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EVALUATION OF THE PHYSIO-CHEMICAL, MICROBIOLOGICAL AND SENSORY ATTRIBUTES OF COMPOSITE JAM FROM PAWPAW, MANGO AND PINEAPPLE PULPS

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Abstract: This study shows the physicochemical, microbiological and sensory attributes of jam produced from pawpaw, mango and pineapple fruit pulps. The fruit pulp was combined in different proportions to form three composite jam samples $P_{60}M_{25}P^1{}_{15}$, $P_{45}M_{45}P^1{}_{10}$ and $P_{30}M_{55}P^1{}_{15}$. The result of the physicochemical analyses showed that there was no significant (P>0.05) difference in pH, TTA and total soluble solids. PH and TTA values were generally very low and were 3.02 to 3.10 and 0.2 to 0.33 respectively. Total soluble solid were high (73 to 76) giving the jam samples their characteristics firmness and uniform consistency. Viscosity results using spindle 2 at various speeds were reducing indicating that the products were non-Newtonian and exhibit shear thinning. The $P_{45}M_{45}P^1{}_{10}$ sample showed higher spreadibility than the other jam samples. The microbial analyses carried out recorded higher counts of bacteria than mould both count however were low indicating that the samples were microbiologically safe. The organoleptic studies showed that there was no significant (P>0.05) difference among the samples for all the sensory attributes considered in this work. The $P_{60}M_{25}P^1{}_{15}$ sample was not acceptable (4.40) and p45m45p110 (4.00) least for colour. For taste and mouth feel, $P_{45}M_{45}P^1{}_{10}$ was most acceptable followed by $P_{30}M_{55}P^1{}_{15}$ and $P_{60}M_{25}P^1{}_{15}$ least. Samples $P_{60}M_{25}P^1{}_{15}$ and $P_{45}M_{45}P^1{}_{10}$ were the most generally accepted with mean sensory score of 3.80 each.

Keywords: *Pawpaw, Mango, Pineapple, Composite and Jam.*

Introduction

In the tropics there is a great deal of different fruits produced with season all year round. They do not receive the desired attention due to technological hindrances. This has led to wastage of these highly perishable fruits before reaching the consumers table. It has therefore become imperative to explore ways of processing these fruit into shelf stable products to minimize post harvest losses. With the advancement of research into food processing and preservation, conversion of fruits into jams and jellies offer an easy, cheap, and economic yet most reliable means available for reducing post harvest

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losses. Jam is a product made with whole fruit, cut into pieces or crushed. The fruit is heated with water and sugar to activate the pectin in the fruit (www.wikipedia.org). Generally, jam is produced by taking mashed or chopped fruit or vegetable pulp and boiling it with sugar and water. The proportion of sugar and fruit varies according to the type of fruit and its ripeness, but a rough starting point is equal weights of each. When the mixture reaches a temperature of 104 °C (219 °F), the acid and the pectin in the fruit react with the sugar, and the jam will set on cooling. However, most cooks work by trial and error, bringing the mixture to a "fast rolling boil", watching to see if the seething mass changes texture, and dropping small samples on a plate to see if they run or set (Berolzheimer *et al.,* 1959). This study is aimed at the production of composite jam from pawpaw, mango and pineapple fruits which in turn reduce the loss of this perishable fruits incurred during post harvest time, this also offers the consumer variety of ways of eating different fruits with an improved nutritional valued product and also to reduce the high cost of jam produced from a single fruit.

