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Research Note

Quality Attributes of Jams from Low-Usage Tropical Fruits

ABSTRACT

The chemical, sensory and storage properties of jams produced from two low-usage tropical fruits are presented. High-solids jams, either singly or blends, were produced from mature-ripe pulps of African star apple (Chrysophyllum albidum*) and African plum (* Spondias mombin*) using the open-kettle process. Analytical data on the apple and plum jams showed that values obtained for fruit contents (43–45%), soluble solids (68·6–68·9%), reducing sugar (35·6–40·6%) and pH (2·80–3·40) are within the range typical of table jams. Whilst sensory evaluation indicated that the apple jams were preferred to the plum jams, storage trials showed that the fruit jams maintained good stability even when stored at tropical ambient conditions.*

INTRODUCTION

In the tropics, fruits grow in abundance even in the wild. African star apple and African plum are amongst the commonest and most nutritious of the indigenous fruits found in the Nigerian lowland forest zone (Okigbo, 1977; Okafor, 1980, 1983). These fruits, though produced in considerably large quantities, are under-utilized except for eating in the fresh form, particularly among the rural populace. Fresh fruits are, however, inherently more liable to deterioration under tropical conditions owing to high ambient temperatures and humidities, pest and disease infestations, poor handling and storage facilities (Pantastico, 1975). One attractive and effective means

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of fruit utilization and preservation is jam processing (Desrosier, 1970). This work reports on the chemical, sensory and storage properties of jams produced from the fruits of African star apple and African plum.

MATERIALS AND METHODS

Fresh, mature-ripe fruits of African star apple (*Chrysophyllum albidum*) were obtained from local farms near Ibadan while fruits of African plum (*Spondias mombin*) were collected from trees in several locations on University of Ibadan campus. Analysis of the fruits for pectin, total acidity, reducing sugar, ash and ascorbic acid was accomplished using the methods described by Ruck (1969).

Preparation of jam

Unblemished ripe fruits of African star apple and African plum were selected for jam processing using the open-kettle process (Moyls *et al.*, 1962). Jams were prepared in 200-g batches using only the fruit pulps, the sugar requirements being calculated from the soluble solids and weight of pulps used. Blends were made with a more popular tropical fruit, pawpaw (*Carica papaya*) in equal proportions. Hot-water dip pretreatment (60°C for 2 min) was omitted in the case of African plum and pawpaw as these fruits peel easily when ripe. Simmering of these fruit pulps was also reduced from 10 to 5 min to prevent mushiness. Following setting, the resultant jams were analysed for fruit content, total soluble solids, reducing sugar and acidity as described by Pearson (1976). A sensory panel of 35 assessed the jam samples for colour, flavour, spreadability and overall acceptance using the preference test (Larmond, 1977). The sample ranked first of four samples was assigned a value of $+1{\cdot}03$ and $-1{\cdot}03$ to the sample least preferred. The scores were subsequently subjected to analysis of variance.

Storage tests

Stability of the apple and plum jams held for 16 weeks at ambient (28 ± 2°C) and cold storage (5 ± 1°C) were assessed periodically by monitoring changes in acidity, reducing and total sugar levels. Changes in these storage indices were compared to similar changes observed in a commercial table jam held under the same storage conditions. Total soluble solids were measured directly using a Bausch and Lomb refractometer at 20°C while reducing sugar was determined according to Pearson (1976). A metrohm Herisau pH meter (model E520) was used for pH measurements.

RESULTS AND DISCUSSION

Table 1 shows analysis of the fresh indigenous tropical fruits. The low pH values recorded for these fruits clearly reflect their acidic nature. On the other hand, values obtained for ash and ascorbic acid are higher than figures typically reported for some more popular tropical fruits like mango, pawpaw and pineapple. These results are in accord with the reports that, besides juiciness and characteristic acid taste, these low-usage tropical fruits possess substantial nutritive value (Okigbo, 1977; Okafor, 1983; Keshinro, 1984). Table 2 shows that the apple and plum fruits produced satisfactory high-solids jams either singly or in blends with pawpaw. Formation of high-sugar jellies implies formation of regular gels and consequently presence of high-methoxyl pectins in these fruits (Moyls *et al.*, 1962). The rate of solidification further reflects the jelling properties of the fruits. The short setting time (14 min) for the plum jam suggests that the fruit contained rapid-set pectin rather than the slow-set type encountered in African star apple which took longer (45 min) to set under the same processing conditions. Whilst sensory evaluation (Table 3) indicates that the apple jams were preferred to the plum jams, storage trials show that the fruit jams maintained good stability as reflected by the small decreases in acid and sugar levels. At ambient storage, losses in soluble solids over the 16 weeks storage period ranged between 0·3 and 1·7%, with a loss of less than 0·5 unit in pH values (Table 4). The comparative losses in cold storage, though not significantly different, were much lower (Table 5), which reinforces the beneficial effect of cold temperature storage on maintenance of jam quality.

