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Full Length Research Paper

Studies on the storage stability of soursop (*Annona muricata* L.) juice

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This work was aimed at producing juice from soursop (*Annona muricata L.*) and understudying its storage stability at refrigeration (4°C) and ambient (28°C) temperatures. Physicochemical, microbiological and sensory qualities of the juice were analysed before they were stored for 8 weeks. Changes in physicochemical quality and microbiological quality were analysed regularly during the period of storage. Results showed that processing affects the physical and chemical composition of the soursop pulp. The soursop juice was found to be microbiologically safe for consumption. Results showed that the soluble solid of the pasteurized juice was more stable at 4°C than at 28°C. More acid was produced in the juice at higher temperature (28°C) than at lower temperature (4°C) during storage. Results have shown that pasteurisation of soursop juice reduced microbial counts from 3 x 10^5 to < $10x10^1$ cfu/g for mesophilic aerobic counts and 27.5 x 10^6 to < 10 x 10^1 cfu/g for moulds and yeasts.

Key words: Soursop juice, storage stability, physicochemical quality, microbiological quality.

INTRODUCTION

Juices produced from tropical fruits have increasingly gained global importance due to their characteristic exotic aroma and colour. There are different types of tropical fruits readily available for the production of fruit juice. These include orange, grape, pineapple, banana, guava and watermelon. Their uses depend on the type of drink or juice one intends to produce. The juice may be produced from single fruit or combination of fruits of different choices. Fruits may also be processed into other fruits products such as beverages, wine, jellies, jam, and fruit-butter preserves and pure. There are fruits that are less well known or highly dispersed. Such fruits include lychee, babaco mamay and soursop (Bates et al., 2001).

Soursop, also known as guanabana (*Annona muricata* L.) is one of the exotic fruits prized for its very pleasant, sub-acid, aromatic and juicy flesh (Morton, 1987; Umme et al., 1997). However it softens very rapidly during ripening and becomes mushy and difficult to consume fresh. It is rejected at market because of external injury, or uneven shape and size (Umme et al., 2001). Soursop is commonly found in Southern part of Nigeria. It is mostly eaten as fresh fruits. Therefore, soursop can become a potential source of raw material for puree, juice, jam, jelly, powder fruits bars and flakes. Once the juice has been extracted and placed in storage it will need considerable treatment before being acceptable to the consumer.

Freshly expressed juice, is highly susceptible to spoilage, in fact more so than whole fruit. Unprotected by skin or cell walls, fluid components are thoroughly mixed with air and microorganism from the environment. Thus, unheated juice is subject to rapid microbial, enzymatic, chemical and physical deterioration. The goal of processing is to minimizing these undesirable reactions while still maintaining and in cases enhancing, the inherent quality of the starting fruit (Bates et al., 2001). The most frequent reason for quality deterioration of food product is the result of microbial activity and this often result in food moulding, fermenting and change in acidity.

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Table 1. Physicochemical composition of soursop pulp and juice.

Parameter	Soursop pulp	Soursop juice
Moisture (%)	81.5±0.0.07	87.5±0.0.06
Fat (%)	0.87±0.0.02	0.05±0.0.02
Protein (%)	1.0±0.0.05	0.64±0.0.05
Ash (%)	0.8±0.0.01	0.51±0.0.02
Carbohydrate (%)	16.83±0.0.12	11.3±0.0.2
Brix (°)	6.0±0.0.3	15.0±0.0.4
pH	3.7±0.0.1	3.85±0.0.2
Acidity (g citric acid/100 g)	0.7±0.0.03	0.02±0.0.01

Many consumers are concerned with the wholesomeness of products, which have undergone minimal heat treatment. Therefore the objective of this study was to determine the storage stability of soursop juice.

MATERIALS AND METHODS

Preparation of soursop juice

Fresh fully ripe soursop (*Annona muricata* L.) fruits were purchased from the Station Market in Kaduna metropolis. The fruits were washed under running tap water, hand peeled, decored, deseeded and the pulp blended using an electric blender (Kenwood, England). Water was added in the ratio of 1:2 (w/v, pulp/water) to facilitate the blending process. The pulp was filtered using a muslin cloth. About 10% sugar solution was added to bring the brix to 15°.

Physical and chemical analyses

The moisture, crude protein (N x 6.25), crude fat and ash contents of soursop pulp and soursop juice were determined using relevant AOAC methods (AOAC, 1984). Titratable acidity (g citric acid/100 g) and pH of the samples were determined according to the methods described by Egan et al. (1981).