Materials and Methods

Source of Raw Materials

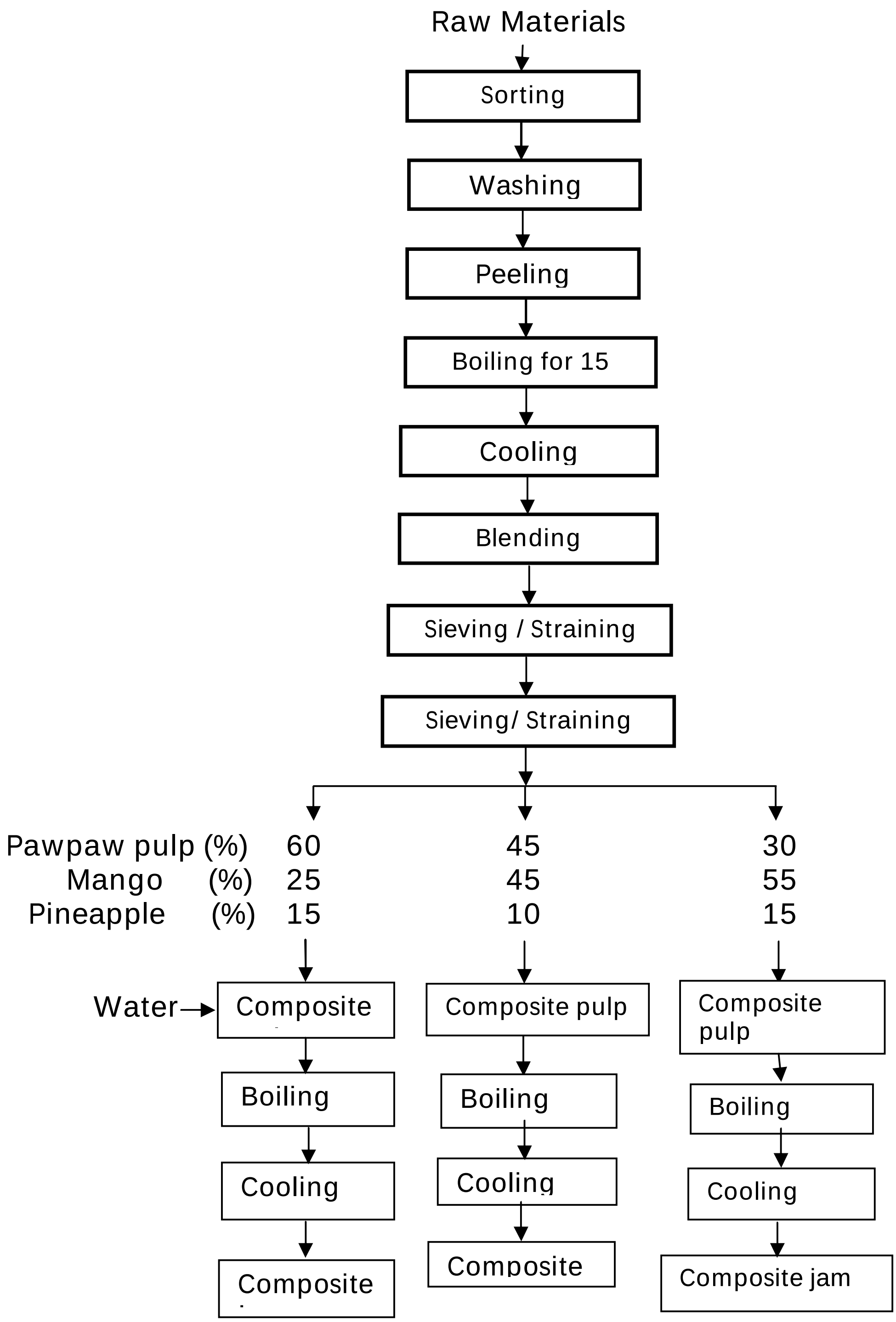
Pawpaw, mango and pineapple fruits (fresh and moderately matured ones) were purchased from Wurukum fruit and vegetable market in Makurdi, Benue state in Nigeria. White granulated sugar free from stones, dirts and extraneous materials was purchased from local supermarket in Makurdi. All the chemicals, apparatus and machine equipment used were procured from the Department of Food Science and Technology, Animal Production and Chemistry laboratories of University of Agriculture Markurdi.

Production of Intermediate Pectin

Extraction of the solutes was carried out according to the method described by Zafaris and Orepoulou (1992).

