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Nutrients, Physicochemical and Sensory attributes of jams produced from Soursop and Pawpaw pulp

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ABSTRACT

Ready- to- eat soursop and pawpaw fruits were purchased from Ubani and Umuariaga markets Umuahia, Abia State. Crude protein and crude fiber ranged between 1.17-1.27% and 0.04-0.05% respectively. Ca (90.39mg/100g), Mg(143.49mg/100g), Na(290.51mg/100g) P(185.67mg/100g), I(6.67mg/100g) and Fe(0.35mg/100g) were significantly higher in pawpaw jam,while K (69.38mg/100g) was significantly higher in soursop jam. All the vitamin analysed were significantly higher in pawpaw jam. Phytochemicals were within permissible limits. pH, total titratable acidity and total soluble solids ranged between 3.24- 3.45, 0.63-0.78% and 63.45-70.71% respectively. Pawpaw and soursop jams compared fovourably with pineapple jam (commercial jam) in terms of flavor, taste and texture, but colour attribute for pawpaw jam (7.65) was significantly higher than that of pineapple jam. The results indicated that the jams particularly that of pawpaw would provide essential valuable minerals, energy and vitamin C, needed for good body development.

Keywords:

pawpaw lam, soursop jam, nutritional, physicochemical, sensory attributes.

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1.0 Introduction

Commonly consumed fruits are usually surplus in Nigeria in their various seasons however; more than 50% are lost due to the perishable nature of fruits occasioned by high moisture content, poor post-harvest handling and marketing strategies (Olukunle *et al.*, 2007). In some countries like the Caribbean and the Pacific, transformation of fruits into juices, jams and chutneys have reduced spoilage and have formed the basis for lucrative value chains (CTA, 2012).

Annona muricata L. commonly known as soursop is a tropical fruit that belongs to the family *Annonaceae* (Armstrong, 2000). Soursop tree tends to flower and fruits more or less continuously but in every growing area there is a principal season of ripening. In Puerto Rico, it flowers between March to June or September. In southern India and Florida, it extends from June to September while in Hawaii, the early crop occurs from January to April with midseason crop occurring between June to November (Morton, 1987). In Nigeria, the first fruits normally appear at the end of the drying season (February, March). A hundred (100)grams of edible portion of soursop contains 66 kilocalories, 16.48g carbohydrates, 3.3g fibre, 0.3g fat, 1g protein, 20.6mg vitamin C, 0.05mg riboflavin, 0.9mg niacin, 0.059mg vitamin B_6, 14μg folate, 0.253mg pantothenic acid, 0.6mg iron, 21mg magnesium, 27mg phosphorus, 278mg potassium and 0.086mg Copper (USDA, 2008). Pawpaw (*Carica papaya*) belongs to the family *Caricaceae* (Layne, 1996). In Nigeria, pawpaw grows throughout the year but the main harvesting season occurs between September and May. It is rich in vitamin C, magnesium, Iron, copper and manganese (Jones and Layne, 2009).

Soursop and pawpaw are majorly consumed raw in Nigeria (Koleosho, 2013; Muanya, 2015); this could be the reason why at their peak period, the surplus fruits suffer post-harvest losses due to poor handling (CTA, 2012). There is therefore urgent need to explore an affordable and easily adoptable food processing method that can be used to convert the surplus fruits into shelf stable products like juices, jams and jellies which are easy, cheap and economically reliable alternative that will reduce post-harvest losses and in the long run reduce micronutrient deficiencies in individuals. This work was therefore designed to produce jam from soursop and pawpaw pulps; with a view to improving utilization efficiency of the fruits pulp; thereby, adding value to the tree and encouraging its cultivation and sustainable management.

Materials and methods

Sources of raw materials

Ready to eat soursop and pawpaw fruits were purchased from Ubani and Umuariaga markets Umuahia, Abia State.

Preparation of the jam

A modified method described by (Adepoju *et al.*, 2010) was adopted for this purpose. The fruits were washed with potable water, cut and peeled manually with washed hands. The seeds were removed manually. The pulps (400g) were blended separately for 5minutes using an electric blender (Panasonic MX-GX 1021). Sugar (400g) lime juice (16.2ml) and a pinch of salt were added to each of the pulp. The mixture was left at room temperature for 45minutes and afterwards cooked slowly with occasional stirring for 20minutes.The jam was poured into a sterilized bottle and allowed to cool at a room temperature (29^0C-32^0C). It was then kept in a refrigerator for further analysis.

