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Comparative analysis of properties of fresh and fermented palm wine

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Abstract

This study attempted a proximate comparison of fresh and fermented palm wine to determine the percentage of their nutritional values. It used AOAC Guidelines for Single-Laboratory Validation of Chemical Methods for Dietary Supplements and Botanicals (current edition) Official Methods of Analysis. The physiochemical proximate analysis showed that fresh palm wine contains carbohydrate (1.21%), protein (0.588%), moisture content (94.99%), ash (2.00%), fat (0.90%), crude fibre (0.32%) and little amount of alcohol content of 28.00%). While the analysis showed that fermented palm wine contains moisture contents (92.00%), ash content (2.00%), protein (0.32%), fat (0.100%, carbohydrate (4.92%), fibre (0.66%). The key findings of the study showed that fresh palm wine is rich in protein, which has reduced alcohol contents. The paper thus surmised consumption of freshly tapped palm wine is good. Hence, submits that it is advisable to take palm wine when it is freshly tapped. The paper also encouraged mechanization of the tapping process to enable the youths participate.

Keywords: Freshly tapped; Proximate; Alcoholic Fermented; Physiochemical

1. Introduction

Palm wine might be known as a local alcoholic drink which has a sweet taste when freshy and tapped and is enjoyed by as many that loved it either when sweet or sour, thus refreshing them all the time but is really more than just refreshing. In as much as it does all of the above, most people still fail to understand that palm wine contain rich nutrients which provides the body with lot of amazing benefit which are to be discussed in chapter ahead.

Alcohol beverages are among the oldest and most commonly abused substances in the world. Although they are psychoactive substances; the society has allowed their use by the public either socially and medically (Ichiro, 2009). They may exist in many forms; commercial and non-commercially which can be either licit and illicit (Ndetei et al, 2010).

They can be categorized into various types depending on the content of ethanol in it. Non-commercial alcohol consumed world (ICAP, 2005) increasing to 9% in East, Africa.

In rural Africa, many women engage in the production and sales of local brews (palm wine) as their more economic activity to support their families. Moreover, since these products are untaxed and can use low cost or non-ingredients and production methods, they tends to be cheaper than their commercial counterparts (Ndetie el al, 2012; Both 2010). Local brews contain a wide range of microbial flora that carry out natural fermentation of sugar containing product converting them to ethanol under anaerobic condition (Dake et al, 2010). Although yeast is the major micro-organisms in many fermentation processes, involvement of other microbial flora has been reported (Ejiofor et al, 1994; Ormaije, 1997; Nester et al, 2004) which may play a role in contamination and health related effects of the brews (palm wine). The presence and survival of microbial flora supported by physiochemical properties; alongside other factors determine

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the quantity of the palm wine. palm wine is made from the natural fermentation by tapping the juice from the young growing of the palm tree that bear the fruit. After removal from the fermentation container, it is left for at least 24 hours for it to mature, i.e in the production of fermented palm wine. The current study aims at illuminating on the types of micro-organisms present and the physiochemical properties of these brew (palm wine). This has the bearing information of providing information for advising the producers and consumers on hygienic production, storage and consumption of local brews. Armed with the relevant information, producers can advise further on how to reduce the level of non-microbial and microbial contamination more-over, the government can use also the information recommended the sale or ban of brew for the health of its citizens.

2. Methods

2.1. Collection of samples

Palm wine, was collected at Orie market in Udi Local Government Area of Enugu State, Nigeria

2.2. Characterization of the Physiochemical Properties of Palm Wine and Chemical

The physical and chemical characters of palm wine was determined based on the following parameters; moisture content, Ash content, fat protein, carbohydrate, PH, specific gravity, density, viscosity and Alcohol content was done by visual and chemical comparisons.

2.3. Physical content determination

The AOAC (2005) method was used, the empty petri dish was first weighed done, then 5g of the sample i.e fresh and fermented palm wine were weighed into separate clean, dried petri dish. The petri dish and their contents were dried in the moisture extraction oven at 105°C for 1 hour. The palm wine samples were then removed from the oven, cooked and reweighed. The sample were again put back into the oven and dried until a constant weight was obtained. This analysis was carried out in triplivate and the average value recorded as moisture content.

2.3.1. Calculation

Weight of Petri dish = W1

Weight of Petri dish + sample before drying = W2

Weight of Petri dish + sample after drying = W3

$$\% \text{ of moisture contents} = \frac{(w2-w1)-(w3-w1)}{weight\ of\ sample} \text{ x } \frac{100}{1}$$

2.4. Ash Content Determination

According to the AOAV (2005) used two (2) clean dried crucibles were weighed on an electronic balance and 10g of palm wine samples were dried n the moisture extraction oven until constant weights were obtained. Then the sample were transferred into muffle furnace with a pair of thong and ashed at 5500°C for 4hours until a white ash was obtained. The samples were then removed from the furnace and cooled in and reweighed.

