

# Components of Fermenting Palm Sap and Bottled Palm Wine

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## ABSTRACT

The length of preservation and bacteria associated with the variation in the components of palm sap during fermentation were investigated at room temperature. The fermenting palm sap at room temperature deteriorated after two days of storage; while its counterpart treated at 75° C for 30 minutes stored well at room temperature for 12 months. There was a sequence in the bacteria genera (*Micrococcus*, *Streptococcus*, *Leuconostoc*, *Lactobacillus* and *Acetobacter*) isolated during the palm sap fermentation. The activities of these microorganisms result to changes in the composition of the chemical constituents of palm sap and palm wine. Whereas, NIFOR fabricated general purpose waterbath at 75° C for 30 minutes inhibited the proliferation of bacteria.

The incorporation of bottled palm wine (fermented palm sap) into the local beverage market is currently gaining wide acceptability in Nigeria. Palm wine is a popular traditional African beverage which is obtained by tapping *Raphia* palm (*Raphia hookeri* G. Mann and H. A. Wendl.) and oil palm (*Elaeis guineensis* Jacq.) trees. Palm sap ferments easily, and becomes sour within a few hours of collection. When fresh it is sweet, refreshing, nourishing and a nutritious drink containing sugar, vitamins and minerals. *Raphia* palm wine has a sugar content of about 6-8%, an acidity (calculated as acetic acid) of about 0.4% and protein (% w/v) of about 0.05% (Eapen 1982, Okiy and Ojomo 1985). Within 24 hours of fermentation, sugar content reduces to 0.5-1% while acidity increases to 0.5-0.6% (Eapen 1982). Present in the wine are various microorganisms (mainly bacteria and yeasts) which originate from the indig-

enous flora of the palm trees and from equipment used in collecting the sap (Okafor 1975, Ojomo et al. 1984).

The Nigerian Institute for Oil Palm Research (NIFOR) has successfully designed and made its own General Purpose Waterbath for bottling palm wine. The need has arisen to investigate the efficiency of the waterbath to ensure that the bottled palm wine can be preserved for up to twelve months without appreciable deterioration of quality. I report here the changes in bacteria composition and the major chemical constituents of fresh and bottled palm wine due to the activities of microorganisms.

## Materials and Methods

Aliquots of 630 mL of freshly collected *Raphia* palm wine were crown-corked and then pasteurized by treating in NIFOR waterbath at 75° C for 30 minutes and stored for periods ranging 2-12 months at 28° C. The unbottled palm sap was allowed to ferment in the air at room temperature for 5 days. During the fermentation and at 3 months interval (bottled palm wine), 1 mL samples were used for chemical analyses; pH was determined using pH meter; alcohol was determined by gas liquid chromatography according to the procedure of Sharma et al. (1984); the total sugar content was determined by the anthrone method of Yemm and Willis (1954) and the acidity by titration against 0.1 N sodium hydroxide. Media and meth-

Table 1. Bacterial variability during fresh palm sap fermentation.

Bacterial Genera	
Day 1	<i>Micrococcus, Streptococcus, Leuconostoc.</i>
2	<i>Micrococcus, Streptococcus, Leuconostoc, Lactobacillus.</i>
3	<i>Micrococcus, Streptococcus, Lactobacillus, Acetobacter.</i>
4	<i>Micrococcus, Streptococcus, Lactobacillus, Acetobacter.</i>
5	<i>Micrococcus, Streptococcus, Acetobacter.</i>

Table 2. Bacteria associated with bottled palm wine.

Bacterial Genera	
Months 1	—
3	—
6	<i>Lactobacillus</i>
9	<i>Lactobacillus</i>
12	<i>Lactobacillus</i>

Table 3. Chemical components of fresh palm sap during fermentation.

	pH	Sugar (%)	Alcohol (%)	Acidity (%)
Day				
(fresh) 1	3.83	7.5	2.0	.35
2	3.64	5.2	3.8	.42
3	3.53	2.8	4.5	.47
4	3.5	2.2	3.6	.5
5	3.37	1.2	3.2	.57

Table 4. Chemical components of bottled palm wine.

	pH	Sugar (%)	Alcohol (%)	Acidity (%)
Months 1	3.83	7.5	2.0	.35
3	3.85	7.3	2.05	.36
6	3.9	7.28	2.1	.36
9	3.95	7.27	2.15	.37
12	3.85	7.2	2.1	.375

ods for bacteria isolation procedure were of Ojomo et al. (1984). Bacteria identification was in accordance with the method described by Buchanan et al. (1975).

## Results and Discussion

Due to microbial variability changes in the components of fresh palm sap during fermentation were observed. At atmospheric temperature, the sugar concentration of the palm sap started to fall after a few hours and fermentation was completed within four days. As from the second day (Table 3), sugar decreased in concentration; the concentration fell from 7.5% to 5.2% on the first day, and less than half of the first day value after a period of three days. This fall was accompanied by a progressive increase in acidity and a sharp rise in the level of alcohol concentration. At this stage, the palm wine contained 1–2% alcohol after 24 hours fermentation and its value never rose beyond 4.5% after 72 hours. A fresh sap contains no alcohol, but after a few hours the production of alcohol usually begins, with rapid evolution of CO<sub>2</sub> (Faparusi and Bassir, 1972).

At pH 3.5 to 4.0, the palm wine is considered suitable for drinking. Within 24 hours of tapping, the pH of the fermenting sap fell rapidly from 7.0 to 3.83. At this stage of the palm sap fermentation, the degree of infection is high. The lowering pH and rising alcohol content are both factors resulting from the metabolic activities of the bacteria which get into the sap as it drips out of the tree (Table 1). Bacteria which are always present in the palm wine during the five days' analyses are *Micrococcus* and *Streptococcus*. The lactic acid bacteria isolated include certain species in the genera *Streptococcus*, *Leuconostoc* and *Lactobacillus*. Fermentation

was started by the bacterial genera *Streptococcus* and *Leuconostoc* (Tables 1 and 3). The sugar was converted to lactic acid, alcohol, acetic acid and other products. As the acids accumulate, *Leuconostoc* was inhibited after day 2, but the fermentation continues with *Lactobacillus*. A slight fall of alcohol level after the third day is due to oxidation of alcohol by a newly invading species of *Acetobacter*. Its appearance decreased the alcohol percentage from 4.5% to 3.6% and there was an increase in acidity. Okiy and Ojomo (1985) reported that a good quality fresh or bottled palm wine should possess the following characteristics: Sugar level not less than 6%, alcohol concentration of about 2% and acidity level not more than 0.5%. Using the above criteria, the fermenting palm sap at room temperature deteriorated after two days of storage. Whereas, the major chemical constituents of the bottled palm wine remained normal after 12 months of storage at room temperature. The activities of the microorganisms using NIFOR All Purpose Waterbath at 75° C for 30 minutes were inhibited. So far, attempts to preserve palm wine by use of NIFOR waterbath have produced acceptable results.

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## THE 1988 BIENNIAL MEETING

The next Biennial Meeting of The International Palm Society will be held in Queensland, Australia in the latter part of September 1988, with two tentative Post Biennial optional tours, (1) Australia or (2) New Guinea. Details concerning itineraries, accommodations, and costs will be included in a forthcoming issue of *Principes*. Meanwhile save your pennies and join fellow members in 1988 down under.

EDWARD M. MCGEHEE, President  
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