Sensory evaluation

Each jam sample was coded using three digit numbers and served in clean plates to twenty (20) panelists recruited from Michael Okpara University of Agriculture, Umudike. The samples were assessed for colour, taste, texture, appearance. All samples were presented to panelists at room temperature (29^0C-32^0C) and a sachet of water was served to each panelist to rinse his/her mouth before and after each tasting. A 9-point hedonic scale as described by (Iwe, 2010) was used for the evaluation; where 1 represented "dislike extremely", 9 represented "like extremely" and 5represented "neither like nor dislike". A commercial pineapple jam was used as control.

Determination of proximate

The proximate composition of the samples was determined by AOAC (2006). Moisture content of the samples was carried out by oven drying at 105^0C to constant weights. Crude protein was determined using micro-keldahl method. Crude fat was determined by soxhlet extraction method using petroleum either. Ash was determined by furnace incineration method. Crude fiber was determined by digesting the sample in a reagent mixture (Trichloroacetic acid, acetic acid, nitric acid and distilled water), boiling, refluxing, drying and ashing. Carbohydrate was obtained by difference, while gross energy (KJ and Kcal per 100g) was calculated based on the formular by Eknayake *et al*. (1999). Gross energy (Kcal per 100g dry matter) = (crude protein x 16.7) + (crude lipid x 37.7) + (crude carbohydrate x 16.7) for protein, carbohydrate and lipid respectively.

Determination of minerals

The minerals were determined using wet acid digestion method for multiple nutrient determinations as described by AOAC (2006). Potassium and sodium were determined by flame photometer (Jenway Digiter, Model PFP7, USA). Calcium and magnesium were determined by EDTA versarale complexiometric titration method. The iron mineral was by Atomic Absorption Spectrophotometer (Model 3030 Perkin Elmer, Norwalk USA).

Determination of vitamins

Vitamin A, Thiamin, Niacin, Riboflavin, vitamin E and Folic acid were determined by using spectrophotometric method. Ascorbic acid by dye solution of 2, 6-dichloroindophenol (DCIP) titration method was determined according to the Association of Official Analytical Chemist Methods (2006).

Determination of anti-nutrients

Gravimetric method (Harborne, 1973) was used to determine alkaloids and flavonoids. Tannin content of the samples was determined spectrophometrically as described by Kirk and Sawyer (1991). Saponin was determined by comparing the absorbance of the extract of the samples with the standard at 380nm (Makkar and Becker, 1996). Oxalate was determined spectrometrically at 420nm. Phytate was determined by titration with ferric chloride solution using the method described by Makkar and Becker (1996).

Physicochemical analysis

Total Soluble Solids was determined gravimetrically as described by A.O.A.C., (2006) method. Total titratable acidity was determined using titration method. The pH of the samples was determined by the method described by Pearson (1976).

Statistical analysis

The data generated was keyed into the computer and analyzed using Statistical product for service solution (SPSS version 20). Means and standard deviations were calculated. Sensory attributes of samples (jam) were calculated using one-way analysis of variance (ANOVA); the mean separation was done using Duncan multiple range test. All calculations were done at 5% level of significance ($p< 0.05$).

Results and Discussion

Energy and proximate composition of jam made from soursop (*Annona muricata* L.) pulp and pawpaw (*Carica papaya*) pulp.

The proximate composition of soursop jam and pawpaw jam are shown on Table 1. The moisture content of soursop jam (42.77g/100g) was significantly higher ($p< 0.05$) than the value for pawpaw jam (36.61g/100g). These values are lower than the value reported by Tanwar *et al*. (2014) for commercial orange jam (96.3g/100g). High moisture in food is an index of food spoilage; this implies that the low levels of moisture in both the soursop jam and pawpaw jam could retard microbial attack (Dewole *et al*., 2013). Protein obtained for both jams were low. The low protein found in this study was however not surprising because fruits and their products are known to be low in protein (Aworh, 2014). Low protein obtained in both jam makes them suitable for people with renal diseases (Joshi, 2010).

