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Full-Length Research Paper

Proximate Analysis of Yeast Fermented Oil Palm SAP

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ABSTRACT: Palm sap of the oil palm (Elaies guineensis) was collected fresh from a palm tapper in Auchi, Etsako West Edo State using sterile screw capped container and transported in a cooler containing ice to prevent fermentation. The palm sap was immediately analyzed for its chemical constituents using the methods of AOAC 2012, 2013. The palm sap sample was allowed to undergo yeast fermentation at room temperature, chemical/proximate analysis was carried out on the sap sample on 24 h basis for a period of 120 hours. The proximate analysis showed an increase in moisture content (83.60-90.60%); increase in ash content (0.50-1.02%), Fat content (0.11-0.92%), other contents showed a decrease; crude protein (3.28-1.10%); and carbohydrate content (12.56 – 6.36%). The result shows that the chemical composition of palm sap is influenced by fermentation especially the type of fermentation and the specie of palm tree used.

Keywords: Proximate composition, fermentation, oil palm sap

INTRODUCTION

Palm wine is an indispensable alcoholic beverage which often sterns out from the spontaneous fermentation of the sap of the palm either Raphia palm and the oil palm tree, it is often produced from the sugary sap of various palms throughout the tropics., fermentation of the palm sap has largely been attested to yeast and bacteria (Onwuka, 2011: Opara *et al.,* 2013). The development of the vine by individual farmers has helped in promoting and sustaining conservation as it has been touted that palm trees has now become a sole source of regular income for household and that it may economically he worth more than the value of some timbers that are being sold (Astudillo-Melgar *et al.,* 2019: Ali, 2008). Fresh palm wine is often a sweet, clear, neutral, whitish colouration which contain minimal sugar (which is often less than 0.5%) small amount of protein. gums and even minerals (Opara *et al.,* 2013). According to the study and research of Oyeku *et al.,* (2009). some constituents of the palm wine have been seen to contain water, sugar, vitamins and many aroma arid flavour components in very little and infinitesimal amount (Ogueri and Martin 2017). The biochemical composition of palm saps varies among different locations and may depend on the species of a palm tree from which the palm wine was sourced. The biochemical makeup of palm wine has been reported (Ubi *et al.,* 2017), and it consists of different sugars and essential elements (Ogueri *et al.,* 2016). The fermenting/fermented palm sap known as palm wine is the commonest consumed alcoholic beverage that has several economic, social, health and nutritious benefits (Santiago and Ruiz, 2016). The aim of this research is therefore to know the nutritive/chemical composition of fresh palm sap undergoing fermentation for a period of time. This will further provide and add to the existing literature on the biological and chemical constituents of palm wine.

MATERIALS AND METHODS

Sample collection

Fresh palm sap was collected from a palm wine tapper in Auchi Etsako Local Government, Edo State. 1 litre of the palm wine was collected in sterile sample container. The wine was collected as fresh as it was brought down, placed in a cooler containing ice cubes at 4°C, these to prevent fermentation. It is immediately taken to the laboratory for analysis.

Proximate Analysis of palm sap (oil palm)

The methods of AOAC, 2012 and 2013 was used to determine the following, moisture, Ash, crude fat, crude fibre, crude protein and carbohydrate contents respectively before, during and after 120 hours of yeast (Alcoholic) fermentation at room temperature (27 ± 2^{0}C)

Determination of percentage moisture content

Washed crucibles were oven dried at 105^{0}C for an hour to ensure total dryness. They were then transferred into the desiccator to cool for about 30 minutes. The crucibles were weighed on an electronic balance and the weight recorded as (W_1). 5g of grinded sample were weighed into the dried crucible (W_2). The crucibles and the content were oven-dried at 105^{0}C for 4 h. 1 samples were removed from the oven and dried until a constant weight was obtained. After drying, the crucible was transferred into the desiccator to cool for about 45 minutes and weighed (W_3). This analysis was carried out in triplicate and the average value was recorded as moisture content, this procedure was repeated for an interval of five (5) days.

Calculations

$$(\%)\ \text{Moisture content} = \frac{Loss\ in\ weight\ \ due\ to drying}{Weight\ of sample\ \ before\ \ drying}$$

$$(\%)\ \text{Moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where,
W_1 = Weight of empty Crucible
W_2 = Weight of empty crucible + sample before drying
W_3 = Weight of crucible+ sample after drying (constant weight).

$$\%\ \text{Total Solid} = = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Or % Total solid = (100 - % Moisture content)

Totals solid is the part that is not water AOAC (2013).

