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# Production and Quality Evaluation of Jam Produced from Pineapple Fruit

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**Abstract:** Production and quality evaluation of jam produced from pineapple fruit was carried out. A sample of jam was made from fresh pineapple fruit and a conventional fruit jam was procured from the open shelf market. Both samples were subjected to quality evaluation which included physico-chemical, minerals, vitamin A and vitamin C and sensory properties evaluation. Statistically, student T-test was used to analyze results obtained from physico-chemical and sensory analyses. The results obtained in this work showed that mean values of physico-chemicals, minerals and vitamins studied were different ($p<0.05$) as compared. Physico-chemical properties: 19.76% moisture, and 1.04% crude fiber of prepared pineapple jam were significantly ($p<0.05$) higher than 17.01% moisture and 0.88% crude fiber of conventional fruit jam sample. Minerals such as 3.58mg100g$^{-1}$ magnesium, 5.07mg100g$^{-1}$ calcium, 4.83mg100g$^{-1}$ potassium and 0.85mg100g$^{-1}$ iron of prepared pineapple jam were higher than (mg100g$^{-1}$) 2.45, 3.85, 1.71, and 0.33 of the same minerals content of conventional fruit jam. However, 2.56 µgg$^{-1}$ β-carotene content of conventional fruit jam was higher compared with 1.73 µgg$^{-1}$ β-carotene prepared pineapple jam but lower in vitamin C 7.61mg/100g. Sensory evaluation showed that prepared pineapple jam sample with mean score 7.50 overall acceptability was preferred well than conventional fruit jam sample. Indication from this study revealed that homemade or laboratory prepared jam from pineapple fruit can compete favorably with conventional or imported jam in the market.

**Keywords:** Production, quality evaluation, pineapple, jam

## I. Introduction

### Background Information

Several types of fruits have been used in adding more nutritive value to food product such as jam. Jawaheer, (2013) stated that jams are a preserved mixture of fruit boiled with sugar and allowed to congeal. It can further be produced by preservation of fruits which are canned or sealed. Jam is a shelf-stable food product from fruit pulp, pectin and sugar cooked to form a gel. Fleshy or pulpy fruits such as pineapple, orange and mango etc or combination of these fruits are usually employed in the production of jam, (Madhave & Pushpalatha, 2012)

Jam is often spread on bread, biscuit and ice-cream for delicious consumption. In addition, it is observed, according to Jawaheer, (2013), that good jam has a soft consistency and a distinct part of fruit with a bright colour, flavour and jam-jellied texture. Jams are fruits preserved through the use of high concentration of sugar. It is most often classified as sugary food, and their quality characteristics may be more easily determined from their relationship with fruit rather than with sugar.

Jones and Layner, (2003) reported that the sugar and the fruits used in producing jam vary according to the type of fruit and its ripeness. When the temperature of the mixture reaches 104$^{o}$C, the acid and the pectin react with the sugar. In a similar note, perfectly ripe and unblemished fruits are suitable for jam production because they have the best levels of pectin and a finest flavor. Pectin is important to the jam "set"; low-pectin fruit like strawberries need extra pectin (from peel of unripe lemon or pectin-enriched sugar) to attain a spreadable consistency (Blitz, & Grosch, 2004).

The production of jam from tropical fruits helps in improving the nutritive content of the final product obtained from the varieties of fruits used in the production, ensuring food variety for breakfast menu and other purposes. (Galkowska & Zagorska, 2010). Tropical fruits are examples of fruits grown in Asia, Africa, South America and other parts of North America. The tropical fruits are rich in carbohydrate; vitamin, mineral and fiber. Examples of tropical fruits include papaya, mango, banana, guava, and pineapple.

According to Luís et al, (2017) and Pem & Jeewon, (2015) fruits are recommended for a well-balanced diet. Fruits are important and very necessary in the daily diet of households. Many fruits are perishable; they cannot stand a long time before getting rotten. However, inadequate consumption of fruits may cause lack of some essential nutrients in the body and increase in post-harvest losses

Recently, it has been observed that rotten fruits are dumped in refuse dumps along the market areas which indicate wastage. This is probably due to inability to preserve or consume the available fruits after harvest by individuals and households. In the light of the above, preserving fruits through jam production is considered a step in the right direction to mitigate waste. Therefore, the researcher purposefully selects pineapple as a tropical fruit for this study. Pineapple, scientifically known as (*Ananascomosus*), is a perennial

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plant of the family *bromelicaea* and it is an edible fruit which can be used for jam production. Pineapple is native to tropical and subtropical America, and has been introduced elsewhere. The fruit is eaten fresh where available and in canned form worldwide. In the United States and in Europe, it is sometimes used as a pastry filling or in baked desserts.