Crude fat content of pawpaw jam was 0.23g/100g while that of soursop jam was 0.19g/100g. Most fruits and their products are low in fat (Sheila, 1978). Ash content of pawpaw jam (0.69g/100g) differed significantly ($p< 0.05$) from that of soursop jam (0.49g/100g), but was similar to the ash value reported by Umeh and Nwadialu (2010) for *Cola parchycarpa* jam (0.6g/100g). The value

Table 1: Energy and Proximate composition of Jam made from Soursop and Pawpaw pulp.

Nutrients	Soursop jam	Pawpaw jam
Moisture content (g/100g)	$42.77^{a}\pm0.42$	$34.61^{b}\pm0.13$
Crude protein (g/100g)	$1.17^{b}\pm0.01$	$1.27^{a}\pm0.03$
Crude fat (g/100g)	$0.19^{a}\pm0.00$	$0.23^{a}\pm0.00$
Ash (g/100g)	$0.49^{b}\pm0.01$	$0.69^{a}\pm0.00$
Crude fibre (g/100g)	$0.04^{a}\pm0.00$	$0.05^{a}\pm0.00$
Carbohydrate (g/100g)	$55.38^{b}\pm0.13$	$63.16^{a}\pm0.16$
Energy (Kcal/KJ)	$227.91/968.38^{b}$	$253.79/1103.82^{a}$

Values are means ± standard deviation of duplicate samples

$^{a\text{-}b}$ Means with different superscripts along the same row are significantly different from each other ($p<0.05$).

Table 2: Mineral composition of jam made from soursop and pawpaw pulp.

Mineral	Soursop jam	Pawpaw jam
Calcium(mg/100g)	$84.78^{b} \pm 0.03$	$90.39^{a}\pm 0.01$
Potassium(mg/100g)	$69.38^{a} \pm 1.61$	$59.60^{b} \pm 0.28$
Magnesium(mg/100g)	$135.8^{b} \pm 0.01$	$143.49^{a}\pm 0.16$
Sodium(mg/100g)	$284.30^{b} \pm0.00$	$290.51^{a}\pm 0.14$
Phosphorus(mg/100g)	$179.60^{b} \pm0.11$	$185.67^{a} \pm0.09$
Iodine(µg/100g)	$7.35^{b}\pm0.04$	$8.67^{a}\pm0.05$
Zinc(mg/100g)	$0.13^{a}\pm0.00$	$0.14^{a}\pm0.00$
Manganese(mg/100g)	$0.01^{a}\pm0.00$	$0.01^{a}\pm0.00$
Copper(mg/100g)	$0.01^{a}\pm0.00$	$0.02^{a}\pm0.00$
Iron(mg/100g)	$0.03^{b}\pm0.00$	$0.35^{a}\pm0.00$

Values are means ± standard deviation of duplicate samples

$^{a\text{-}b}$ Means with different superscripts along the same row are significantly different from each other ($p<0.05$).

ash has been regarded as an indicator for mineral composition of food (McClement, 2016).

Crude fibre value for pawpaw jam and soursop jam were 0.05g/100g and 0.04g/100g respectively. Study shows that fibre helps in digestion, bowel movement and body maintenance (Whitney and Rolfes, 2014); but if consumed in excess, it may bind trace elements thereby leading to deficiency of iron and zinc in the body(Othman *et al*., 2014). Carbohydrate content of pawpaw jam (63.16g/100g) was significantly different ($p<0.05$) from that of soursop jam (55.38g/100g). Carbohydrate is a readily available source of energy for the body thereby sparing protein (Brown, 2011).The energy value of pawpaw jam (259.79Kcal/1103.82KJ) was significantly higher ($p< 0.05$) than the value obtained for soursop jam (227.91Kcal/968.38KJ). The values obtained for energy in this study were higher than those reported by Okudu *et al*. (2015) for *Cola lepidota* jam (80.2Kcal/340.5KJ). The estimated energy requirement (EER) for children 1-3 years is 992Kcal/day (Whitney and Rolfes, 2014). Consumption of 100g each of soursop jam and pawpaw jam can provide 22.9% and 26.2% of the EER for children respectively.

Mineral composition of jam made from soursop (*Annona muricata* L.) pulp and pawpaw (*Carica papaya*) pulp.