2.4.1. Calculation

Weight of empty crucibles = WI

Weight of empty .crucible + Sample after heating and cooling= W2

Ash content = W2-W1

$$\% \text{ Ash content} = \frac{(w2-w1)}{weight\ of\ sample} \text{ x } \frac{100}{1}$$

2.5. Fat determination

A clean dry empty beaker was weighed on the electronic weighing balance. Then 20g of Palm wine sample were weighed into a thimble carefully and put in the sample holder of the soxhlet extraction apparatus. A clean, dried and weighed

soxhlet extraction flask was filled with 250m1 of N hexane using a measuring cylinder and the whole was assembled together, then' the flask was placed on the heating mantle and heated at 68°C or three (3) hours. At the end of the extraction, the sample holder was disconnected and the palm wine samples removed. then, the equipment was re-assembled with only the extraction flask and its oil content. The flask was then heated and the solvent evaporated leaving the oil in the flask. Next, the was dried into a moisture extraction oven in order to remove completely the solvent residues in the oil. Then the dried samples were cooled with re-weighed. The drying cooling and re-weighing of the sample were repeated until a constant weight was obtained.

2.5.1. Calculation

Weight of empty beaker = WI

Weight of beaker + oil after drying = W2

$$\% \text{ of fat and oil} = \frac{(w2-w1)}{weight\ of\ sample} \text{ x } \frac{100}{1}$$

2.6. Crude Fibre Determination

This was carried out according to the Kjeldahl method of the AOAC (2005). This method was, divided into three namely: Digestion, distillation and titration

2.6.1. Digestion

Approximately 1.0g of palm wine samples were weighed into a clean, dried kjeldahl flask for digestion, and lg of copper tetraoxosulphate (iv) (CuSO4) crystals,. 1 g of sodium tetraoxosulphate (vi) (Na2SO4). crystals, and 20m1 of concentrated hydrogen tetraoxosulphate (vi) acid (H2SO4) Were added into the flask with constant shake on addition. some glass beads were also added into the flask content as anti-bumping agents. The kjeldahl flask and its contents were transferred to the digesting chambers in a fume cupboard and digested. digestion continued with the constant rotation of the digestion flask until the sample color change from black to light green. They were then removed from the digesting chambers and allowed to cool. The digest-was made up to 100m1 using distilled water from the measuring cylinder and shaken Vigorously to a homogenous solution.

2.6.2. Distillation

Out of the homogenous solutions of the digest, 20m1 were transferred into a distillation flask using a pipette. Then 20m1 of 40% Sodium hydroxide solution (NaOH) were added carefully down the side of the flasks through a funnel.

Then 50m1 of boric acid was pipetted into two (2) receiving flasks and two drops of methyl red indicator added into each flask. The distilled units were fitted such that the condensers were connected to the receiving flask with glass tubes, and the condensers cooled with constant supply cold water from the taps. Also, the tips of the glass tubes were immersed in the boric acid. The distillation units were then heated on heating mantle for about 35minutes each until the pink solutions of the boric acid turned blue and the volumes increased to about 100m1 by the distillates!

Titration: 10m1 of the distillates each were titrated against 0.1m of hydrochloric acid (HCL). Also, blank solutions were also titrated to get any trace of nitrogen in the blank. All the titres were recorded.

2.6.3. Calculation

$$\% = \frac{TV\ x\ 0.0014\ x\ 6.25}{weight\ of\ sample\ used} \text{ x } \frac{100}{1}$$

Where 0.014 = Constant i.e 0.014 is liberated by lml of 0.1m

6.25 = Protein constant according to Kjeldahl method

TV = Average titre from each sample

2.7. Determination of Viscosity

The viscometers were set using a titration stand. Then the palm wine samples were poured into each meter. The samples were pipetted from one of the meters until they reached the Meniscus curve, with the help of a stopwatch the time taken

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for them to drop from the curve to the line pattern were taken. These was done repeatedly for three (3) times and the tables drawn.

2.7.1. Calculation

M = Weight of the sample

t = Time for the sample

Density of water 1.00 Constant.

Tr = Time for water,

Nr = 1.002 Constant

$$\text{Viscosity} = \frac{T\ x\ T\ x\ nr}{mr\ x\ tr}$$

2.8. Specific gravity

Two (2) empty specific gravity bottles were weighed then filled with distilled water and re-weighed using an electronic weighing balance. Then two (2) dry, empty specific gravity bottles and the palm wine sample were weighed too. Their readings noted.