Pineapple (*Ananas comusus*) belongs to the *bromelicaea* family, and is one of the tropical fruits with a high nutritional content. As a tropical fruit, it may be enjoyed whole and fresh, juiced or canned. The pulp is yellow to golden yellow, sweet, and juicy. Pineapple may be used fresh, juiced, dried, made into candies, and incorporated into cooked dishes and desserts. (Xu, Liu, Chen, Ye, Ma, &Shi, 2008). Pineapple as food, has both nutritive and anti- nutritive properties. Ripe and mature pineapple fruit has high moisture content of up to 86.2 % and total solids of about 19 % which is contributed largely by sucrose, glucose and fructose. Carbohydrate constitutes about 85 % of pineapples total solids and fibre about 2 – 3 %. Citric acid is the most abundant organic acid in pineapple. Pineapple has negligible fat and protein content and very low ash content (Hemalatha &Anbuselvi, 2013)

In the light of the above, jam produced from pineapple could be acceptable and nutritive for human consumption, thereby reducing the post-harvest-losses of this raw material (fruit). To fill this gap, the present study examines the production and sensory evaluation of jam produced from pineapple fruit.The main aim of the study was focused on compares the qualities of homemade pineapple fruit jam with conventional imported jam samples.

## II. Materials and Methods Procurement of raw materials

Pineapple fruits were purchased from Eke-Ukwu, Owerri, Imo State Nigeria. The fruit includes three (3) medium size pineapple, citric acid and pectin.

### Sample preparation

The ingredients used were:3 medium-size pineapple;500g of sugar;3 tea spoonfuls of lime juice;3 tea spoonful of citric acid.

### Procedure

The pineapple was peeled and diced into little pieces. It was blended into liquid substance using an electric blender. The fruit blend was sieved to remove the fibre. It was heated (low heat) to a boil for 45 min to reduce the moisture content. Sugar and pectin were added to the fruit blend and allowed to boil for extra 20 min, with continuous stirring. The fruit product was brought down and allowed to cool (Ref).

### Physico-chemical analysis

Physico-chemical properties moisture content, total soluble solid and crude fibres were analyzed using methods described by

A.O.A.C (2010) while minerals content was determined using procedures described by Onwuka (2005).

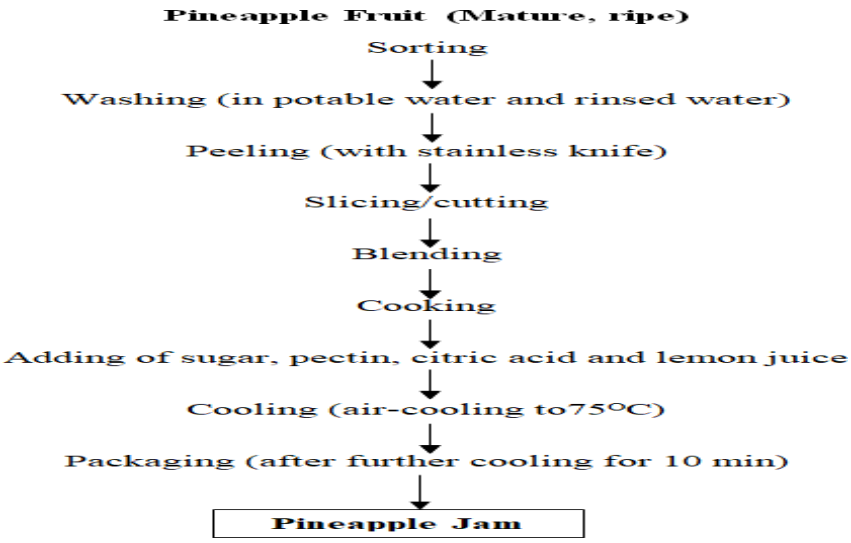


Figure 1: Flow diagram for the production of pineapple fruit jam

### Vitamin Analysis

Vitamin A and vitamin C were determined using procedures described by Awolu *et al* (2013).