Determination of percentage ash content

Clean crucible was pre-dried in m oven for 30 minutes at 100 ^{0}C to assure total dryness of the crucible. It was then transferred into the desiccator to cool for 30 minutes and weighed on an electronic weighing balance a W_1. 5 of sample was weighed into it and weighed as W_2. It was placed in a muffle furnace for 4 hours and the temperature was slowly increased to 450 ^{0}C to avoid incomplete ashing. Samples were ash until it becomes whitish in colour. It was removed into the desiccator with a tong and cooled to room temperature for an hour. Sample was reweighed as W_3. this procedure was repeated for an interval of five (5) days. The percentage ash was calculated as followed and average taken:

Calculation

$$\%\ \text{Ash Content} = \frac{weight\ of\ ash}{Weight\ of sample\ \ (after\ drying)} \times 100$$

$$\%\ \text{Ash Content} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

% Organic matter = 100 - % Ash AOAC (2013)

Determination of percentage crude far content

Previously dried, far free thimble was weighed as W_1. 5 g of sample was weighed into the thimble and weighed as W_2. The thimble and the sample was carefully wrapped and tied. Washed and dried 500 ml round bottom flask was weighed as W. The flask was half filled with 40/60 petroleum ether and the sample was dropped into the sample holder of the soxhlet extraction apparatus. The flask was then placed on a heating mantle and the heat source was adjusted to allow it to boil gently at 34^{0}C. It was allowed to siphon over 5 hours. The condenser was detached and the thimble removed. Petroleum ether was distilled from the flask. The distilling flask containing the oil was air dried at 100 °C for exactly 5 minutes to remove the solvent residues in oil. This was put inside a desiccator to cool and the weight was taken as W_4, this procedure was repeated for an interval of five (5) days. The percentage fat contained was determined thus:

$$\%\ \text{Crude fat} = \frac{Weight\ of\ Flask + oil - Weight\ of\ \ empty\ \ flask}{initial\ \ Weight\ of\ sample} \times 100$$

$$\%\ \text{Crude fat} = \frac{W_4 - W_3}{W_2 - W_1} \times 100 \quad \text{AOAC (2013)}$$

Table 1: Proximate Analysis of the Palm Wine Samples.

Proximate Composition	Fermentation Periods (Hours)					
	0	24	48	72	96	120
Moisture content (%)	83.60	84.47	85.21	86.15	88.20	90.60
Ash content (%)	0.50	0.68	0.75	0.81	0.87	1.02
Crude protein (%)	3.28	2.92	2.00	1.80	1.50	1.10
Fat content (%)	0.11	0.24	0.45	0.63	0.80	0.92
Carbohydrate (%)	12.56	11.69	11.59	10.61	8.88	6.36

Determination of percentage crude fibre

The starch and the protein part of food were dissolved by boiling with acid and then with a very strong base (NaOH). The residue, which comprises of cellulose and lignin was washed and dried and weighed. The residue is ashed and the weight is subtracted from the weight of the residue. 3 g of defatted sample was weighed (W_1) into 250 ml beaker containing 200 ml of 0.125 M or 1.25% tetraoxosulphate (vi) acid (Sulphuric acid). The mixture was heated in a steam bath at 70 - 90^{0}C for 2 hours, it was then allowed to cool. The cooled mixture was filtered using a muslin cloth over a Buckner funnels. The residue was washed three times with hot distilled water to remove the acid and then put in a beaker containing 200 ml of potassium hydroxide. The mixture was heated as before over a steam bath for 2 hours. The solution was filtered and the residue washed three times with hot disilled water, then with petroleum ether and water. The final residue obtained was put in clean preweighed (W_2) crucible and dried at 120 UC to a constant weight. The crucible with the oven dried sample as put in a muffle furnace and ashed at 550^{0}C for 30 minutes such that the sample became ash white. The crucible and its contents were removed from the furnace, cooled in a desiccator and reweighed W_3), this procedure was repeated for an interval of five (5) days. The Percentage fibre was calculated as followed:

$$\% \text{ Crude fat} = \frac{Weight\ of\ oven\ dried\ sample - Weight\ of\ ash}{initial\ Weight\ of\ sample} \times 100$$

$$\% \text{ Crude fat} = \frac{W_2 - W_3}{W_1} \times 100 \qquad \text{AOAC (2013)}$$