2.8.1. Calculation

W_1 = Empty specific gravity bottle weight

W_2 = Weight of empty specific bottle + water.

W_3 = Weight of empty specific gravity bottle + Sample

Mass of water = W_2 - W_1

Mass of sample= W_3-W_1

$$0/0 \text{ of specific gravity} = \frac{mass\ of\ water}{mass\ of\ sample}$$

2.9. Alcohol Content

The soxhlet apparatus was set-up in two different places, then 1000m1 of the palm wine samples were each poured into the soxhlet flask, a pipe was connected from the tap above which transfers cold water into the soxhlet. Another pipe was connected into an empty bucket through which distilled water from the palm wine sample passes into separating' the contents of the palm wine samples remaining in the flask were measuring using a measuring cylinder.

2.9.1. Calculation

V1 = Initial volume of the sample

V2 = Volume after distillation

$$\text{Alcohol content} = \frac{volume\ after\ distillation}{initial\ volume\ of\ the\ sample} \text{ x } \frac{100}{1}$$

2.9.2. pH Determination

2g of the palm wine sample each were weighed into a dry clean beaker, then 13m1 of hot distilled water was measured out using a measuring cylinder and added into the palm wine samples in each beaker and stirred slowly than the pH electrodes were standardized with buffer solution before immersing into the samples in the beakers. the values of the pH were read and recorded. Also, the Universal indicator papers were used by dipping the papers into the palm wine samples the color changes were compared with the chart and the reading gotten from the pH electrodes.

3. Results

The result of the analysis carried out on fresh fermented palm wine are presented in the tables below:

Table 1 Result of the Nutritional Analysis of Fresh Palm Wine

S/N	Parameters	Values (%)
1	Moisture content	94.99
2	Ash content	2.00
3	Protein	0.58
4	Fat	0.90
5	Carbohydrate	1.21
6	Fibre	0.32

Table 2 Result of the Nutritional Analysis of Fermented Palm Wine

S/N	Parameters	Values (%)
1	Moisture content	92.00
2	Ash content	2.00
3	Protein	0.32
4	Fat	0.100
5	Carbohydrate	4.92
6	Fibre	0.66

Table 3 Result of the Physical Analysis of Fresh Palm Wine

S/N	Parameters	Values (%)
1	pH	3.98
2	Density	0.84g/mol
3	Specific gravity	1.02g/mol
4	Viscosity	0.97pa.s
5	Alcohol content	28.00%

Table 4 Result of the Physical Analysis of Fermented Palm Wine

S/N	Parameters	Values (%)
1	pH	4.01
2	Density	0.81g/mol
3	Specific gravity	0.99g/mol
4	Viscosity	1.11pa.s
5	Alcohol content	48.00%

4. Discussion

The result of the comparative analysis of the Physiochemical properties, of fresh and fermented palm wine showed that fresh palm wine has high protein (0.58%) Moisture content (94.99%) More than that of fermented palm wine. The crude fibre of fresh palm wine (0.32%), Suggest that the fresh palm wine is less only than the fermented palm wine (0.66%). The ash content of both fresh and fermented palm wine indicates that palm wine is a source of minerals. The result of the moisture content of both fresh and fermented palm wine, indicates that palm wine contains enough moisture/water, more than half of its content being water.

Also, from the physical analysis, the pH of palm wine indicates that palm wine is acidic in nature, having fallen within the range of 1-6 on the pH scale. The density of fresh palm wine (0.840/0) Indicates to be higher than fermented palm wine (0.810/0). The alcohol content of fermented palm wine indicates that fermented palm wine contains high level alcohol, hence it usefulness in the production of alcoholic drinks and gins than fresh palm wines (28.00%).

5. Conclusion

Generally, the study has been able to 'generate a proximate data as the comparative analysis of the nutritional composition of fresh and fermented palm wine. The results of the research reveal that palm wine contains protein which is an essential nutrient which the body cannot do without. It also contains high level of moisture content hence the increased rate at which takers urinate. It has little amount of fibre which though in small quantity are necessary for proper peristaltic action in intestinal tract.

Recommendations

The research carried out about palm wine showed that:

- More research should be carried out on new method of tapping and preservation of palm wine that will make the youths to engage in it.
- More research should be carried out to Increase and create an improved species of palm wine trees
- More farmland should be released to farmers for palm wine plantations
- People should be lectured on importance of palm wine, alcoholic content of fermented palm wine and reduction in intake
- Palm wine can be utilized in the production of other product rather than being discarded as waste and inadequate alcoholic drinks, gins drinking
- More research should be done to know more about the nutritional value of palm wine.

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