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Microbial and Sensory Characteristics of Wine Produced from the Fermentation of Coconut, Banana and Watermelon Blend

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ABSTRACT

The study was conducted to produce a ready-to-serve wine from Coconut (*Cocos nucifera*), Banana (*Musa* spp.*)* and Watermelon (*Citrullus lanatus)* blend fermented by *Saccharomyces cerevisiae.* Findings of the microbial studies showed tolerable number of total plates counts, Total Heterothrophic count, 1.77x 10^2 (*Bacillus and leuconostoc* spp.)and Total yeast count, 1.59 x10^4 while no coliform was detected in the formulated wine.. Sensory properties evaluated by a semi-trained panel judging from the flavour, colour and taste recorded an average satisfactory and acceptability level of 3.5 on a scale of *5.* The produced 'Cobawa' wine can be consumed moderately for its nutritional and medicinal benefits. The results obtained showed that the produced wine is microbiological safe and acceptable for human consumption.

KEY WORDS: Wine, *Sacchaomyces cerevisiae*, Coconut, banana, watermelon, Microbial, Sensory

INTRODUCTION

Wine is any alcoholic beverage produced from juices of variety of fruits by fermentative action of microorganisms either spontaneously or seeding with a particular strain mainly of yeast species to adopt a particular quality of wine. Wine is one of the most recognizable high value-added products from fruits. Most commercially produced wines are usually made from fermented grapes; this fermentation process is not done by introducing any chemicals or sugar but by adding different species of yeast to the crushed grapes. Yeast has the capability of converting grapes into an alcoholic compound and removing the sugar content in it to produce different types of wines. Sometimes wines are produced from different types of fruits like; Pawpaw, mango, Pineapple, Banana, Lemon, Watermelon etc., here the wine so produced bears the name of the fruit or fruit mixture used in its production (Robinson, 2010). In the European Union, wine is legally defined as the fermented juice of grapes (Harding, 2005) . Wine can be made from virtually many plant matters that can be fermented (Harding, 2005). Most fruits and berries have the potential to produce wine. Wine making involves the use of yeast to ferment the 'must' of a chosen fruit or fruits for several days, depending on the objective of the winemaker. The yeast which is the main organism responsible for alcoholic fermentation usually belongs to the genus Saccharomyces.

MATERIALS AND METHODS

Study Area: Fruit Samples (Coconut, Banana and watermelon), Sugar, and fermenting bowls were obtained from Big Tree Market, Iwofe road and was transported to biology research laboratory, at the Ignatius Ajuru University of Education Rumuolumeni, Port Harcourt, Rivers State, Nigeria for analysis.

Fermentation of fruits for wine production

Ripe fruits (Coconut, Banana, and Watermelon) were obtained from big tree market, Iwofe and were transported to the Ignatius Ajuru University of Education research laboratory. The fruits were thoroughly sorted to remove bad ones from the lot. The sorted fruits were washed to remove adhering soils, dirts and extraneous materials. The fruits were thereafter peeled, sliced and seeds removed. It was then diced into smaller pieces, blended, and put in a separate sterilized airtight container.

500g of each blended fruit (in a ratio of 1:1:1) was weighed and placed in the sterilized container and 200ml of distilled water was added. 100g of granulated sugar and 20g yeast syrup were added and properly stirred and the container was properly sealed and kept for 21 days, after every 48hrs it was opened and stirred at the end of the fermentation it was clarified and pasteurized and racked for proximate analysis.

Microbial Analysis of Wine

Total Heterotrophic count (THC): The microbiological analysis was carried out according to Harrigan (2013). Plate count agar was used for enumeration of bacteria. A well homogenized sample was serially diluted with 0.1% peptone water up to 10^{-6}. 1ml aliquot from a suitable dilution was transferred aseptically into sterile Petri dishes. To each plate about 15ml of melted and cooled Nutrient Agar was added. The inocula was evenly mixed with media by rotating the plates and allowed to solidify. The inverted plate was incubated for 48hours. The TVC (cfu/ml) was determined using a colony counter.

3.6.2 Total coliform Count:

Mac Conkey broth was used for the detection of coliform bacteria by the multiple tube technique. The medium was distributed in 9ml quantities standard test tubes with inverted Durham tube and was then autoclaved for 15 minutes at 121^{0} C and 15 P.S.I. Well homogenized samples was serially diluted (10^{-1}, 10^{-2}, 10^{-3} and 10^{-4}) with 0.1% peptone water.1 ml from each dilution was aseptically inoculated into triplicate of 9 ml sterile Mac Conkey broth in standard test tube and incubated for 48hrs at 370 C. Positive tests gave gas in the Durham tubes and changed the color of the medium (Harrigan, 2013).