Determination of percentage crude protein

The analysis of Crude protein was determined using Kjeldahl method. This process involved 3 different stages namely; digestion, distillation and titration. A chemical mixture of 150 g of K_2SO_4 and 10 g of $CuSO_4$ was made. I of sample and 10 g of chemical mixture was weighed into a 250 ml digesting tube. 12 ml of concentrated H_2SO_4 was carefully added in the mixture. The digesting tithes containing samples were kept in a rack and digested fir 30 minutes at 420^{0}C in a flume cupboard. After digestion, the samples were allowed to cool to room temperature for about 1 hr. 80 m1 of distilled water was then added to the digested samples. 25 ml of diluted digested sample as well as 25 ml of NaOH were measured into a distillation tube. Distillation was carried out using 5 ml of Boric Acid and methyl red indicator This process was stopped when the conical flask containing boric acid-indicator solution reached 100 ml mark. The distillate was titrated using HCl until end point was reached. At this stage, the purple colour obtained during distillation changed to dark yellow, this procedure was repeated for an interval of five (5) days. The formula used for protein calculation is:

$$\% \text{ Nitrogen} = \frac{(v_2/v_1)\ xcx0.0140x\ (S-B)_1}{z} \times 100$$

% Protein = % Nitrogen x 6.25 AOAC (2013)

Carbohydrate content determination

The carbohydrate content of the sample was obtained by difference, that is, as the difference between the total summations of percentage moisture, fat, fibre, protein and ash.

% Carbohydrate = 100 — (% moisture + % protein + % fibre + % ash) 3.14

RESULT AND DISCUSSION

The result of' the proximate analysis summarized in (Table 1). Figures are shown in (Table 1 and Figures 1 to 5), the result of the moisture content of the fermented fresh palm wine shows an increase in moisture content from 83.60% to 90.60%. This shows that the water content of the fermented palm wine increases as the hours increased. Mintah *et al.,* (201 1) reported that the moisture content of saps determines the shelf life. The higher the moisture content of a sap, the shorter the

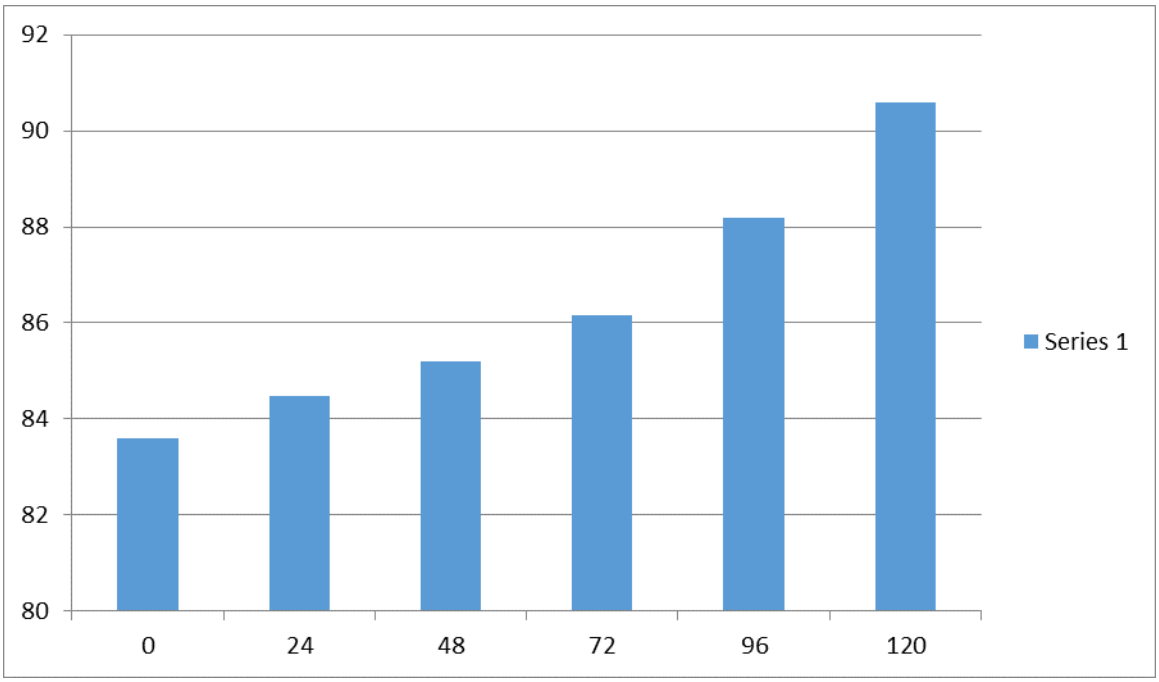

Figure 1: Changes in the moisture content of the fermented palm wine.

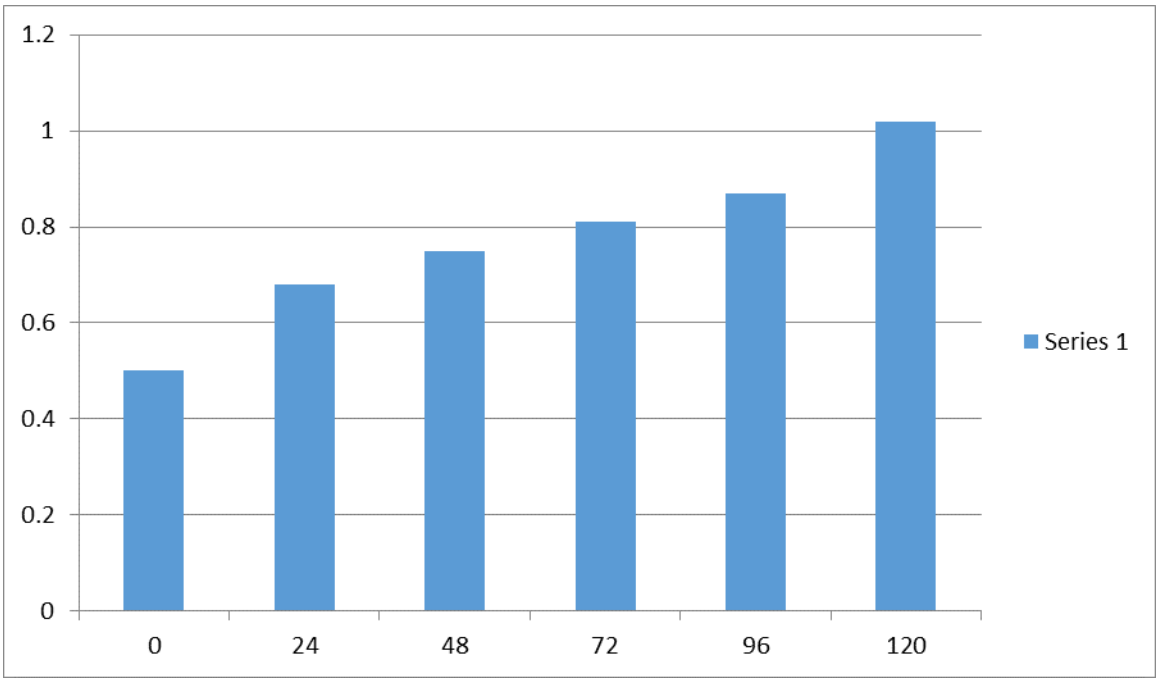

Figure 2: Changes in ash content of the fermented palm wine.

shelf-life, thus moisture content is an important measure of sap quality. The result of the ash content of the fermented fresh palm wine shows an increase in ash content from 050% to 1. 02%. This shows that the ash content of the fermented palm vine increases as the hours increased, increase in ash content of' palm wine indicates high sugar level (Matthew *et al.,* 2004 There was a decrease in crude protein of the fermented fresh