Microbiological analysis

Samples were serially diluted with sterile 0.1% peptone water and plated into microbiological media by the pour plate technique (AOAC, 1984) in duplicate. Yeasts and moulds counts were determined using Sabouraud Dextrose Agar (SDA) and 14% tartaric acid. Aerobic mesophilic bacterial counts were determined using plate count agar (PCA) while coliform counts with Endo agar and 0.4 ml Fuchsin solution. Plates were incubated inverted for moulds at 30°C for 3 days while for aerobic mesophilc bacteria it was at 35°C for 24 h and coliforms at 35°C for 48 h.

Storage studies

Pasteurized soursop juice was store under refrigeration temperature (4°C) and ambient temperature (28°C) for 8 weeks. Samples were analysed for brix, titratable acidity (g citric acid/100 g), pH, aerobic mesophilic bacteria and moulds/yeasts counts and coliform counts at regular intervals of one week.

RESULTS AND DISCUSSION

Physicochemical and microbiological quality of soursop juice

Table 1 gives the physicochemical composition of soursop pulp and soursop juice. The result shows that there were decreases in the fat, protein, ash, carbohydrate and acid content of the soursop juice, while increases were observed for moisture content, brix and pH of soursop juice compared to the pulp. This shows that processing affects the physical and chemical composition of the soursop. The values for the composition of soursop and the juice were similar to those given by Morton (1987), CFN/PAHO (1998) and Umme et al. (2001). The pH value of the juice was similar to that given by Umme et al. (2001) while the brix fell within the values given by Bates et al. (2001) for fruit juices.

The results also showed that aerobic mesophilic counts for pasteurized juice was $<1 \times 10^1$ cfu/g while mould and yeasts counts for pasteurized juice was $< 1 \times 10^1$ cfu/g. There were no coliforms in both the unpasteurized juice and pasteurized juice. This shows that the soursop juice was microbiologically safe for human consumption.

Changes in physiochemical qualities of sour-sop juice during storage

Figure 1 shows that there was also a gradual decline in the brix from 14° to 3° for pasteurized soursop juice stored at 28°C. However, the brix of the pasteurized juice stored at 4°C was fairly stable throughout the storage period. The stability of the brix of the pasteurized juice stored at 4°C could be due to the effect of low temperature during storage couple with the heat treatment given before storage. This inhibited the growth

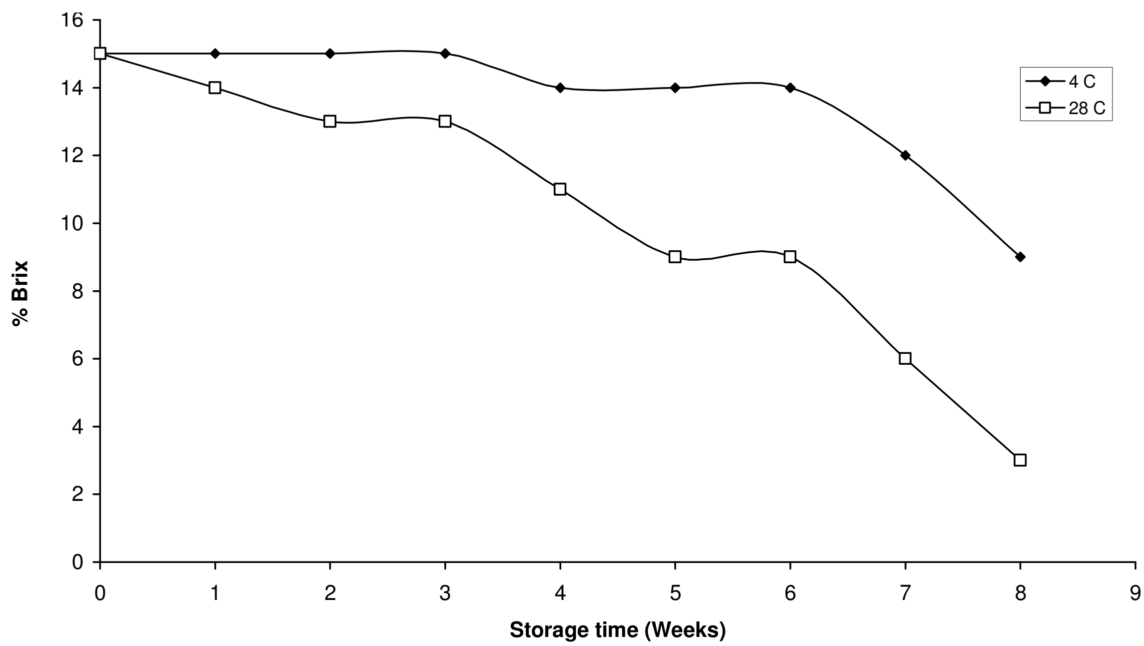

Figure 1. Changes in brix of pasteurized sour sop juice during storage.

