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Changes in the Physico-Chemical Characteristics of Processed and Stored *Raphia hookeri* Palm Sap (Shelf Life Studies)

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Abstract: The matured *Raphia hookeri* palm was tapped and the sap was collected. The sap was pasteurised in green bottles and stored on a wooden shelf under ambient temperature. The samples were analysed physico-chemically for a total period of 24 months to ascertain stability and shelf life. The nutrients detected in the fresh sap at day one, were retained in the pasteurised bottled sap at the twenty-fourth month. No significant differences were observed between day one unpasteurised samples and pasteurised samples at twenty-fourth month. A minimum of twenty-four months shelf life has been established for the sap of *Raphia hookeri* palm after pasteurisation.

Key words: Raphia hookeri, sap, pasteurisation, shelf life

INTRODUCTION

For centuries, the sap of *Raphia hookeri* palm, drunk by millions of people as beverage in Africa had been wasted because of the difficulties that were associated with its preservation and short shelf life. The storage of the sap was done in calabashes and clay pots, from where sales were made. Within three days the sap sours due to fermentation and thus become unacceptable to most people for consumption. When its preservation began, it seemed impossible then, that the sap could not be preserved without chemical preservative. As the health hazards of preservatives in foods became apparent, most consumers were scared because of the reactions they had after taking the beverage. The above background motivated this study.

The shelf life is the length of time for which a stored item, especially food, remains in good condition. The *Raphia hookeri* palm is one of the genuses of *Raphia* palms, which yield more sap when tapped (Otedoh, 1976). The *Raphia* palm sap is the exude or liquid which flows when the base of the inflorescence of the palm is tapped. The sap is colourless and becomes whitish after some time due to impartation of some organoleptic properties. The fermented sap is called palm wine, emu in Nigeria and nsafufuo in Ghana. The sap is very nutritious. Bassir (1962) found that within 24 h of the fermentation process, the sucrose content in the sap of *Elaeis guineensis*, dropped to 50%. The main yeast, which ferments the sap of *Raphia hookeri palm*, is *Saccharomyces cerevisiae*. The fermentation process increases the levels of some vitamins in the sap; e.g., vitamin $B_{12,}$ Pyridoxin, riboflavin and thiamine (Bassir, 1968). As a result of the fermentation of the sap of *Raphia hookeri*, after 24 h, excessive accumulation of acetic acid results which makes it unacceptable and unpalatable to some consumers. Due to its social and cultural significances earlier attempts have been made by natives in the South-South geo-political zone of Nigeria to preserve the sap with the bark of a tree, *Sacaglottis gabonensis*, which impacts alkaloid, phenolic compounds into the sap and has anti microbial effect. Levi and Oruche (1957) and Eapen (1982), recommended the use of refrigeration and chemical preservative along side with pasteurisation at 70°C for 30 min, respectively. Esechie (1978) recommended the use of sodium metabisulphite and pasteurisation at 70°C for 40 min. Ukhun *et al.* (2005) had reported on some of the mineral nutrients of the palm wine (fermented sap).

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Ezeagu and Fafunso (2003), reported on the biochemical constituents of the palm wine, that it contains sugars, protein, amino acids, alcohol and minerals. The beverage therefore, is a rich source of food nutrients and could serve as sweeteners in food preparations. In the light of the above, we were motivated to examine the stability of these nutrients in storage after processing.

The shelf life of *Raphia hookeri* sap has been found to be a minimum of 24 months from this study, without the use of any chemical preservative. In addition, the nutrient compositions of the sap were retained throughout the period under reference.

MATERIALS AND METHODS

The materials including the sap of the *Raphia hookeri* palm were obtained from the Nigerian Institute for Oil Palm Research (NIFOR), Benin City. This study was conducted in the processing laboratory of NIFOR between the year 2000 and 2002.

Tapping

The sap of the *Rahpia hookeri* palm was obtained by making an incision at the base of the inflorescence. The exude or liquid which flows from the panel was led into a plastic jerry can with polythene sheet made into a funnel. The tapping panel, collecting jars and all implements for tapping, were washed daily to prevent contamination.

Processing

The fresh sap was filtered, dispensed into 33 mL green bottles, corked with Axe crown corker and was pasteurised with a Gallenkamp Laboratory water bath, at 75°C for 45 min. Bottles containing the sap were pasteurised and stored on a wooden rack, under ambient temperature. The understated parameters were determined in the fresh sap and in the pasteurised sap. The pasteurised sap were analysed every three months, for a period of 24 months.

Physico-Chemical Assay

The physico-chemical assays done on the sap include: pH, taste, sucrose content, acidity, relative density, crude protein, alcohol and moisture contents. The pH determination was done with a pH meter, EIL Model 7055, as described by Bates (1973). The authors and some processing staff to ascertain the taste of the sap sipped a little quantity of the sap. The sucrose content was determined by refractometric method (Maley, 1968). The titratable acidity was assayed for, as acetic acid (percent w/v) by the method of AOAC (1965). The relative density was determined as described by Anyakoha (2001). The crude protein was assayed for, by the semi-micro Kjeldahl method (Harris, 1970). An alcohol meter was used in the determination of the alcohol content of the sap. The total solid in the sap was determined by the drying (105°C) and weighing method, until a constant weight was achieved.

