IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

BIOCHEMICAL CHANGES AND QUALITY ASSESSMENT DURING APPLE WINE PRODUCTION

M. Naveen* and Dr. