PROXIMATE AND MINERAL COMPOSITION OF LOCALLY PRODUCED PAWPAW AND BANANA WINE

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ABSTRACT

Due to non- availability of/or poor storage facilities large quantities of these fruits are wasted yearly. Consequently, vital nutrients (especially Vitamins) and potential revenue sources are lost. Fruits are rich in sugars and thus can be used to produce wine. This study evaluates the proximate and mineral composition of fruit wines produced locally from ripe Pawpaw (*Carica Papaya*) and Banana *(Musa sapientum*) using commercial *Saccharomyces cerevisiae* (E. C Kraus USA) and compared them with Red wine (Carlo Rossi). Carbohydrate contents of the produced wines were 6.1% (banana wine) and 6.2% (pawpaw wine); sugar contents were 0.1 g/100g (banana wine) and 0.2 g/100g (pawpaw wine), Vitamin C contents were 10mg/100g (pawpaw wine) and 15mg/100g (banana wine); while protein contents were 0.12 (pawpaw wine) and 0.28 mg/l (banana wine). The total solid contents were 7.0 (pawpaw wine) and 7.3 mg/ml (banana wine), dissolved solid content ranged between 990 -1650 mg/l while crude fibre and crude fat were absent in all the wines. The K^+ Na^+ Mg^+ Ca^{++} and Cl^- contents were 12, 64, 48, 0.8 and 24 and 21 mg/l, content ranged between 64 and 78 mg/l, content ranged between 48 and 54 mg/l); content ranged between 0.8 and 12mg/l; while content ranged between 24 and 60 mg/l.

The fruit wines produced were comparable to Red wine in terms of nutritive quality and Vitamin C content and can therefore serve as source of minerals.

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INTRODUCTION

Wine is an alcoholic beverage made by fermentation of fruit juice of ripe grapes using *Saccharomyces cerevisae;* other sugar rich fruits can also be used. It has been produced for thousands of years since ancient civilization to modern times, and is enjoyed by people: from peasants to kings (Michael, 2000). Wine is an alcoholic beverage made by fermentation of juice of ripe grapes using *Saccharomyces cerevisae;* other sugar rich fruits can also be used. Fruits are an integral part of African diet and are consumed as relishes and snacks. They are rich in vitamins, especially vitamin C, minerals, fats and sugars (Ogbonna, 1991). Fruits are neglected by many people due to ignorance of the nutritive value of most of the fruits. Rising cost of fruits, problems of storage of distribution also contribute to this neglect (Tindall and Florence, 1983).

Pawpaw (*Carica papaya*) is grown mostly for fresh consumption or for production of proteolytic enzyme papin from the fruit latex. Unripe pawpaw fruits are commonly used as vegetables for cooking. It is relished for the attractive pulp color, flavor, succulence, and characteristic aroma (Desai and Wagh, 1995). It is consumed in large amounts in most areas of the tropics and is thought to contribute greatly to the vitamin C component in large amounts in

most areas of the tropics and is good source of carotene (Morton, 2006; Papaya, 2008). Banana (*Musa sapietum)* originated in Southeast Asia and Malaysia. It is one of the most sought after fruits in the world and plays an important role in the economy of developing countries (Chandramita, 2011). It is low in Calories and fat, high in vitamin C, potassium and magnesium and is therefore referred to holistic food. Fresh fruits are easily perishable; the nutrients that could be lost can be harnessed and made available all year round, if the fruits are put to other use such as wine production. In addition, foreign exchange can be saved by producing wines locally instead of importing wines.

MATERIALS AND METHODS

Wine production

Fresh, ripe healthy Pawpaw and Pineapple fruits were obtained, they were peeled and their proximate composition determined**.** Pawpaw and Pineapple wines were produced in the laboratory of the Department of Microbiology, University of Ilorin, Ilorin, Nigeria using *Saccharomyces cerevisae* purchased from E. C Kraus USA as a fermenting organism.Ten Kilogram (10 kg) of each fruit was blended to obtain the fruit pulp. The fruit pulp was mixed with warm water (45°C) in the ratio (1:2) to obtain the 'must' needed for wine production. The must was sterilized with sodium metabisulphate solution. Standardized campden tablet, 30% sucrose and yeast nutrient were added to the must and allowed to stay for 24 hours, after which yeast was added (Berry, 2000).

