EVALUATION OF SOME PHYSIOCHEMICAL PARAMETERS OF FERMENTING RIPE PLANTAIN (MUSA PARADISACA) USING A CO-CULTURE OF SACCHAROMYCES CEREISAE AND LACTIC ACID BACTERIA (LACTOBACILLUS BULGARICUS)

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ABSTRACT

Matured Ripe plantain was obtained from a nearby market in Auchi, Etsako West area of Edo State. They were brought to the microbiology Laboratory, Auchi Polytechnic, Auchi. Saccharomyces cerevisae and Lactobacillus bugaricus were purchased from the Federal University of Technology, Akure, Ondo State and were transported to the microbiology laboratory, Auchi Polytechnic, Auchi for analysis of fermenting Ripe plantain. The ripe plantains were washed with clean tap water to remove debris. They were peeled using a clean knife and diced into small pieces. The weight of diced plantain pulp was taken with a weighing balance to get 500 grams. The ripe plantain pulp was then homogenized in a mechanical blender containing 1 litre of sterile distilled water. This formed a ‘must’ 10 grams of the starter culture; Lactobacillus bulgaricus in a dry form and 30 grams of Saccharomyces cerevisae were added into the ‘must’ already contained in an air-tight container, it was stirred properly together before the container was sealed. The ripe plantain sample was left to undergo fermentation for 120-144 hours. Some physiochemical properties such as pH, total titratable acidity, alcohol content, specific gravity and temperature were analyzed using standard methods daily, during fermentation period. Co-culture fermentation of Ripe plantain reduced its pH from 5.4 to 2.0; the total titratable acidity of the fermenting sample increased from 0.062% to 0.315%; Alcohol content increased from 0.0%v/v to 10.0% v/v. specific gravity of the sample increased from 0.998 to 1.059 and the temperature was relatively constant. Fermentation of ripe plantain using a co-culture of Saccharomyces cerevisae and Lactobacillus bulgaricus revealed a considerable reduction of fermentable sugars in the sample, a wine rich in alcohol and moderately acidic. The use of co-culture fermenting microorganisms should be encouraged during fermentation and further research should be carried out.

Keywords: Fermentation, Ripe Plantain, co-culture, Saccharomyces cerevisae, Lactobacillus bulgaricus, Physiochemical analysis.
Introduction

Wine is a product of alcoholic fermentation by yeast of the juice of ripe grape or any other fruit including orange, sugar, plantain pawpaw, apples, mango nut having a good proportion of sugar (Hailu, 2018). Wine is one of the most recognized high value added product from fruits. It can also be used as a substrate for manufacture of vinegar, a byproduct of wine production (Jove, 2018). Plantain is very rich in sugar, hence it can be processed into chips dry flour and for wine making (UNCST, 2007).

Robinson, (2016) reported that wine can be produced from plantain by fermentation using *Saccharomyces cerevisae* and lactic acid bacteria under specified condition and adjusted nutrient concentration.

Wine making from plantain is made without the addition of sugar, enzymes, acids water or other nutrients. (Hailu, 2013) Alcoholic fermentation using *Saccharomyces cerevisae* consumes the sugar and converts it to ethanol and carbon dioxide, this may later react to form aldehydes, esters, and other chemical compounds which also help to preserve the wine (Fleet, 2013, Duarte *et al.*, 2014).

Lactic acid fermenters are members of lactic acid bacteria family, they are known to improve sensory qualities of wine, although they may also be associated with wine spoilage because of the tolerance of low pH (Goupy and Creighton, 2006).
The Research work is aimed at evaluating some physiochemical parameters during the fermentation of ripe plantain using a co-culture of *Saccharomyces cerevisiae* (an alcoholic fermenter) and *Lactobacillus bulgaricus* (Lactic acid fermenter)

**Materials and methods**

**Collection of samples:** several fingers of Ripe plantain were purchased from a neighbouring market in Auchi, Etsako West, Edo State. They were transported to the microbiology Research laboratory, Auchi polytechnic, Auchi for sample analysis.

**Collection of yeast and lactic acid bacteria:** *Saccharomyces cerevisiae* isolated from palm wine and *Lactobacillus bulgaricus* industrially produced in dried form were both purchased from the federal University of Technology, Akure, Ondo state and transported to the Auchi Polytechnic Microbiology Laboratory, Auchi.

All materials to be used were sterilized appropriately.

General process; the ripe plantain fingers were washed with clean water, they were peeled with a clean knife, the pulp was slized and crushed using a wooden spatvlar and then milled into a paste using a blender. The plantain paste was weighed using a beam balance to 500grams (Okafor, 2007).

The paste was put into a clean container, a little water was added and culture was added; that is 30grams of *Saccharomyces cerevisiae* and 10 grams of *Lactobacillus bulgaricus* to the ‘must’ in the container. The container was sealed air-tight (Okafor, 2007). The container was allowed to stand to ferment at room temperature $27\pm2^0$C for 120 hours.
Determination of physiochemical parameters.

The standard methods of Jackson (2018) were used to determine the physiochemical parameters during and after fermentation. The parameters investigated were pH, total titratable acidity, specific gravity, alcohol content, temperature.

RESULT AND DISCUSSION

During and after fermentation of Ripe plantain using *Saccharomyces cerevisae* and *Lactobacillus bulgaricus*, the following values were gotten as shown in the figures below.

Fig 1. Change in pH value during and after fermentation
Fig 2. Change in TTA value during and after fermentation

Fig 3. Change in specific Gravity (g/cm$^3$) value during and after fermentation
Fig 4. Change in Alcoholic content value during and after fermentation
Fig 5. Change in Temperature value during and after fermentation

The pH values as shown in fig 1 dropped from 5.4 at the 24th hour to 2.0 by the 120th hour. Fig 2 should total titratable acidity increasing from the 24th hour at 0.062% to 0.315% by the 120th hour. No alcohol content recorded at the first 24 hours but by the 48th hour, co-culture fermentation showed an increase from 6% to 10% as shown in fig 3. Specific gravity also increased from 0.998 to 1.059g/cm³ as shown in fig 4 and temperature change was relatively constant.
The reduction in pH values was due to the production of lactic acid during the period of fermentation as observed by (Akingbala, *et al.*, 2015) when he produced wine from ripe mango. Production of lactic acid which is an organic acid is also responsible for the increase in total titratable acidity during the fermentation period (Ba and Boyac, 2007).

The increase in specific gravity of the sample however may be due to conversion of sugar to alcohol as described by Okafor, (2007).

Temperature was relatively constant, the slight change in temperature was probably as a result of bio-chemical changes during the metabolism of the substrate by the fermenting microorganisms.

Overtime, wines have been produced by alcoholic fermentation using *Saccharomyces cerevisae* as the starter culture but this research has shown a wine produced from ripe plantain using a co-culture of *Saccharomyces cerevisae* and *Lactobacillus bulgaricus*. The wine had a sugar level, alcohol and organic aid tolerable by the body system.

Wineryes should employ the use of co-culture in the production of wine from fruits especially from plantain.

Extensive research should also be carried out to acertain the organoleptic qualities of wine produced from co-culture fermentation against single culture fermentation.
REFERENCES


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