Mineral composition of soursop jam and pawpaw jam are presented Table 2. Calcium and magnesium contents of pawpaw jam (90.39 and 143.49mg/100g respectively) were significantly higher ($p< 0.05$) than those of soursop jam (84.78 and 135.3mg/100g respectively) but the potassium content of soursop jam (69.38mg/100g) was significantly higher ($p<0.05$) than that of pawpaw jam (59.60mg/100g). Calcium and magnesium are said to play significant roles in bone and teeth health/maintenance, nerve transmission, muscle contraction and blood clotting ((Smolin and Grosvenor, 2010; Zimmerman and Snow, 2012); potassium is required for fluid balance, nerve transmission and muscle contraction (Zimmerman and Snow, 2012). Sodium was high in both products (284.30 and 290.51mg/100g for soursop and pawpaw jam respectively). The high sodium content in both jams could be attributed to the addition of salt during preparation. The required adequate intake (AI) of sodium is 1500mg/day for males and females between 9 and 50years (Whitney and Rolfes, 2014); this implies that both products are still safe for consumption as they do not contain toxic levels of sodium (>2300mg/day) (Whitney and Rolfes, 2014). Phosphorus content of soursop jam was 179.60mg/100g whereas that of pawpaw jam was 185.67mg/100g. These values were higher than the value (1.3mg/100g) reported by Tanwar *et al*. (2014) for guava jam. Phosphorus is an essential component of phospholipids, bones and teeth, membranes, adenosine triphosphate and deoxyribonucleic acids. Its deficiency could lead to bone loss, weakness and loss of appetite (Smolin and Grosvenor, 2010).

Micro minerals were generally low in all the products. Iodine content of soursop jam was 7.35µg/100g and that of pawpaw jam was 8.67µg/100g. Iodine is an important micronutrient of public health concern. It is needed for synthesis of thyroid hormone and its deficiency could lead to goitre, cretinism, mental retardation, growth and developmental disabilities especially in children (Smolin and Grosvenor, 2010). There was no significant difference ($p>0.05$) between the zinc content of soursop jam and that of pawpaw jam (0.13mg/100g and 0.14mg/100g respectively). Zinc is a micronutrient of public health interest as it plays a vital role in protein and deoxyribonucleic acid (DNA) synthesis, wound healing, growth and immune function (Zimmerman and Snow, 2012). It is also a component of insulin and many enzymes (Brown, 2011). Manganese content of soursop jam and pawpaw jam were similar (0.01mg/100g). Manganese is a component of many enzymes including glutamine synthetase, pyruvate carboxylase and mitochondrial superoxide dismutase; it is also associated with the formation of connective and skeletal tissues, growth, reproduction, carbohydrate and lipid metabolism (Mahan and Stump, 2008). The copper content of soursop jam was 0.01mg/100g while that of pawpaw jam was 0.02mg/100g. Copper is a part of proteins needed for iron absorption, lipid metabolism, collagen synthesis, nerve and immune function and antioxidant protection; its deficiency leads to poor growth, bone abnormalities and anaemia (Smolin and Grosvenor, 2010). The iron content of pawpaw jam (0.35mg/100g) was significantly higher than the value for sour-

Table 3: Vitamin composition of jam made from soursop and pawpaw pulp.

Sample	Beta-carotene (μg/100g)	Thiamin (mg/100g)	Riboflavin (mg/100g)	Niacin (mg/100g)	Vitamin C (mg/100g)
Soursop jam	$1.65^{b} \pm 0.00$	$0.02^{b} \pm 0.00$	$0.02^{b} \pm 0.00$	$1.08^{b} \pm 0.00$	$17.53^{b} \pm 0.11$
Pawpaw jam	$5.72^{a} \pm 0.00$	$0.05^{a} \pm 0.02$	$0.04^{a} \pm 0.00$	$1.24^{a} \pm 0.00$	$29.53^{a} \pm 0.11$

Values are means ± standard deviation of duplicate samples

$^{a-b}$ Means with different superscripts along the same column are significantly different from each other ($p<0.05$).

Table 4:Phytochemical content of jam made from soursop pulp and pawpaw pulp.

Sample	Alkaloid (mg/100g)	Flavonoid (mg/100g)	Phenol (mg/100g)	Tannin (mg/100g)
Soursop jam	$0.05^{a} \pm 0.00$	$0.04^{a} \pm 0.00$	$0.05^{b} \pm 0.00$	$0.13^{a} \pm 0.00$
Pawpaw jam	$0.04^{a} \pm 0.00$	$0.03^{a} \pm 0.00$	$0.08^{a} \pm 0.00$	$0.07^{b} \pm 0.00$

Values are means ± standard deviation of duplicate samples

$^{a-b}$ Means with different superscripts along the same column are significantly different from each other ($p<0.05$).