Fermentation Process

The must from each fruit was transferred into separate fermenting jars and inoculated by sprinkling the surface with standardized quantity of yeast. The fermenting jars were covered with muslin cloth and incubated at room temperature (29±2°C). Yeast multiplication was stimulated by stirring each must to aerate it; it was done daily for six days (Berry, 2000). Aerobic fermentation was terminated after 6 days. Each of the must was sieved to remove the shaft and debris of the crushed fruits. The filtrates obtained after sieving each must were transferred into anaerobic fermentation jars and incubated at room temperature.

An air trap was fixed to the fermenting jar to monitor progress of fermentation. Campden tablet was added to the filtrate to supply sulfur dioxide gas. Fermentation was terminated after six weeks, the wine was then stored at room temperature to allow the yeast to flocculate. The wines were racked monthly for three months to clear them and then aged for 6 months. The wine was filtered using pressurized filtering kit Model FLT250 manufacture by E.C Kraus, USA and decanted into sterile bottles and corked.

Proximate and chemical analysis

The ash content, organic acid, glucose content and total solid contents were determined as described by Manual of Chemical Methods of Food Analysis (1982). The vitamin C content was determined by volumetric method as described by Dickinson *et al.* (1992)**.** The protein and crude fibre contents were determined using the methods of Association of Official Agriculture Chemists (AOAC, 1980). The carbohydrate content was estimated as described by Jacob (1999). The Crude fat content was determined by the method described by Southgate (1971). The chemical compositions: Na^+, K^+ contents of the samples were determined using the methods of

MCMFA (1982). The Mg^{++} and Ca^{++} contents were determined according to the method of Benton and Vernon (1990). The chloride contents were determined by potentiometric titration as described by Skoog and West (1982). Red wine (Carlo Rossi) imported from USA served as a control for this work.

RESULTS

Proximate analysis of the fruits showed that the fruits were rich in carbohydrate: 41.4% and 48.2% for Pawpaw and Banana respectively. However, their sugar contents were low: 2.87g/100g and 3.38g/100g for Pawpaw and Banana respectively while they were rich in vitamin C: 19.2mg/100g and 12.2g/100g for Pawpaw and Banana respectively (Table 1). The wines produced were rich in carbohydrate and vitamin C (Table 2). The mean carbohydrate contents were 6.10% (banana wine) and 6.20% (pawpaw wine) compared to 8.30 (red wine). The sugar content was 0.1 g/100g (Banana wine) and 0.2 g/100g (pawpaw wine) compared to 0.3 g/100g (red wine).

The Vitamin C contents were 10 mg/100g (pawpaw wine) and 15 mg/100g (Banana wine), while the Red wine had Vitamin C content of 25 mg/100g. The protein contents were low; 0.12 and 0.28 mg/l for pawpaw wine and banana wine respectively while Red wine had protein content as high as 0.60%. The ash contents were 0.70% (banana wine), 0.30% (pawpaw wine) and 0.02 (Red wine). The total solid contents were 7.00 (pawpaw wine) and 7.30 mg/l (banana wine), which is similar to that in Red wine (9.10mg/l). The total dissolved solid content was 990 (pawpaw wine) and 1650 mg/l (banana wine) as against 1300 in Red wine. The produced wines

were free of crude fibre and crude fat. The alcohol contents were 10 and 9.8% for banana and pawpaw respectively.

Table 1: Proximate compositions of fruit samples

Composition Parameters	Fruit		
	Pawpaw	Banana	Grape*
Carbohydrate %	41.4± 0.2	48.2 ± 0.2	15.7± 0.1
Sugar (glucose) g/100g	2.87 ± 0.01	3.38 ± 0.02	17.9± 0.01
Organic Acid mg/100g	1.18 ± 0.04	1.02 ± 0.01	4.0± 0.01
Vitamin C mg/100g	19.2 ± 0.2	12.2 ± 0.2	ND
Moisture content %	91.4 ± 0.2	67.2 ± 0.2	80.0± 0.01
Protein %	0.12 ± 0.02	0.28 ± 0.02	1.3± 0.02
Ash %	0.43 ± 0.02	1.39 ± 0.03	ND

Key: ND = Not Determined * Source: Alwood (2011).