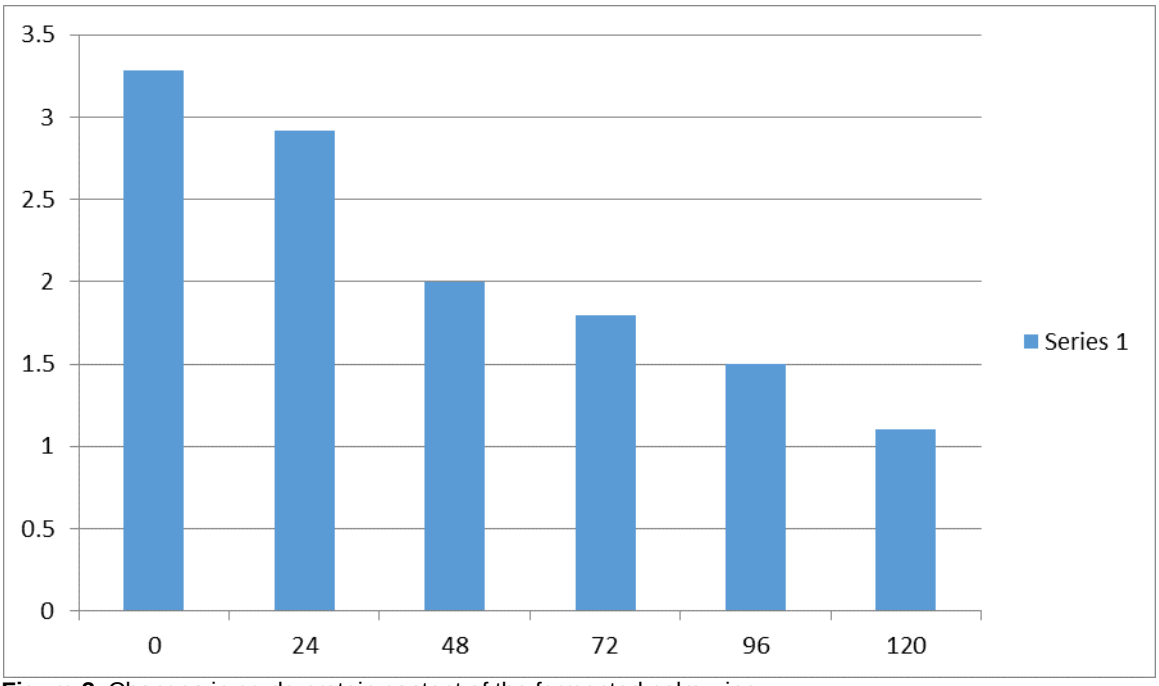

Figure 3: Changes in crude protein content of the fermented palm wine.

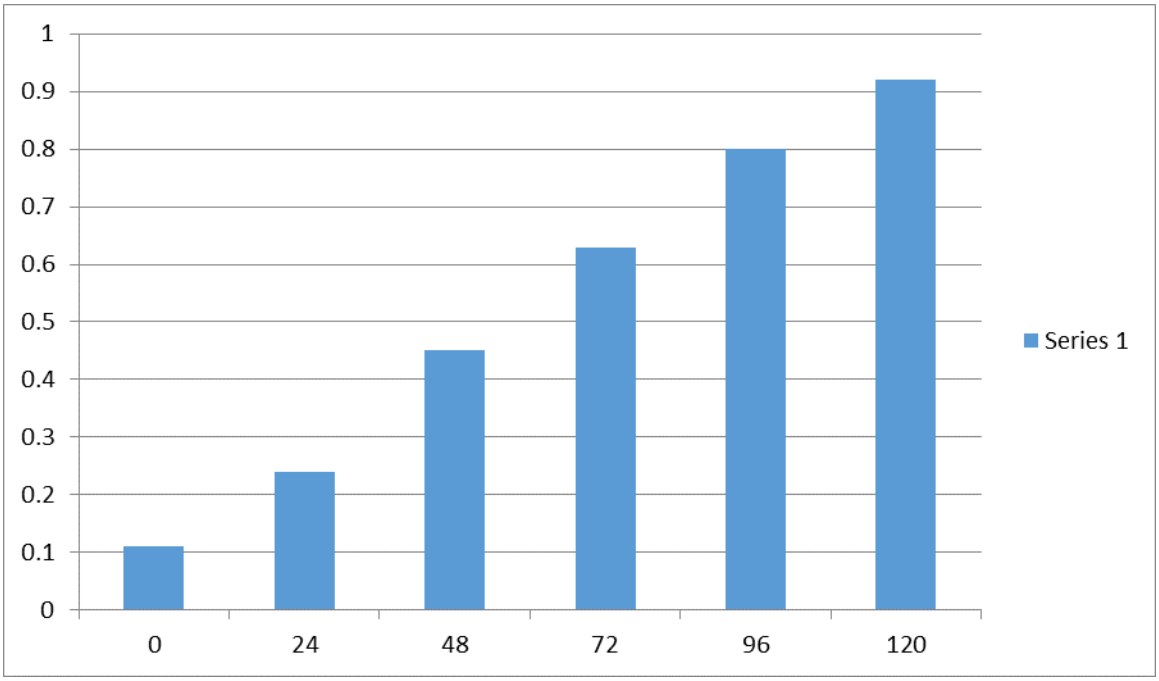

Figure 4: Changes in fat content of the fermented palm wine.