Production of Composite Jam

Composite pulp from pawpaw, mango and pineapple fruits was obtained using the modified method described by Maum for and Lyongan, (1987), and Degregory and Cante, (1992). The individual fruit pulps were prepared according to flow chart in Fig. 2. The resulting pulps from pawpaw, mango and pineapple were then mixed in different proportions in accordance with the standard regulation governing the production of composite jam in Table 2 as outlined by Ihekoronye an Ngoddy (1985).


Raw Materials
Sorting
Washing
Peeling
Boiling for 15
Cooling
Blending
Sieving / Straining
Sieving/ Straining
Pawpaw pulp (%) 60 45 30
Mango (%) 25 45 55
Pineapple (%) 15 10 15
Water
Composite
Composite pulp
Composite pulp
Boiling
Boiling
Boiling
Cooling
Cooling
Cooling
Composite
Composite
Composite jam

KEY: P=pawpaw $P_{60}M_{45}P^{1}_{15}$= (60-25-15) % Paw-man-pine jam
M=mango $P_{45}M_{45}P^{1}_{10}$ = (45-45-10) % Paw-man-pine jam
P^{1}=pineapple $P_{30}M_{55}P^{1}_{15}$ = (30-55-15) % Paw-man-pine jam

Physico-Chemical Analyses Viscosity

This is the measuring of the time used for the food to run through a small hole of known diameter. The viscosity of the jam was determined using the method of Mosha and Svanberg, 1983. 1og of the jam was weighed into a beaker and 100mL of water was added. This was stirred properly and heated in boiling water-bath to 90℃ for 10-20minutes. The heating was continued for another l5 minutes with occational stirring. The sample in the jar was then transferred to another water bath maintained at 45℃ and the viscosity was measured at this temperature using Brookfield viscometer (model LV 8 Brookfield Engineering laboratory Inc. U. K).

PH Determination

The digital pH meter (Jenway 3015) was standardized with a buffer of 4 7. 50g of a well mixed portion of the jam was placed in 100mL beaker. The electrode of the pH was then inserted into the jam solution and when the reading was steady it was read.

Total Soluble Solid Determination

The solid content of the jam pulp was determined using the refract meter based on Bigelow's *et al., (*1950) method, which expressed the relationship between the refractive index and total soluble solid of the sample the sample. The refractive index of a drop of jam was determined by allowing the jam drop at ambient temperature to fall on the screen of the refract meter and the reading taken at the lower calibration of the refract meter through the lens.

Total Titrable Acidity Determination

Total titratable acidity was determined according to Pearson, (1991). 25g of the jam was weighed and transferred into 400mL beaker and diluted with hot water to about 200ml. The resulting solution was boiled gently for 15 to 20minutes, transferred into 250ml volumetric flask, cooled and made up to standard volume at 20℃ and filtered using 12.5cm diameter what man filter paper. 50mL of the filtrate was pipetted into 250ml beaker and 100ml water was added and titrated with 0.1N sodium hydroxide using 2 - 3drops of phenolphthalein and the total titratable acidity was calculated as:

$$\%Acidity = \frac{\text{Vol. of NaOH} \times 0.1N \times \text{ml. eq. wt. of Predominant acid}}{\text{Weight of sample used.}} \times 100$$

Microbiological Analyses

Total Plate Count

Total plate counts of jam were determined using the method described by Bradshaw (1979), using serial dilution. The sample was prepared using four sterile coded test tubes. Iml from each of the test tube was pipetted into sterile coded petri dishes containing about 10 - 15ml nutrient agar. The petri dishes were then gently swirled and allowed to rest. The plate was incubated at the temperature 37 + 1°C for 48hours.

Mould and Yeast Counts

Yeast and mould analyses were made using potato dextrose agar acidified with 10% tartaric acid as outlined by Banwart (1979). 9mL of distilled water was pipetted into four serial test tubes. Serial dilution of the samples was prepared. Iml from each tube was pipetted into sterile coded petri dishes containing potato dextrose agar acidified with 10% tartaric acid. The plates were then incubated at 37 ±_1°C for 72hours.