### Sensory Evaluation

Sensory evaluation of the jam samples was conducted using procedure described by Iwe (2002) A 10-members panel randomly

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selected from the Department of Home Economics and Hospitality Management in AIFCE, Owerri. The judges were made up of lecturers and students of the Department of Home Economics and Hospitality Management. A nine point scale instrument was used to judge each criterion by the panel of judges with =1 dislike very extremely = 2 dislike very much =3 dislike moderately =4 dislike slightly =5 neither like nor dislike =6 like slightly =7 like moderately =8 like very much =9 like extremely. The samples was packaged in transparent jam bottles and presented in a coded manner. The sensory attributes of the samples was appearance, taste, mouth feel, aroma, after taste and overall acceptability. . The evaluation form was presented to the panelists and they were requested to observe and taste each sample as Bread was provided and grade them based on a 9-point hedonic scale showing least acceptable to most acceptable in all attributes. Water was (29°C) provided for members of the panel to rise their mouth after each tasting. A conventional fruit jam was purchased and used as a control for the experiment. The two samples were labeled as:

Table 1: The conventional (commercial) and experimental jam samples

| | **Sample** | **Code** |
|---|---|---|
| a | Commercial Fruit Jam | CFJ |
| b | Prepared pineapple jam | PPJ. |

**Statistical Analysis Techniques**

T- Test was used to analyze the data gathered to determine their difference while the least significance attributes at $p< 0.05$ was used to determine difference among the means.

**III. Results**

**Physico-chemical properties of jam samples**

Table 2 presents the phyisco-chemical, minerals and vitamins content of jam samples. The moisture content 17.01 % and 19.76% were found on Conventional Fruit Jam (sample CFJ) and Prepared pineapple jam (sample-PPJ) respectively. Total soluble solid (TSS) of the jam samples were 71.59% for sample CFJ and 66.10% for sample PPJ. Crude fibre content of 0.88% and 1.04% were found on sample CFJ and sample PPJ respectively. Minerals content evaluated are magnesium, calcium, potassium and iron. The concentration of magnesium content of the jam sample CFJ and sample PPJ were 2.45mg100g$^{-1}$ and 3.58mg100g$^{-1}$; while calcium content of 3.58mg100g$^{-1}$ and 5.07mg100g$^{-1}$ respectively. Potassium content of 1.71mg100g$^{-1}$ and 4.83mg100g$^{-1}$ were found on sample CFJ and sample PPJ. In similar samples order, iron content found was 0.33mg100g$^{-1}$ and 0.85mg100g$^{-1}$. Vitamin A evaluated as µgg$^{-1}$ β-carotene showed concentration of 2.56 µgg$^{-1}$ and 1.73 µgg$^{-1}$ for sample CFJ and sample PPJ while vitamin C discovered from the samples are 7.61mg100g$^{-1}$ and 12.23mg100g$^{-1}$.

Table 2: Physico-chemicals, mineral and vitamin contents of jam samples

| **Property** | **Sample-CFJ** | **Sample- PPJ** | **t-value (p<0.05)** | **df** | **Significant (2-tailed)** |
|---|---|---|---|---|---|
| Moisture content % | $17.01^{a}\pm0.08$ | $19.76^{a}\pm0.05$ | -131.048 | 1 | .005 |
| Total Soluble Solid % | $71.59^{a}\pm0.0$ | $66.10^{b}\pm0.1$ | 56.092 | 1 | .011 |
| Crude fiber % | $0.88^{a}\pm0.01$ | $1.04^{a}\pm0.05$ | -2.925 | 1 | .210 |
| Magnesium mg/100g | $2.45^{a}\pm0.02$ | $3.58^{a}\pm0.01$ | -40.643 | 1 | .016 |
| Calcium mg/100g | $3.85^{a}\pm0.0$ | $5.07^{a}\pm0.06$ | -29.169 | 1 | .022 |
| Potassium mg/100g | $1.71^{a}\pm0.02$ | $4.83^{a}\pm0.03$ | -79.000 | 1 | .008 |
| Iron mg/100g | $0.33^{a}\pm0.0$ | $0.85^{a}\pm0.01$ | -173.333 | 1 | .004 |
| Vitamin A µg/g β-carotene | $2.56^{a}\pm0.02$ | $1.73^{b}\pm0.09$ | 15.182 | 1 | .042 |
| Vitamin A µg/g β-carotene | $2.56^{a}\pm0.02$ | $1.73^{b}\pm0.09$ | 15.182 | 1 | .042 |
| Vitamin C mg/100g | $7.61^{a}\pm0.03$ | $12.23^{a}\pm0.1$ | -30.973 | 1 | .021 |