TABLE 1
Chemical Analysis of African Star Apple and African Plum Fruits

Parameters[a]	*African star apple*		*African plum*	
	Pulp	*Peel*	*Pulp*	*Peel*
Total acidity (%)	1·10	0·56	1·69	0·42
Pectin (%)	1·58	2·33	0·60	0·90
Reducing sugar (%)	7·96	n.d.	7·46	n.d.
Ascorbic acid (mg %)	64·5	73·7	128·90	110·50
Ash (%)	4·23	5·10	4·11	4·91
Soluble solids (%)	12·10	n.d.	10·80	n.d.
pH	2·80	n.d.	2·50	n.d.

[a] Values are the means of three replicates.
n.d. = not determined.

TABLE 2
Physico-Chemical Properties of Jams from African Star Apple and African Plum Fruits

Parameters[a]	*African star apple*		*African plum*	
	Whole fruit pulp	*Blend with pawpaw*	*Whole fruit pulp*	*Blend with pawpaw*
pH	3·00	3·40	2·80	3·10
Soluble solids (%)	68·90	68·80	68·80	68·60
Reducing sugar (%)	36·90	40·60	35·60	37·40
Fruit content (%)	45	n.d.	43	n.d.
Setting time (min)	45	65	14	8
Colour	Reddish	Reddish brown	Amber yellow	Golden yellow

[a] Values are the means of three replicates.
n.d. = not determined.

TABLE 3
Mean Scores of Sensory Attributes of Jams from African Star Apple and African Plum Fruits

*Sensory attributes**	*Mean sensory scores***			
	African star apple		*African plum*	
	Whole fruit pulp	*Blend with pawpaw*	*Whole fruit pulp*	*Blend with pawpaw*
Colour	$0·37^a$	$0·33^a$	$-0·46^b$	$-0·54^b$
Flavour	$0·49^a$	$0·33^a$	$-0·26^b$	$-0·56^b$
Spreadability	$0·22^a$	$0·16^a$	$-0·20^b$	$-0·18^b$
Overall acceptability	$0·59^a$	$0·32^a$	$-0·43^b$	$-0·38^b$

* Ranks converted to $-1·03$ to $+1·03$ scores.
** Means for each attribute bearing the same superscript are not significantly different at $P = 0·05$ by Tukey's test. Higher values indicate greater preference.

TABLE 4
Comparative Stability of Tropical Fruit Jams Stored at Ambient Temperature[a] ($28 \pm 2°C$)

Jam sample	*Soluble solids (%)*				*pH*				*Reducing sugar (%)*			
	6 weeks	*12 weeks*	*14 weeks*	*16 weeks*	*6 weeks*	*12 weeks*	*14 weeks*	*16 weeks*	*6 weeks*	*12 weeks*	*14 weeks*	*16 weeks*
African star apple												
Whole pulp	68·9	68·9	68·8	68·6	3·00	2·96	2·92	2·80	36·9	36·8	36·5	36·4
Blend with pawpaw	68·8	68·5	68·2	68·1	3·40	3·34	3·29	3·23	40·6	40·2	39·8	39·6
African plum												
Whole pulp	68·8	68·2	67·5	67·1	2·80	2·65	2·43	2·25	35·6	34·9	33·9	33·6
Blend with pawpaw	68·6	68·4	68·2	68·0	3·10	2·96	2·90	2·86	37·4	36·9	36·6	36·3
Commercial jam	69·0	68·7	68·2	68·0	3·30	3·20	3·12	3·07	36·2	36·1	35·8	35·4

[a] Values are the means of three replicates.

TABLE 5
Comparative Stability of Tropical Fruit Jams Stored at Cold Temperature[a] ($5 \pm 1°C$)

Jam samples	*Soluble solids (%)*				*pH*				*Reducing sugar (%)*			
	6 weeks	*12 weeks*	*14 weeks*	*16 weeks*	*6 weeks*	*12 weeks*	*14 weeks*	*16 weeks*	*6 weeks*	*12 weeks*	*14 weeks*	*16 weeks*
African star apple												
Whole pulp	68·9	68·9	68·9	68·8	3·00	2·98	2·95	2·93	36·9	36·8	36·7	36·6
Blend with pawpaw	68·8	68·6	68·5	68·4	3·40	3·38	3·35	3·34	40·6	40·3	39·9	39·7
African plum												
Whole pulp	68·8	68·6	68·3	68·1	2·80	2·68	2·47	2·38	35·6	35·2	34·6	36·9
Blend with pawpaw	68·6	68·5	68·4	68·3	3·10	3·06	3·02	2·90	37·4	37·1	37·0	36·9
Commercial jam	69·0	68·8	68·6	68·6	3·30	3·22	3·16	3·12	36·2	36·3	36·0	35·6

[a] Values are the means of three replicates.

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