Table 2: Proximate Composition of Wine Samples

Parameters	Wine		
	Red	Pawpaw	Banana
Carbohydrate (%)	8.30 ± 0.20	6.20 ± 0.02	6.10 ± 0.02
Sugar-glucose (g/100g)	0.30 ± 0.01	0.20± 0.01	0.10 ± 0.02
Fat (%)	0.00 ± 0.00[a]	0.00 ± 0.00 [a]	0.00 ± 0.00 [a]
Vitamin C (mg/100g)	25.00 ± 0.20	10.00 ± 0.02	15.00 ± 0.02
Crude Fibre (%)	0.00 ± 0.00 [a]	0.00 ± 0.00 [a]	0.00 ± 0.00 [a]
Protein (%)	0.60 ± 0.01	0.12 ± 0.02	0.28 ± 0.02
Ash (%)	0.02 ± 0.03	0.30 ± 0.02	0.70 ± 0.02
Total solids (mg/l)	9.10 ± 0.20	7.00 ± 0.00	7.30 ± 0.02
Total dissolved solids mg/l	1300.00 ± 0.01	990.00 ± 0.02	1650.00 ± 0.03

[a] Have no values; Values along the same row are significantly different (P<0.05)

The minerals composition of the wines is shown in Table 3, they were rich in K^+, Na^+, Mg^{2+}, Ca^{2+} and Cl^-. The K^+ contents were 12, 21 and 35mg/l for banana wine, pawpaw wine and red wine respectively. The Na^+ contents were 64, 78 and 128mg/l for banana wine, pawpaw and red wine respectively. The Mg^{2+} contents were 48, 54 and 28 for banana wine, pawpaw wine and red wine respectively. The Ca^{2+} content were 8, 12 and 8mg/l for banana wine, pawpaw wine and red wine respectively. The Cl^- content were 60, 24 and 35mg/l for banana wine, pawpaw wine and red wine respectively.

Table 3: Minerals Composition of wine samples

Parameters	Wine		
	Red	Pawpaw	Banana
K+ (mg/l	35.00 ± 0.10	21.0 0± 0.20	12.00 ± 0.20
Ca ++ (mg/l)	08.00 ± 0.10	12.00 ± 0.01	08.00 ± 0.02
Na + (mg/l)	128.00 ± 0.02	78.00 ± 0.04	64.00 ± 0.01
Mg ++ (mg/l)	28.00 ± 0.10	48.00 ± 0.2	54.00 ± 0.20
Cl- (mg/l)	35.00 ± 0.03	24.00 ± 0.2	60.00 ± 0.20

Values along the same row are significantly different ($P<0.05$)

DISCUSSION

The proximate composition of fruit wines produced reflected the composition of the fruit substrate used in producing them. It has been reported by Salvi and Rajput (1995) that proximate compositions of fruits vary with location where the fruits are grown. Hence, the variation in

proximate composition of the fruit wines can be regarded as a confirmation of the assertion by Salvi and Rajput (1995) that composition of wines varied with geographical location. The production process used in producing the wine retained about 52% of Vitamin C present in the banana fruit while it added to that in the pawpaw fruit. The low protein content of the wines produced is good for maintenance of cellular organization (Desai and Wagh, 1995). The absence of Crude fibre and Crude fat further demonstrate the desirable nutritive quality of the fruit wines produced. The carbohydrate and sugar contents of the fruits wines were comparable to those of Red wine used as control. The absence of crude fats suggests that the wine could provide protection against excess body lipids (cholesterol).

Some of the minerals present in the fruit wines produced are required for metabolic functioning of the body. Minerals are important for bone and teeth formation, blood clotting, muscle contraction, transmission of impulses in nerves and maintenance of osmotic balances. They are usually taken in minute quantities through food we eat (Michael, 2005). Macronutrients are essential components of biological membrane and aid the transport of ions in and out of the membrane. Ca^{2+} are tissue components of bones and teeth while Na^{+}, Cl^{-} and K^{+} aid in impulse transmission along membrane; they also help in maintaining osmotic balance (homeostasis). Ca^{2+} also enhances enzyme catalysis as cofactors. This further demonstrates the desirable nutritive quality of the wines. The wines produced were comparable to Red wine in terms of nutritive quality including Vitamin C content and minerals.

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