palm wine from 3.28% to 1.10%. This shows that the crude protein of the fermented palm wine decreases as the hours increased. The result also shows increase in the fat content of the fermented fresh palm vine from 0.11% to 0.92%. This shows that the fat content of the fermented palm wine increases as the hours increased.

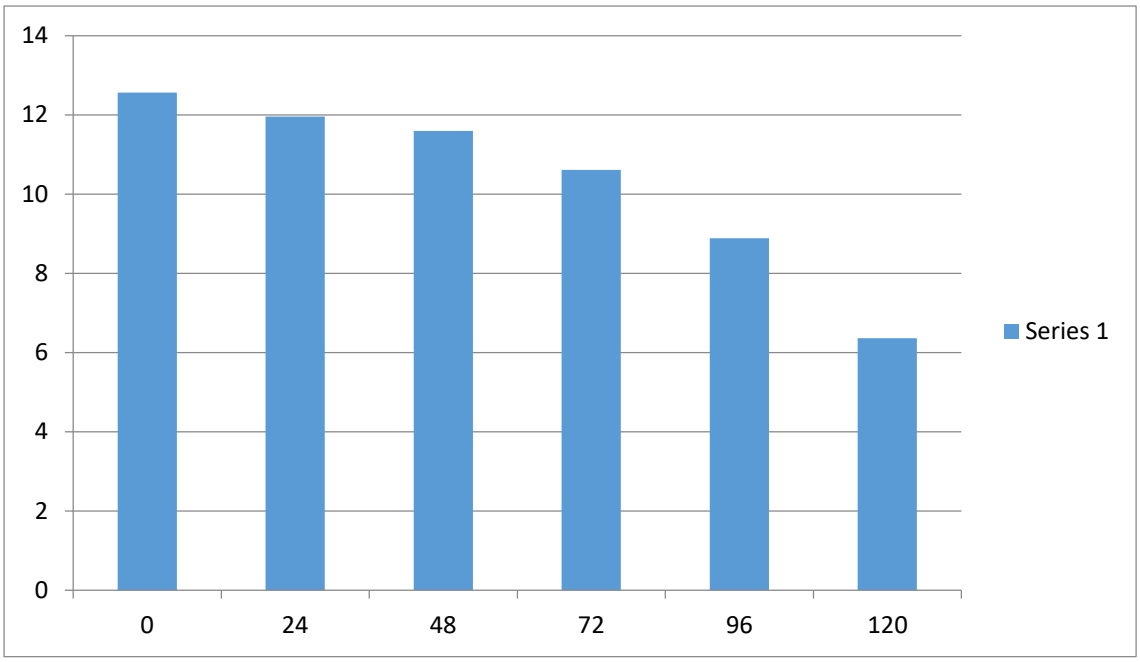

Figure 5: Changes in carbohydrate of the fermented palm wine

The carbohydrate of the fermented fresh palm wine shows a decrease in from 12.56 % to 6.36 %. This shows that the carbohydrate of the fermented palm wine decreases as the hours increased.

Conclusion

The results show that as the fermentation period increased the moisture content the ash content and fat content, while the crude protein and carbohydrates content decreased. Palm wine has been touted to have several medical, religious, nutritional, and socioeconomic uses which have now increasingly enhanced the popularity and demand for this palm wine product. Palm wine is often rich in such nutrients as proteins, amino acids, vitamins, sugars, and minerals. Its residue (dregs) is rich in a dense population of yeasts which are often claimed in some quarters to improve eye sight. The probiotic content of palm wine also bears on its nutritional value. Palm wine is widely accepted as a food drink wine is high majorly due to the presence of carbohydrates, lipids, proteins and even some vitamins most especially the vitamin B while its highest constituent is water. The white liquid that is initially being collected often tends to be very sweet and contains no alcohol before it undergoes fermentation.

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