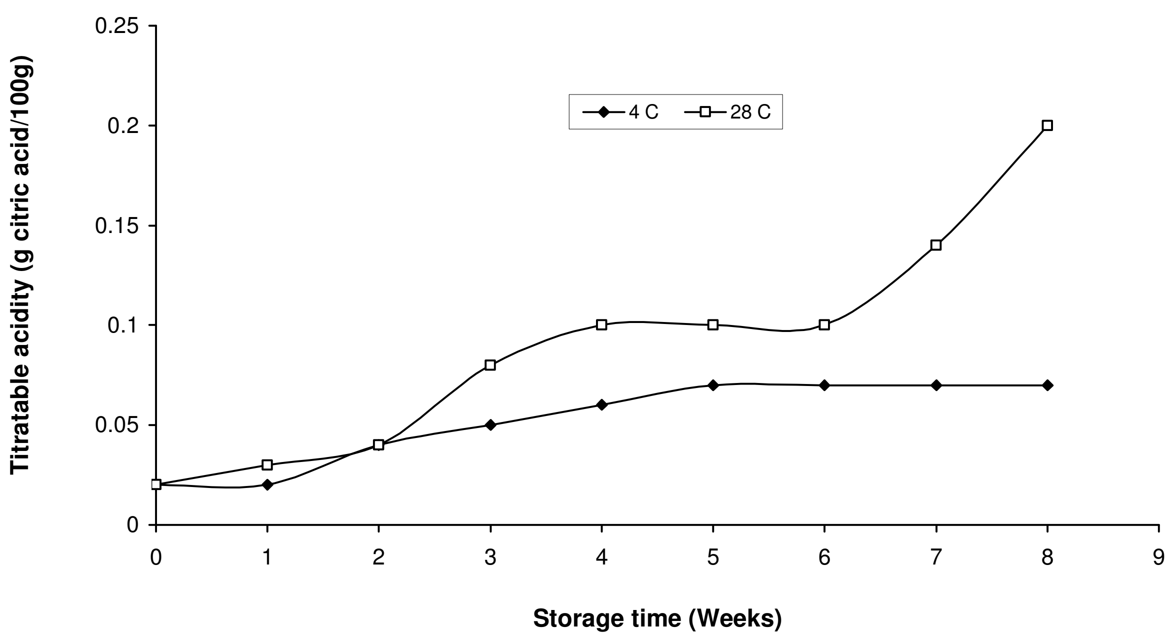

Figure 2. Changes in titratable acidity of pasteurized sour sop juice during storage.

of microbes especially yeasts which are known to infect sugar and sugar products such as fruit juices that have low acid and initiate fermentation resulting in sugar reduction in the juice.

There was a gradual decline in pH for juice stored at 4°C from 3.85 to 3.0 (Figure 2). Lower pH values were obtained for storage at 28°C (from pH 3.85 to 2.7). There was a gradual increase in the acidity of the pasteurized juice within the 1st 3 weeks, followed by fairly constant acidity (from 4 – 7 weeks). The acidity was 0.2 g citric acid/100 g and 0.07 g citric acid/100g for juice stored at 4°C and 28°C, respectively, by the 8th week (Figure 3).

