



RESEARCH PAPER

Production and Evaluation of the Nutritional Properties of Cashew Apple Jam for Consumer Acceptance

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ABSTRACT

Cashew Apple was used in the production of Jam to study the nutritional and sensory properties of the product and to determine its suitability and acceptability. The product was analyzed for some quality parameters (Total Titrable Acid (TTA), Total Soluble Solid (TSS or Brix), Vitamin C and pH), nutritional composition, and sensory acceptability. The result showed a high vitamin C content (85.62%) and Total Soluble Solid (56%) in the quality parameters assessed. The proximate revealed a high level of moisture content (61.32%) and an unusually low level of carbohydrate (27.20%) in cashew apple products. The recorded sensory scores which ranged from 7.20 -8.60 using the 9-point hedonic scale indicated that the fruit jam samples were highly acceptable by the consumers. This study showed that an acceptable Jam can be produced from Cashew Apple with nutritional compositions and quality parameters favorably. It will be recommended that studies should be carried out to improve the quality standards of the Cashew Apple Jam to conform to standards sets for Jam products.

Keywords: Cashew, Cashew Apple, Jam, consumer acceptability

INTRODUCTION

The cashew (*Anacardium occidentale*) is a tropical fruit that originated in South America before spreading to the rest of the world. The cashew apple is the fleshy part of the cashew fruit. It contains a lot of tannins, reducing sugars (fructose and glucose), minerals like calcium, iron, phosphorus, vitamin C, and some amino acids (Sanoppa, 2021). The cashew apple is a fruit that is underutilized. After collecting raw cashew nuts, the apples are generally discarded during harvest operations (Preethi *et al.*, 2021). As reported by Oyeyinka *et al.*, (2011), cashew apple industrial applications are limited in Nigeria. However, as their nutritional potential is realized, their use in the preparation of value-added products is increasing and in high demand (Oyeyinka *et al.*, 2011). But even so, there are only a few products that can be made from whole apples, namely cashew apple jam, sauce, ketchup, and pickle (Preethi *et al.*, 2021).

Several studies have been conducted in order to use cashew apple in the food industry. To supplement cassava flour biscuits, an enriched product was created using Cashew apple powder (Ogunjobi & Ogunwolu, 2010). A mineral and proximate analysis of Cashew apple juice was also performed on various cashew species. The

findings indicated that cashew apple juice has the potential to contribute to daily dietary requirements (Lowor and Agyente-Badu, 2009). In addition, the organoleptic and mineral properties of cashew apple juice preserved with chemicals were recently studied. The results confirmed that the combination of clarification and chemical preservation is suitable for preserving cashew apple juice under refrigeration for up to 24 hours. The method was also found to be effective in reducing astringency and retaining the nutrient quality of the juice (Dania *et al.*, 2021).

Jam is a popular food item due to its preserving qualities and organoleptic profiles. It has the appearance of jelly but is less firm. Its production necessitates the use of appropriate quantities of ingredients (fruit pulp, acid, pectin, and sugar) to achieve the desired finished product. The quality of finished goods is determined by the quality of raw materials and formulation (Rana *et al.*, 2021). According to Codex Alimentarius Commission standards [CAC] (2008), Jam should contain Total Soluble Solids (TSS)

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greater than 65% (CAC, 2008; Rana *et al.*, 2021). Jam is expected to contain approximately 67-68% total soluble solids (TSS) along with 45% fruit pulp at least (Baker *et al.*, 2005). The cashew tree is abundant in Lapai, and the majority of the apple from the fruit is wasted. The majority of the residents are only interested in selling the nut to make money. Therefore, there is an urgent need to reduce the number of fruits wasted annually. This can be achieved by converting some of these fruits into jams that can be stored for a longer period of time. As a result, the purpose of this research was to create and evaluate an acceptable cashew apple jam in order to promote its use in the food industry.

METHODOLOGY

Fresh cashew apple, sugar and lime were purchased from Lapai market in Lapai Local Government Area of Niger State with coordinates 9.0449°N, 6.5741°E.

Jam preparation

Cashew fruits were sorted by separating the nuts from the apple. The cashew apple was cut into small pieces, rinsed and drained. It was put in a boiling water with salt to remove the astringent taste. It was drained after boiling for about 5 minutes. The cashew apples were then placed in a pot with addition of sugar, lime and water to cover the mixture. The mixture was boiled at 80°C for about 30 minutes until set. The resultant mixture (jam) was hot filled into a sterilized jar, sealed and rapidly cooled (Emelike & Akusu, 2019).