3.6.3Total Yeast count:

Potato dextrose agar (PDA) was used for enumeration of yeast. Well homogenized samples were serially diluted with 0.1%pepetone water up to 10^{-6}. Aliquots(0.1ml) from a suitable dilution were transferred aseptically into solidified PDA plates. Samples were spread all over the surface of the plates using sterile bent glass rod. The plates were then incubated for 48 to 72hrs at 280 Colony Counting (cfu/ml) was carried out by using colony counter (Harrigan, 2013).

3.6.4 Subculture

After 24hrs, colonies were subcultured on fresh agar plate, incubated and stained for observation using gram staining technique. The colonies were subjected to other biochemical tests (Catalase, Citrate, Indole, Spore formation. Gas production, Sugar fermentation etc.) for further identification.

Sensory evaluation

A semi trained panel of judges (their age group was between 24 and 45) who participated in previous Banana wine evaluation. Five males and five females analyzed the sensory characteristics of the wine. Participants were students and employees of the Ignatius Ajuru university of Education.

Randomly distributed 30ml wine sample was filled into 150ml tulip-shaped wine glasses (covered with watch glass) were evaluated by the panelists. Each panelist evaluated the wine sample in a 5- point hedonic scale (from 1=dislike extremely, 2.5 median to 5=like extremely) to determine the satisfactory levels of the produced ‘Cobawa’ wine judging from the following characteristics, Colour, taste, and flavour.