Distinct letters in row are significant different by the student's t-test ($p<0.05$)

**Key:** Sample-A = Commercial Fruit Jam CFJ; Sample-B = Prepared pineapple jam PPJ

**Sensory properties of jam samples**

The results of sensory properties of jam samples were presented in Table 3. Sensory properties evaluated on Conventional Fruit Jam (sample CFJ) and = Prepared pineapple jam (sample PPJ) are appearance, mouth-feel, aroma, taste, aftertaste and overall acceptability.

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The mean values of 7.60 and 6.70 were found on the appearance of sample CFJ and sample PPJ respectively; while mouth-feel showed 7.0 each mean values for sample CFJ and sample PPJ. Evaluation on taste attribute showed 7.30 and 6.90 for sample CFJ and sample PPJ, so also so the mean values of 6.90 and 7.10 were recorded for the aroma of sample CFJ and sample PPJ. Aftertaste attribute of the samples showed 7.10 and 6.60 mean values while the overall acceptability of the samples recorded

7.40 and 7.50 for sample CFJ and sample PPJ respectively.

Table 3: Sensory properties of jam samples

| Property | Sample-CFJ | Sample-PPJ | t-value (p<0.05) | df | Significant (2-tailed) |
|---|---|---|---|---|---|
| Appearance | $7.60^{a}\pm0.69$ | $6.70^{b}\pm1.25$ | 1.711 | 9 | 0.121 |
| Mouth-feel | $7.0^{a}\pm1.05$ | $7.0^{a}\pm1.05$ | 0.000 | 9 | 1.000 |
| Taste | $7.30^{a}\pm0.94$ | $6.90^{a}\pm0.99$ | 0.712 | 9 | 0.494 |
| Aroma | $6.90^{a}\pm1.91$ | $7.10^{a}\pm0.87$ | -.361 | 9 | 0.726 |
| Aftertaste | $7.10^{a}\pm1.10$ | $6.60^{b}\pm1.42$ | 0.832 | 9 | 0.427 |
| Overall acceptability | $7.40^{a}\pm0.84$ | $7.50^{a}\pm0.70$ | -.231 | 9 | 0.823 |

Distinct letters in row are significant different by the student's t-test ($p<0.05$)

**Key:** Sample-A = Commercial Fruit Jam CFJ; Sample-B = Prepared pineapple jam PPJ

## IV. Discussion of findings

The results of Physio-Chemical, Minerals and Vitamins content of jam samples were presented in Table 2. There was no distinctive difference ($p<0.05$) on the moisture, total soluble solid (TSS), crude fiber content between conventional fruit jam (CFJ) and prepared pineapple jam (PPJ) samples when paired. The Moisture content 17.01% of CFJ sample was lower than 19.76% of PPJ sample. Again the crude fibre of 0.88% of conventional jam sample was lower than 1.04% of prepared pineapple jam sample; but the Total soluble solid of 71.59% of CFJ was relatively higher than 66.10%. The differences found on the Physio-chemical properties of both jam samples may be attributed to the processing methods and as well as recipe adopted which differed for the production of conventional and laboratory prepared jam samples. The moisture content found in this work was relatively lower than 24.20% reported for melon jam *(*Benmeziane *et al.,* 2018), 27-34%by Nwosu *et al*. (2014) and 27-34% recorded by Ejiofor and Owuno (2013) for jackfruit jam. Benmeziane *et al* (2018) stated that moisture has a great impact on the shelf life of products, usually high sugar content makes the moisture unavailable for the growth of microorganisms. It is important to note that moisture content is directly related to the conservation of the product in storage, and jams with lower moisture content have a longer shelf life. The indication from the result suggest that laboratory jam sample may be shelve-stable longer more than the conventional sample due to lower moisture content. The mean total soluble solid (TSS) of the jam samples discovered in this work varied significantly and lower than 73% of melon jam (Benmeziane *et al*). This observation could be attributed to amount of sugar used for the preparation of the jam samples. Codex Alimentarius standard (CODEX STAN, 2009) described that total soluble solid in food represent the level of sugars, acid and minerals. The crude fiber 1.04% was higher than 0.88% of conventional jam sample. Crude fiber is dependent on the chemical nature or composition, maturity and ripening of the main fruit pineapple used. However the mean values of crude fiber found in this work were lower than 1.25% to 3.03 *(Awolu et al.,* 2018) and 3.81% reported by Ajenifuja & Aina (2011).