Quality Analysis

Total Titrable Acid (TTA), Total Soluble Solid (TSS or Brix), Vitamin C and pH were determined using standard methods (AOAC, 1990).

Nutritional Analysis

Nutritional composition was determined using AOAC methods (Carbohydrate, Moisture, crude protein, ash and crude fat) (AOAC, 2000).

Sensory Evaluation

Sensory evaluation was carried out using a 9-point hedonic scale and 10 panelists (both trained and untrained). Samples were assigned to each of the panelist. The panelists were asked to evaluate each sample on given sensory score sheet for the attributes such as color, aroma, texture,

appearance, after taste, sweetness, spreadability and overall acceptability after 3 hours.

The 9-point hedonic scale was represented as: 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely (IFT, 1981).

Statistical Analysis

All experimental data obtained were subjected to analysis of variance (ANOVA) procedure of SPSS version 15.0 at 95% significant level ($P=0.05$) and means were separated using Duncan's multiple range tests.

RESULTS AND DISCUSSION

Quality Analysis

The quality analysis of the Cashew Apple Jam obtained is shown in Table 1. The vitamin C content of the cashew apple jam in Sample B is high (85.62 %). This translates to the apple which has a high Vitamin C content. According to (Singh *et al.*, 2019), vitamin C (Ascorbic acid) is one of the major organic acids found in cashew apple. It is known to be responsible for boosting immunity and serving as an antioxidant in human diet (Akoma *et al.*, 2018). The Total Soluble Solid 56% and 68% was also observed to be high followed by low contents in acidity 0.115 ± 0.01^a and 2.78 ± 0.00^a for both samples A and B respectively. The results were found to be closely related to the control sample A. The TSS of sample B (56%) was observed to be lower than the CAC standards set for Jam products (67-68%). This result coincides with the nutritional attributes and composition of both the fruit and other ingredients used in the Jam production (Dania *et al.*, 2021; Oyeyinka *et al.*, 2011). According to (Singh *et al.*, 2019), the cashew apple fruit is highly acidic, with an average pH of 4.367. Other cashew apple products, such as cashew apple marmalade (Emelike and Akusu, 2019) and cassava flour biscuits with cashew apple powder, showed a similar trend (Ogunjobi and Ogunwolu, 2010). Due to the high acidic tolerance of these microorganisms, microbial deterioration of this fruit by yeasts and molds is very common.

Nutritional Analysis

The nutritional analysis is presented in Table 2. The Cashew Apple Jam shows a significant difference in the level of moisture content. The moisture content observed in this study is comparable to that reported by Emelike and Akusu (2019). High moisture content is a key determinant in faster microbial deterioration, which is attributed to the apple's high moisture content (85.623 %) (Singh *et al.*, 2019). A thorough understanding of a product's moisture content will aid in estimating its stability and shelf life in a given environment. Other parameters such as the crude protein, ash content and crude fat also fall in same range as observed in other Cashew Apple products except for the carbohydrate (27.20%) which was observed to be lower than the control (Sample A) and other cashew products (60%). (Dania *et al.*, 2021; Emelike & Akusu, 2019; Ogunjobi & Ogunwolu, 2010; Oyeyinka *et al.*, 2011).

Sensory Analysis

The sensory analysis was carried out on two samples. Sample A is a fruit Jam randomly selected and purchased from the market as control, while Sample B is the Cashew Apple Jam. The recorded sensory scores which range from 7.20 -8.60 using the 9-point hedonic scale is an indication that the fruit jam samples were highly acceptable by the consumers. There was significant statistical difference ($P < 0.05$) observed in some of the sensory parameters as seen in Table 3; the aroma, texture, after taste, sweetness and spreadability. But the overall acceptability of both samples were beyond 5.50 on a 9-point hedonic scales. This reveals that both samples were acceptable by the panelists. This trend is evident with the occurrence in several studies of Jam production (Emelike & Akusu, 2019; Oyeyinka *et al.*, 2011).