RESULTS

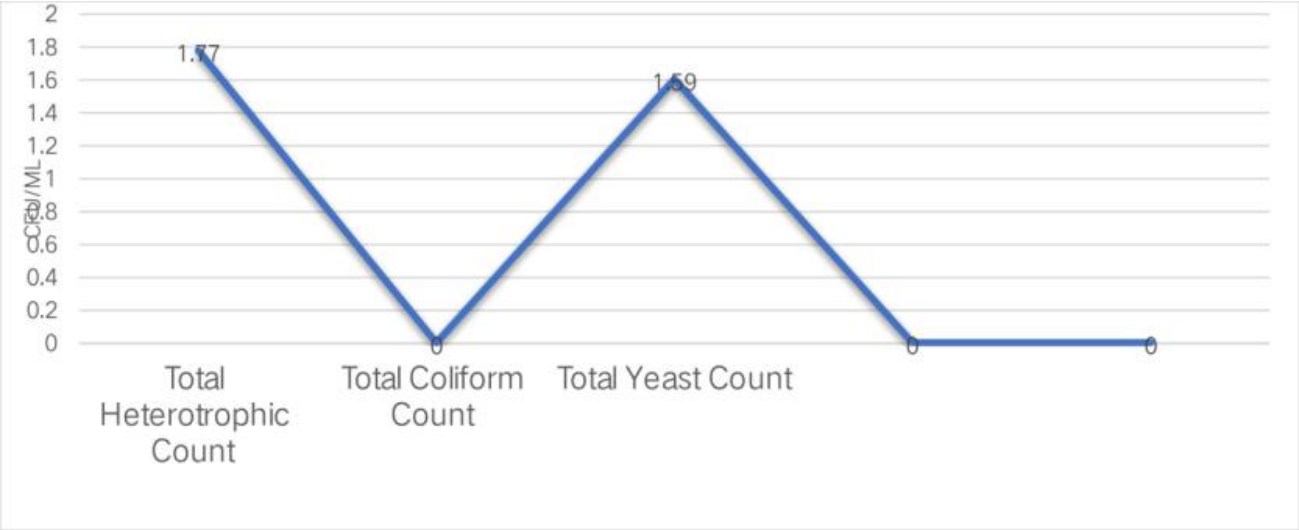

Figure 4.1 Microbiological analysis of the produced wine

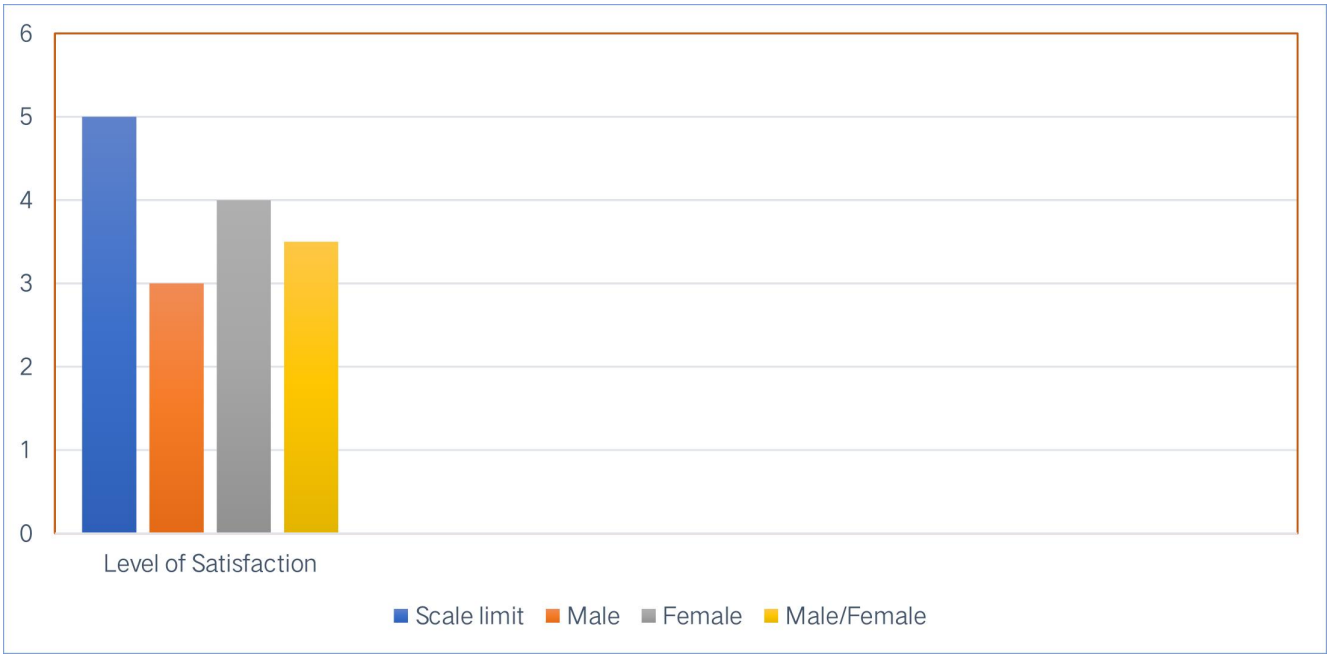

Figure: 4.2 **Sensory Properties of the Wine**

DISCUSSION

The result of the microbial analysis of the produced wine revealed the mean value of total heterotrophic count as 1.77 x 10^2 cfu /ml. which is considerably low when compared to the study of Oladipo et al. (2014) where the total bacterial colony count of the sample ranged from 12 x 10^7 to 90 x 10^7. The result obtained was attributed to the fact that most of the fruit wine samples examined did not meet bacteriological quality standards. However, the study of Alabare and Adebayo-Olaijide (2023) did not record any bacteria count, stating that the wine was produced under aseptic condition making it safe for human consumption. The Mean total yeast count of the produced wine was 1.59 x 10^4 cfu /ml. This is closely related to the result obtained by Alabare and Adebayo – Olaijide (2023) where yeast count ranged from 1.8 x 10^8 – 1.3 x 10^7 for *Meyerozyma guilliermondii* and from 1.7 x 10^8 to 1.4 x 10^7 cfu /ml for *Pichia guilliermondii* from day 17 to 25 of the fermentation. The gradual decline in the yeast count was attributed to the decline in the sugar content in the must as a result of the rapid and effective utilization of the sugar by yeast cells which in turn led to an increase in the alcohol content which will also affect the rate of yeast growth. However, after racking, clarification and aging of the wine there will be no yeast cell present in the wine. Generally, the low yeast count can be attributed to the effect of pasteurization of the wine.

Nevertheless, no coliform was detected in the produced wine, similarly in the studies carried out by Mohammed et al. (2022); Nwobodo (2013); Oladipo et al. (2014); Soumya et al. (2015); Alabare and Adebayo – Olaijide (2023) no coliform was also detected. This generally depicts that the water used in the various wine production was microbiologically safe for consumption and the fruits fermented were thoroughly washed off from every soil particle that may be carrying coliforms. Studies indicate wine does not support the growth of pathogenic microorganisms such as *Clostridium botulinum, Bacillus cereus, Clostridium perfringens*, and others. Studies also show wine has anti-microbial properties due to its high acidity, polyphenol content, alcohol content, low redox potential, and preservative content. As a result, wine has been recognized as a consumer product with a low microbiological safety risk, and governments have issued guidance and employed proportionate regulatory frameworks from a food safety standpoint. Building complex food safety regulatory schemes which must be administered with scarce government resources is unnecessary for a product like wine, with a low microbial risk profile as identified by the general principles of risk management endorsed by the international advisory body, World Wine Trade Group (WWTG).

The result of the sensory properties of wine evaluated by a semi trained panelist of 5 males and 5 females showed a satisfactory level of 4 for females and 3.5 for males on a scale of 5. Both males and females combined had an average satisfactory level of 3.5. The satisfactory level proved that the produced ‘cobawa’ wine can be produced in large scale for commercial purpose. The result obtained revealed the colour was milky, taste was sour, and flavour was generally acceptable. The taste (sour) and aroma (strongly fruity) of the wine is comparable to the control wine except the colour (Milky) that differs from the Carlo rossi red wine.

CONCLUSION

The investigation of the microbial and sensory characteristics of the ‘Cobawa’ wine showed that the produced table wine is a microbiological safe and acceptable product based on the judgement of its organoleptic properties.

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