Table 5: Physiochemical Attributes of jam made from soursop and pawpaw pulp.

Physicochemical Properties	**Soursop jam**	**Pawpaw jam**
pH	$3.24^{b} \pm 0.00$	$3.45^{a} \pm 0.00$
Titratable acidity	$0.78^{a} \pm 0.00$	$0.62^{b} \pm 0.00$
Total soluble solids	$70.77^{a} \pm 7.11$	$63.45^{b} \pm 0.00$
TSS/TA	90.2	102.34

Values are means ± standard deviation of duplicate samples $^{a-b}$ Means with different superscripts along the same column are significantly different from each other ($p<0.05$). TTS- Total soluble solids; TA- Titratable acidity

Table 6: Sensory Attributes of jam produced from Soursop and Pawpaw pulp.

Sample	Colour	Taste	Flavour	Texture	General Acceptability
Soursop jam	$6.60^{b} \pm 1.39$	$6.70^{a} \pm 1.34$	$7.05^{a} \pm 1.39$	$6.15^{a} \pm 1.39$	$6.80^{a} \pm 1.61$
Pawpaw jam	$7.65^{a} \pm 0.81$	$7.05^{a} \pm 1.23$	$7.20^{a} \pm 1.70$	$6.85^{a} \pm 1.42$	$7.35^{a} \pm 1.14$
Pineapple jam (control)	$6.05^{b} \pm 1.99$	$6.70^{a} \pm 1.95$	$7.10^{a} \pm 1.02$	$6.25^{a} \pm 1.42$	$7.00^{a} \pm 1.26$

Values are means ± standard deviation^{a-b} Means with different superscripts along the same column are significantly different from each other ($p<0.05$).The scores for flavour and texture of soursop jam, pawpaw jam and pineapple jam did.

sop jam (0.03mg/100g). These values were lower than 1.6mg/100g obtained by Tanwar *et al.* (2014) for guava jam. Iron transports oxygen as a component of haemoglobin in red blood cells. It is a component of myoglobin and also required for certain reactions involving energy formation (Brown, 2011).

Vitamin composition of jam made from soursop(*Annona muricata* L.) pulp and pawpaw (*Carica papaya*) pulp.

Vitamin composition of soursop and pawpaw jams are shown on Table 3. The value of beta-carotene for pawpaw jam (5.72μg/100g) was significantly higher than that of soursop jam (1.65μg/100g). Apart from been a nutrient β-carotene also acts as anti-oxidants. Thiamin (vitamin B_1) content of soursop jam was 0.02mg/100g while pawpaw jam was 0.05mg/100g. Thiamin helps in energy metabolism by converting complex carbohydrates to glucose. Its deficiency leads to beri-beri (Whitney and Rolfes, 2014). Riboflavin (vitamin B_2) composition of soursop jam (0.02mg/100g) was significantly different (p<0.05) from that of pawpaw jam (0.04mg/100g). Riboflavin serves as a co-enzyme in many reactions (Smolin and Grosvenor, 2010). Niacin (vitamin B_3) composition of pawpaw jam (1.24mg/100g) was significantly higher (p<0.05) than the value for soursop jam (1.08mg/100g). In its co-enzyme forms (Nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) niacin is involved in energy metabolism and synthesis of body fat. Niacin is also involved in the maintenance of normal nervous system function (Brown, 2011).The vitamin C (ascorbic acid) content of pawpaw jam (29.53mg/100g) was significantly higher (p<0.05) than the value for soursop jam (17.53mg/100g). However, the score obtained for soursop jam was close to that obtained by Fasogbon *et al*. (2013) for fresh pineapple jam (18mg/100g). Vitamin C acts as an antioxidant and a promoter of iron absorption in the body (Mahan and Stump, 2008).

Phytochemical composition of jam made from soursop(*Annona muricata* L.) pulp and pawpaw (*Carica papaya*) pulp.