RESULTS AND DISCUSSION

The whitish colour and sweet taste of the unpasteurised sap were retained in the pasteurised samples. No significant differences were observed in the values of pH, acetic acid, protein, sucrose and alcohol contents between the unpasteurised sap and the pasteurised samples. Infinitesimal differences were observed in the values of relative density, moisture and total solids between the unpasteurised sap and the pasteurised samples (Table 1).

The whitish colour and sweet taste are characteristics described by Eapen (1982) for the identification of good quality palm sap/wine. The sweet taste is a measure of the amount of sucrose, which is the dominant sugar in the sap. These results therefore imply that the samples pasteurised are of good quality and would be acceptable by the consumers of the product.

Table 1: Changes in the physico-chemical characteristics of processed and stored *R. hookeri* palm sap (Shelf life studies)

Day/Month	Colour	Acidity (%) (Acetic acid)	pH	RD	Moisture (%)	Total solid (%)	Sucrose (%)	Protein (mg/100 mL)	Taste	Alcohol (%)
Day 1 Unpasteurised	Whitish	0.21	7.00	1.03	97.65	2.35	9.00	0.08	Sweet	0.50
1st Month (Pasteurised)	Whitish	0.22	6.99	1.04	97.60	2.40	8.50	0.07	Sweet	0.49
3rd Month (Pasteurised)	Whitish	0.20	7.00	1.03	97.65	2.35	8.70	0.08	Sweet	0.47
6th Month (Pasteurised)	Whitish	0.20	6.97	1.05	97.71	2.29	8.50	0.06	Sweet	0.49
9th Month (Pasteurised)	Whitish	0.22	7.00	1.05	97.65	2.35	8.80	0.07	Sweet	0.48
12th Month (Pasteurised)	Whitish	0.20	6.89	1.04	97.69	2.31	8.60	0.08	Sweet	0.46
15th Month (Pasteurised)	Whitish	0.21	6.90	1.06	97.65	2.35	8.70	0.08	Sweet	0.49
18th Month (Pasteurised)	Whitish	0.20	7.00	1.05	97.45	2.55	8.90	0.07	Sweet	0.48
21st Month (Pasteurised)	Whitish	0.22	6.99	1.03	97.60	2.40	8.60	0.08	Sweet	0.50
24th Month (Pasteurised)	Whitish	0.21	6.95	1.06	97.63	2.37	8.80	0.08	Sweet	0.49

Relationships existed between the sucrose, acetic acid, colour, taste, pH and alcohol contents in the sap under reference. Faparusi and Bassir (1972) found that when the sap of *Elaeis guineensis*, was allowed to ferment for seven days, the sucrose content decreased by 50% within 24 h. They also observed changes in colour, taste and evolution of gases when the palm sap was left to ferment. In our present studies with the sap of *Raphia hookeri*, which is a beverage like the sap of *Elaeis guineensis*, one can conclude that that the sap did not sour, the alcohol and acetic acid contents did not increase, because fermentation was arrested at the pasteurisation temperature/time adopted. The same treatment on the sap resulted in the values of pH. If fermentation persisted, the pH would have dropped (Fapurusi and Bassir, 1972). Pasteurisation therefore inactivated the yeast, *Saccharomyces cerevisiae,* which ferments the palm sap.

The protein contents were consistent because it was not degraded or hydrolysed to its constituent amino acids, since no mineral acids and or alkali was present. In this same vain, since any of the nutrients did not degrade or hydrolyse during storage, no significant differences were observed between the unpasteurised sap and the pasteurised samples with respect to their total solids, relative density and moisture concentrations.

Statistical analysis done on the laboratory results revealed that there were no significant differences between day one, unpasteurised samples and the pasteurised samples with respect to the parameters determined.

In summary, this study is a pioneering work on the sap of *Raphia hookeri*, which is a specie among the *Raphia* palms. No literature is available on the physico-chemical characteristics of the processed and stored product. Earlier attempts to preserve the fermented sap of the other *Raphia* palms and the fermented sap of *Elaesis guineensis* were done with a combination of heat treatment and chemical preservatives. The maximum shelf life achieved has been 9 months and 12 months as reported by Esechie (1978) and Eapen (1982), respectively. In the present studies, the sap has been preserved without any chemical preservatives, but by heat treatment only, thus saving cost of production for prospective brewers. Secondly, we have provided for the first time, information on the stability of the physico-chemical constituents of the processed and stored product. Thirdly, that the product can have a shelf life of up to 24 months. The above method can therefore be applied

to the saps from any of the palms. The overall contents of the sap also revealed that it could serve as a nutritious beverage. The sap could be useful precursors of the products such as sugar syrup and dehydrated derivatives. Additionally, the sap can become a veritable source of income for small, medium and large-scale processors.

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