Sensory Evaluation of Composite Jam.

Sensory evaluation was carried out on the composite jam containing varying proportions of different fruits using a five point - hedonic scale where 1 represent extremely disliked and 5 liked extremely, as described by (Ihenkoronye and Ngoddy, 1985). A panel consisting of 20 judges who were students of University of Agriculture Makurdi, Benue State was asked to indicate their preference for a sample in terms of taste, colour, mouth feel, and general acceptability. Sensory scores were subjected to analysis of variance (ANOVA) as described by Ihekoronye and Ngoddy (1985). In the presence of any significant difference among samples, Turkey's test was employed to separate the means.

Result and Discussion

Viscosity of Composite Jam

Apparent viscosity measures the rate of flow of foods or shears under friction or applied force and is usually affected by temperature and decreases as temperature increases (Onwweluzo *et al.,* 1994) Table 3 shows the viscosity of the composite jam samples as affected by jam composition of the fruit pulp.

Chemical Properties of Composite Jam

Table 3 also shows the effect of fruit composition on the pH of composite jam. The value of the pH of three samples PeoMasPHs, P45M45P1io, and PsoMssP1^ (3.10, 3.02 and 3.09) respectively are in agreement with standard jam pH range of 3.0 - 3.4 as reported by Kordylas (1990); Birch *et al.,* (1986) and Ronald *et al.,* (1991) - The values of the pH of the samples irrespective of compositional variations were not significantly different (P < 0.05) from each other. This result of pH has demonstrated that the jam samples had acceptable keeping quality. From the pH values of the composite jam samples, P45M4sP1io had a better keeping quality and $P_{60}M_{25}P^1_{15}$ the least.

Total Titratable Acidity

The acidity values obtained in this study for the three composite jam samples were very low as shown in Table 3. This result indicates that the composite jams are microbiologically stable implying the absence of deleterious components in the samples. The highest value of titratable acidity exhibited by $P_{60}M_{25}P^1_{25}$ may be due to the dilution of the pulp by pawpaw and the high acid content of pineapple fruit pulp. Sample P4sM45P1io recorded the least value of titratable acidity thus being the least stable among the samples. The titratable acidity of the samples were however not significantly (P > 0.05) different from each other.

Total Soluble Solid

The result of the determined total soluble solids for the composite jam samples is also shown in Table 3. The sample with the highest percentage of mango fruit recorded the highest soluble solid values followed by that of the highest pawpaw fruit pulp and the least value of total soluble solids was exhibited by the sample with equal fruit pulps of pawpaw and mango. The values of total soluble solid in this study are high and this a positive index of gelling and stability if stored. The total soluble solid values of samples were however not significantly different (P < 0.05) from each other.

Microbiological Analyses of Composite Jam.

The result of the microbiological analysis is shown in table 4. Sample $P_{45}M_{45}P^1_{10}$ recorded the highest growth of both mould and total plate counts, while sample $P_{60}M_{45}P^1$ was least in supporting both mould and total plate count. Generally the total plate counts had higher value of microbial number than the mould counts indicating the jam supports the growth of bacteria than mould. There was no significant difference (P < 0.05) in both the mould and total plate counts among samples. The microbial load in this study did not exceed the standard prescribed by ICMSF

(1980), not exceeding 10^6 cfu/g of sample indicating that the composite jam were still safe and shall be shelf stable.

Sensory Evaluation of Composite Jam.

The result of the organoleptic quality of the composite jam conducted when samples were freshly produced is in Table 5. Which showed no significant difference (P< 0.05) in the sensory attributes of the composite jam assessed? Sample $P_{60}M_{25}p^1{}_{15}$ indicated that it was more preferred for colour, and general acceptability while sample $P_{45}M_{45}P^1{}_{10}$is was least accepted for the same sensory attributes. Sample $P_45M_45P^1{}_{10}$ was liked more than the others for taste while $P_{30}M_{55}P^1{}_{15}$ sample was preferred for its good mouth feel and $P_{45}M_{45}P1_{10}$ least liked for the same attributes. Panelists were happy with the colour than the other attributes, judging from the high scores recorded for colour.