The mineral evaluated in this work showed the presence of beneficial mineral elements. However, the minerals content of the jam samples in mean values but not significant ($p>0.05$). Between the two samples prepared pineapple sample (PPJ) with $3.58mg100g^{-1}$ magnesium, $5.07mg100g^{-1}$ calcium, $4.83mg100g^{-1}$ potassium, and $0.85mg100g^{-1}$ iron were considerably higher than $2.45mg100g^{-1}$, $3.85mg100g^{-1}$, $1.71mg100g^{-1}$ and $0.33mg100g^{-1}$ of magnesium, calcium, potassium and iron content of conventional jam sample. The concentrations of the minerals found in this work are below 100mg and are termed micro-mineral (Murray *et al*., 2000). Magnesium activates many enzymes while iron improves electron transport and activates enzymes as well as plays a role in chlorophyll synthesis *(*Soetan *et al.,* 2010). Nutritionally, calcium helps in formation and stability of cell walls; structure and permeability maintenance and regulate responses to cell stimuli *(*Murray *et al.,* 2000). Potassium is a cofactor that functions in protein synthesis, activation of enzymes, major solute functioning in water balance and thus affecting osmosis, operation of stomata (Murray *et al*., 2000).

Vitamin A and vitamin C content of jam samples studied in this work were the same in concentrations. There was significant difference ($p<0.05$) found on the vitamin A while differences in concentration of vitamin C showed no significant ($p>0.05$) despite mean values of the two samples were not the same. The differences on vitamin A and C content of the two samples could be partly due to methods adopted and recipe used for the production. However, the concentrations of vitamin A and C recorded in this work were closely related to 1.32-3.58µMg of vitamin A and $8.22\text{-}10.31mg100g^{-1}$ reported for banana-watermelon-pineapple composite jam (*Awolu et al.,* 2018) but lower than 700 µg of retinol activity equivalents (RAE) per day for women and 900 µg per day for men. The role of vitamin A and vitamin C cannot be over emphasized in human nutrition. Vitamin A plays an important role in the visual system

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of mankind; it also helps in maintenance of growth and epithelial cellular integrity and immune system (Annette, 2002). Vitamin C functions as effective antioxidant that readily scavenges reactive oxygen species (ROS) and reactive nitrogen species (RNS). The Recommended Dietary Allowance for vitamin C is 75 mg per day for women and 90 mg for men, for nonsmokers (Annette, 2002).

Results on sensory properties of jam samples were presented in Table. The results showed that only two of the sensory properties of jam samples namely appearance and aftertaste have distinct difference ($p<0.05$). While mouth-feel, taste, aroma and overall acceptability of the two samples did not show any distinct difference as paired significantly ($p>0.05$). The mean scores 7.60 appearance, 7.30 taste, and 7.10 aftertaste of the conventional fruit jam were significantly higher than mean scores 6.70, 6.90 and

6.60 for appearance, taste and aftertaste respectively of prepared pineapple jam sample. Conversely, prepared pineapple fruit jam with 7.10 aroma and 7.50 overall acceptability were higher than mean scores 6.90 and 7.40 of aroma and overall acceptability of conventional fruit jam sample. Indications from this results suggest that consumers' rating for sensory properties of jam products may varied on jam due to different recipes and methods adopted by manufacturers. However, prepared pineapple jam with 7.50 mean score was preferred than conventional fruit jam. Pineapple fruits are an excellent source of vitamins and minerals and supply arrays of colour, flavour and texture to the pleasure of eating (Othman, 2011).

**Discussion of findings**

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## V. Conclusion and Recommendation

Pineapple represents one of the most important fruit sources of bioactive compounds, with its high fiber content, nutrient compositions and sensory attributes can successfully be used for the preparation of jam to add value to the fruit, reduce post-harvest losses due to its perish-ability as a result of its high moisture content. The physico-chemicals, minerals and vitamins analyses in this study demonstrated the feasibility of the utilization of some under-utilized tropical fruits such as pineapple as a source of major ingredients in jam making. It is recommended that tropical fruit such as pineapple fruit can be utilized for the small scale and domestic production of jam which will lead to reduction in total dependence importation of jam products.

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