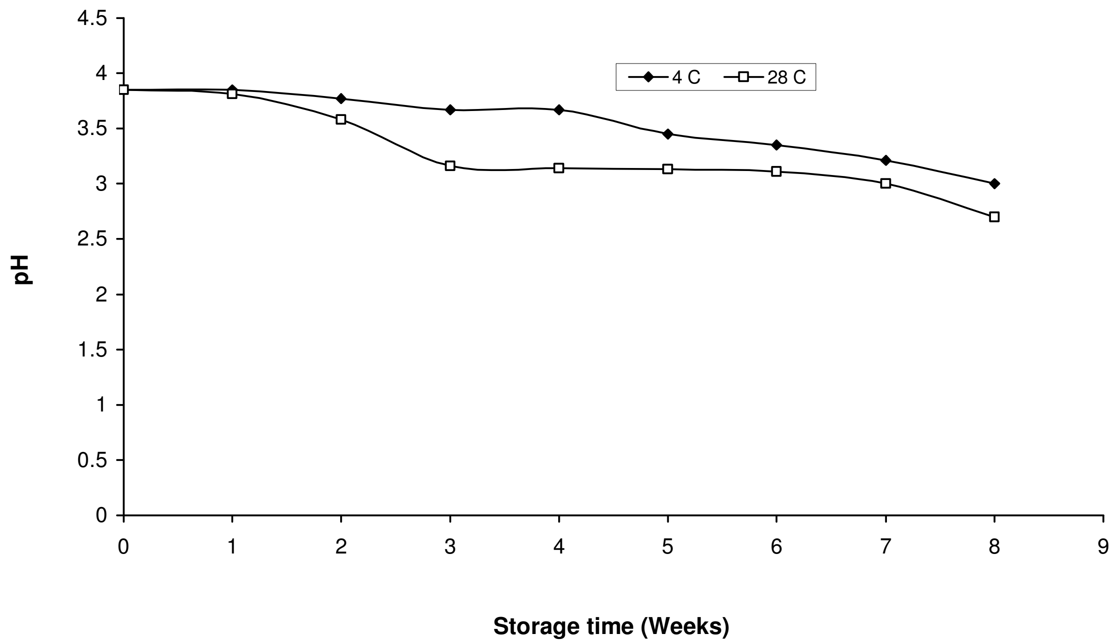

Figure 3. Changes in pH of pasteurized sour sop juice during storage.

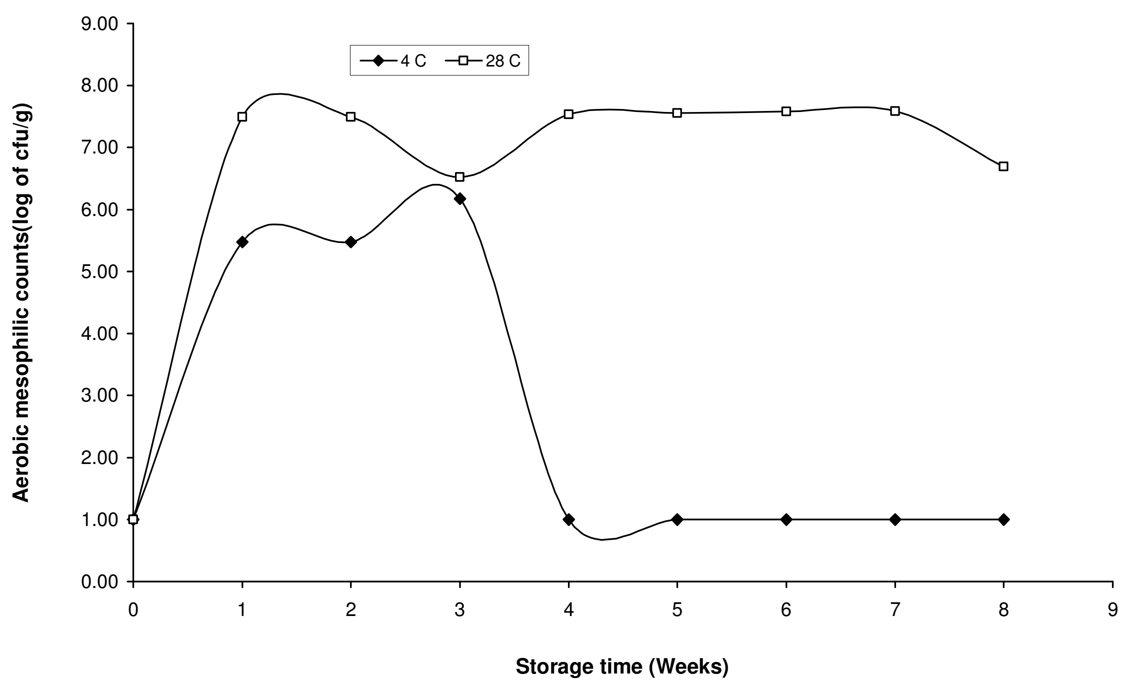

Figure 4. Aerobic mesophilic counts profile of pasteurized sour sop juice during storage.

This indicated that more acids were produced at higher temperature (28°C) than at lower temperature (4°C) during storage. The results generally show that the higher the pH, the lower the acidity of the juice.