Conclusion

The study has shown that is possible to produce an acceptable composite JAM from different proportion of pawpaw, mango and pine apple fruit. The sample obtained exhibited shelf stability because of their low pH and titratable acidic value. The microbiological load of the jam samples were slightly high but fell within acceptable level stipulated by microbiological standards. The microbial result also indicates that the product was safe for consumption. The percentage of total soluble in the samples was high and related to the viscosity values. The viscosity values showed that samples were non - Newtonian and exhibited shear thinning. Sensory result of the composite jam samples indicated no signifance difference in all the sensory attributes studied in this work implying that production of jam from a combination of different proportion of fruit is Acceptable.

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Table 1: Formulation for the Production of Jam

Ingredient	Weight (%)
Fruit pulp	31.55
Water	12.13
Sugar	48.54
Glucose (optional)	6.98
Pectin	0.19
Acid	0.61
Batch weight	100

SOURCE: Ihekoronye, (1999).

Table 2: Effect of Fruit Composition on the Physico-chemical of Composite Jam Produced from a Combination of Pawpaw Mango and Pineapple Fruit Pulp.

Sample	pH	TTA (% citric acid)	Total soluble solid (0Brix)	Viscosity spindle speed(rpm)		
				3	6	12
$P_{60}M_{25}P1_{15}$	3.01[a]	0.33[b]	74.5[c]	3	14	3
$P_{45}M_{45}P1_{15}$	3.02[a]	0.20[b]	73.0[c]	6	31	5
$P_{30}M_{55}P1_{15}$	3.09[a]	0.24[b]	76.0[c]	4	24	4

Values are Means of Duplicate Determinations. Means with Common Superscript letters within Columns are not significantly (P< 0.05) Different from each other for each jam Composition.

1 = (60-25 -15) % Paw - Man - Pine composite jam.

2= (45 -45 -10) % Paw - Man - Pine composite jam.
3= (30-55 -15) % Paw - Man - Pine composite jam.

Table 3: Effect of Sample Composition on the Microbial Quality of Composite Jam Produced from Combination of Pawpaw, Mango and Pineapple Fruit Pulps.

Sample	Yeast and Mould Count (Cfu/g)	Total Plate Count (Cfu/g)
P6oM25P1i5	1-4 x 10[la]	1.43 x 10[la]
P45M45P1io	3.0 x 10[ib]	4.0 x 10[Ib]
P30M55P115	1.1 x 10[lc]	3.1 x 3.I[lc]

Values are means of Duplicate Determinations. Means with Common Superscript letters within Columns are not significantly (P< 0.05) Different from each other for each jam Composition.

1. = (60 - 25 -15) %paw - man -pine composite jam.
2. = (45-45-10)% paw - man - pine composite jam,
3. = (30-55-15) % paw - man - pine composite jam.

Table 4: Effect of Sample of Composition on the Sensory Attributes of Composite Jam produced from a Combination of Pawpaw, Mango and Pineapple Fruit Pu

Sample	Sensory attributes			
	Colour	Taste	Mouth feel	General acceptability
$P_{60}M_{25}P1_{15}$	4.40[a]	3.40[a]	3.10[a]	3.80[a]
$P_{45}M_{25}P1_{10}$	4.40[a]	3.85[a]	2.85[a]	3.80[a]
$P_{30}M_{55}P1_{15}$	4.15[a]	3.80[a]	3.30[a]	3

Each result is the Mean of 20 Panelist's Response on a 5- Point Hedonic Scale

1. =(60-25-15)% paw-man-pine composite jam
2. =(45-45-10)% paw-man-pine composite jam
3. =(30-55-15)% paw-man-pine composite jam

Value with common superscript letters are not significant (P>0.05) different within columns for each attribute.