Table 1. Quality Analysis of Cashew Apple Jam

Sample	TTA (%)	TSS (%)	Vitamin C (mg/100g)	pH
A	2.78 ± 0.00 ^a	68±0.00 ^a	82.72±0.01 ^a	2.45 ± 0.07 ^a
B	0.115±0.01 ^b	56±0.00 ^b	85.62±0.01 ^a	3.57±0.01 ^a

Key: sample A= Commercial Jam in the market; Sample B = Cashew Apple Jam

Table 2. Nutritional composition of Cashew Apple Jam

Sample	%Moisture content	%Crude protein	% Ash Content	% Crude Fat	%Soluble Carbohydrate
A	39.41 ± 0.84 ^a	0.46 ± 0.00 ^a	0.19 ± 0.00 ^a	0.18 ± 0.00 ^a	64.77 ± 0.23 ^a
B	44.32±0.00 ^b	2.95±0.01 ^a	3.86±0.01 ^a	1.72±0.00 ^a	27.20±0.01 ^b

Means followed by different superscript with a column are significantly different ($p < 0.05$)

Key: sample A= Commercial Jam in the market; Sample B = Cashew Apple Jam

Table 3. Sensory analysis of sample A and B

Samples	Color	Aroma	Texture	Appearance	Aftertaste	Sweetness	Spread-ability	Overall
A	8.40±0.70 ^a	7.90±0.88 ^a	8.40±0.79 ^a	8.20±0.92 ^a	7.60±0.70 ^a	8.20±0.92 ^a	8.80±0.42 ^a	8.50±0.53 ^a
B	8.60±0.52 ^b	7.20±0.79 ^b	6.90±0.88 ^b	7.70±0.48 ^a	7.80±0.92 ^b	8.50±0.53 ^b	7.20±0.42 ^b	7.40±0.52 ^a

Means followed by different superscript with a column are significantly different ($p < 0.05$)

Key: sample A= Commercial Jam in the market; Sample B = Cashew Apple Jam

Conclusion

This study demonstrated that an acceptable Jam can be produced from Cashew Apple, with some nutritional compositions and quality parameters remaining within acceptable limits. There is also scope for further improvement on the product by experimenting with different production methods. This will reduce waste while increasing the economic value of these fruits in Lapai LGA and throughout Nigeria. Furthermore, studies can be conducted to establish quality standards for Cashew Apple Jam in order to conform to jam product standards.

REFERENCES

- Akoma, O. A., Nma, N. Y., Musa, S. A., & Salihu, A. B. (2018). Nutritional and phytochemical composition of *Vitellaria paradoxa* (Shea Fruit Pulp).
- AOAC. (1990). Official Methods of Analysis, Association of Official Analytical Chemists, Washington DC.
- AOAC. (2000). Official Methods of Analysis, Association of Official Analytical Chemists, Washington DC.
- Baker, R. A., Berry, N., Hui, Y., & Barrett, D. M. (2005). Fruit preserves and jams. *Processing fruits: science and technology*, 2, 112-125.
- CAC. (2008). Jam, Jellies, Marmalades specifications. *RS*, 136, 2008.
- Dania, M., Abubakar Seghosime, R., & Odion-Owase, E. (2021). Organoleptic And Mineral Properties Of Chemically Preserved Cashew Apple Juice.
- Emelike, N. J. T., & Akusu, O. M. (2019). Quality Attributes of Jams and Marmalades Produced from Some Selected Tropical Fruits. *Journal of Food Processing and Technology*, 10(5). doi: 10.4172/2157-7110.1000790
- IFT. (1981). Sensory evaluation guide for testing food and beverage Products. Sensory Evaluation Division. *Food Technology*. 35(11), 50 - 59.
- Ogunjobi, M. A. K., & Ogunwolu, S. A. (2010). Physiochemical and Sensory Properties of Cassava Flour Biscuits Supplemented with Cashew Apple Powder. *Journal of Food Technology*, 10(1), 24 - 29.
- Oyeyinka, S. A., Ade-omowaye, B. I. O., Ngoddy, P. O., & Karim, O. R. (2011). Selected Quality Attributes of Jam produced from Osmo-dehydrated Cashew Apple. *Journal of Food Technology*, 9(1), 27 - 31.
- Preethi, P., Mangalassery, S., Shradha, K., Pandiselvam, R., Manikantan, M., Reddy, S., . . . Nayak, M. (2021). Cashew apple pomace powder enriched the proximate, mineral, functional and structural properties of cereal based extrudates. *LWT*, 139, 110539.
- Rana, M., Yeasmin, F., Khan, M., & Riad, M. (2021). Evaluation of quality characteristics and storage stability of mixed fruit jam. *Food Research*, 5(1), 225-231.
- Sanoppa, K. (2021). Evaluating the Volatile Compounds during Alcoholic Fermentation of different *Saccharomyces Cerevisiae* strains in mixed Juices of Cashew Apple and Longan. *Journal of microbiology, biotechnology and food sciences*, 10(4), 598-603.
- Singh, S. S., Abdullah, S., Pradhan, R. C., & Mishra, S. (2019). Physical, chemical, textural, and thermal properties of cashew apple fruit. *Journal of Food Process Engineering*, 42(5), e13094