Microbial changes in soursop juice during storage

Figure 4 shows that the mesophilic aerobic counts increased in the 1st week for pasteurized soursop juice stored at 4°C. It rapidly decline by the 3rd to 4th week

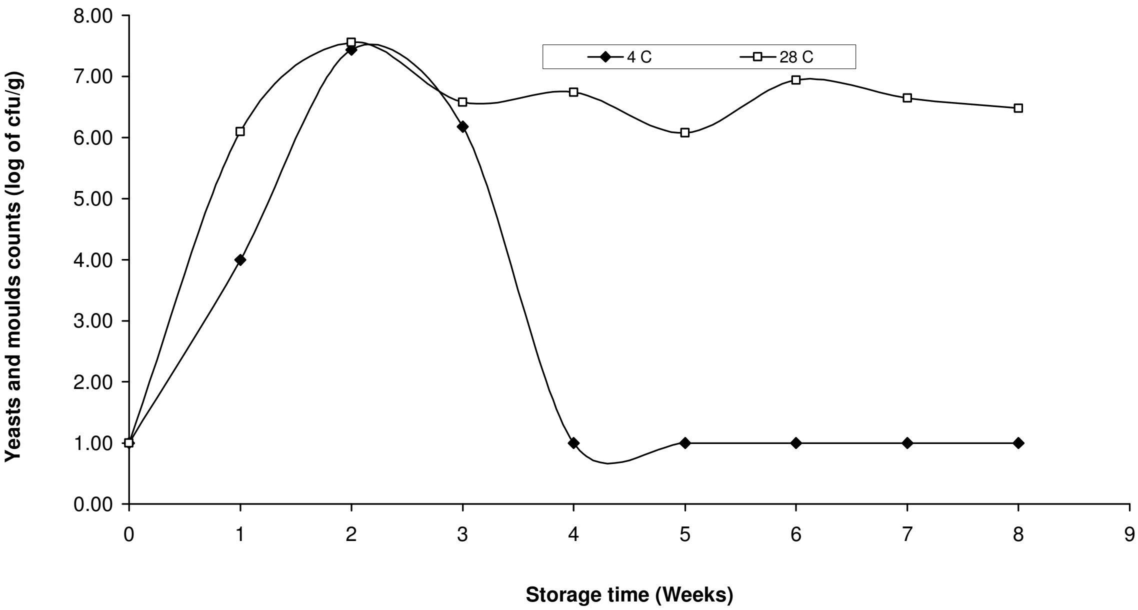

Figure 5. Yeasts and moulds counts profile of pasteurized sour sop juice during storage.

and remained fairly constant till the 8th week. There was a sharp increase for mould and yeast counts in the 1st week of storage for pasteurized soursop juice at 4°C (Figure 5). But it rapidly decline by the 4th week and remained fairly constant till the 8th week. Pasteurized juice at 28°C showed an increase in mould and yeast during the 1st week, slightly fluctuating during the 3rd to 6th week, and decreases during the 7th – 8th week.

Yeast growth was favoured by the presence of sugar and acid pH. Fruit juices are readily fermented by yeast while their acid pH discourages most bacterial growth. Similar trends in reduction were noted by (Gow-Chin and Hsin-Tang, 1996; Sadler et al., 1992).

Pasteurizing soursop juice at 79°C for 69 s reduced microbes of the juice to less than 10 cfu/g for mesophilic aerobic counts and to less than 10 cfu/g for mould and yeast. Generally there were more mould and yeast growth in pasteurized juice stored at 28°C than at 4°C. No growth was observed for coliforms in the pasteurized or unpasteurized soursop juice stored at the two temperatures. The results have therefore shown that the microbiological quality of soursop juice was affected by storage temperature.

Conclusion and recommendation

This work was aimed at producing juice from soursop and understudying its storage stability at refrigeration (4°C) and ambient (28°C) temperatures. There were no counts in bacteria, moulds and yeasts and coliforms in the pasteurized juice, while low counts were observed in unpasteurized juice, which indicates that the soursop juice was microbiologically safe for consumption. Results showed that there was corresponding reduction in pH as the acidity increased. More acid was produced at higher temperature of storage than at lower temperature. Results have shown that pasteurisation of soursop juice reduced microbial counts to less than 10 cfu/g for mesophilic aerobic counts and to less than 10 cfu/g for moulds and yeasts. And storage temperature greatly affects the microbiological stability and hence the quality of the soursop juice. We recommend that studies should be conducted on the effect of packaging and use of chemical preservatives on the storage stability of soursop juice.

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