	23.02	38.18	0.78
Nectar	H	79.81	3.72	19.57	0.18	05.22	13.45	18.67	0.85
Pickles	I	69.11	2.96	31.00	1.08	04.11	25.67	29.78	2.25
Chutney	J	33.88	3.20	65.00	0.23	16.35	46.93	63.28	1.15
Toffee	K	14.55	5.50	-	0.62	5.07	14.55	19.62	0.25

Note below:
A: Carambola, wood apple, elephant apple and wax jambo
B: Carambola, wood apple, elephant apple and wax jambo
C: Wax jambo, carambola
D: Wax jambo, carambola
E: Wax jambo, carambola
F: Wax jambo, carambola
G, H & K: Wood apple
I: Elephant apple, carambola
J: Elephant apple

Keeping quality: The keeping quality of the processed products was observed at a regular interval of time by keeping at room temperature (27 – 32°C). The acidity, colour, flavour and texture and microbial growth were observed at an interval of one month up to two months and then at an interval of two months until the products spoiled. The shelf-life of jam, jelly, pickles and candies were > 12 months; nectar, squash and toffee were up to 12 months and preserves up to 9 months respectively. The shelf-life of jam, jelly, pickle and candies were better because of higher sugar and/or acid content.

Table 6. Sensory evaluation of processed products

SL No.	Products	Taste testing method	Parameters	Statistical test	Condition
1.	Jam	ISI	A*	ANOVA	Acceptable
		Hedonic Rating	B*	DMRT	LVM
2.	Jelly	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
3.	Nectar	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
4.	Squash	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
5.	Pickles	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
6.	Chutney	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
7.	Preserves	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
8.	Candies	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM
9.	Toffee	ISI	A*	ANOVA	Acceptable
		Hedonic rating	B*	DMRT	LVM

A* = Color and appearance (25)
Test & flavor (50)
Absence of defects (25)
B* = Like extremely (9) to dislike extremely (1)
LVM – Like very much

Conclusion

The products produced from indigenous fruits may be recommended for commercial exploitation.

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