The phytochemical composition of jams produced from soursop pulp and pawpaw pulp are shown on Table 4. Alkaloid in soursop jam was 0.05mg/100g while in pawpaw jam it was 0.04mg/100g. Alkaloids are known to act as analgesics and anesthesia (Sahelian, 2016). Flavonoid ranged between 00.03-0.04mg/100g in pawpaw and soursop jam respectively. Flavonoids act as antioxidants and promote several health effects (Robertson, 2014). Phenol content of pawpaw jam (0.08mg/100g) was significantly higher (p< 0.05) than that of soursop jam (0.05mg/100g). Phenolic acids have been found to be beneficial against colon cancer and prostate cancer; they have also been found to exert diuretic properties as well as anti-inflammatory and anti-fungal activity (Kyle, 2011). Tannin contents of soursop jam and pawpaw jam were 0.13mg/100g and 0.07mg/100g respectively. These values are lower than the value (0.19mg/100g) reported by Aina *et al*. (2011) for pineapple jam. Tannin acts as an antioxidant although it has a characteristic dryness and astringency (Vinepair, 2016).

Physicochemical attributes of jam made from soursop(*Annona muricata* L.) pulp and pawpaw (*Carica papaya*) pulp.

The physicochemical attributes of jam made from soursop pulp and pawpaw pulp are shown on Table 5. The pH value of pawpaw jam (3.45) was significantly higher than that of soursop jam (3.24). These values are slightly lower than the value (3.95) reported by Fasogbon *et al.* (2013**)** for pineapple jam but fell within the ranges reported by Gonzalez *et al*. (2010) for kiwi jam and orange marmalade (3.04–4.68). The low pH values obtained in this study is desirable because low pH has been shown to retard some specific bacteria growth (Rahman, 2007).

The total titratable acidity (TTA) of soursop jam (0.78%) was significantly different (p< 0.05) from that of pawpaw jam (0.62%). These values are however lower than the value reported for fresh pineapple jam (1.38%) by Fasogbon *et al.*(2013). These variations can be attributed to the difference in their acid contents. Viana *et al*. (2012) also verified an increase in total titratable acidity and a reduction in pH in mixed jams made with pawpaw and araca-boi (*Eugenia stipitata*).

Total soluble solid (°Brix) value of soursop jam (70.77 °Brix) was significantly different ($p < 0.05$) from the value obtained for pawpaw jam (63.45 °Brix). A similar value to that of soursop jam (69 °Brix) was obtained by Lago *et al*. (2006) for mango jam. However, higher values were obtained by Singh *et al*. (2009) in mixed jams of pineapple and pawpaw (70.5 °Brix) as well as in mixed jams of pawpaw and orange (72.5 °Brix). Total soluble solid is an important parameter in the process of making jam. A total soluble solid content lower than 60 °Brix make the gel weak whereas a total soluble solid content higher than 70 °Brix may cause crystallization of the sugar, an undesirable change in the texture of jam.(Viana *et al*., 2014). The ratio of total soluble solids to total titratable acidity was higher for pawpaw jam (102.34) than for soursop jam (90.73). The ratio is a quality index related to the sweetness of the product. Thus, higher ratio values indicate that the product presents a more pronounced sweetness which directly affects consumer acceptance (Viana *et al*., 2014).

Sensory attributes of jam made from soursop(*Annona muricata* L.)pulp and pawpaw(-*Carica papaya*)pulp.

Sensory attributes of the products are shown on Table 6. The scores for taste (6.70-7.05), flavor (7.05-7.20), and texture (6.15-6.85) for sousop and pawpaw jam were comparable to the taste; flavor and texture of pineapple jam (6.70, 7.10 and 7.00 respectively). The colour attribute for pawpaw jam (7.65) was significantly higher than that of pineapple jam (6.05). The preference for the colour of pawpaw jam may be due to its high beta-carotene content which gave it a brighter colour. Carotenoids in foods are generally classified into carotenes and xanthophyll which give attractive red or yellow colour to fruits and vegetables and also contribute to food quality (Onwuka 2014; Okudu *et al.,* 2015).

Conclusion

The result shows that pawpaw jam was significantly higher in calcium, magnesium, sodium, phosphorus, iodine and iron while soursop jam was higher in potassium. All the vitamins analyzed were higher in pawpaw jam whereas both jams were low in phytochemicals analyzed. The results of the sensory evaluation revealed that soursop jam, pawpaw jam and pineapple jam (control) were comparable with respect to taste, flavour, texture and general acceptability. However, pawpaw jam had the highest score for colour. This makes soursop jam and pawpaw jam good alternatives to commonly consumed jams.

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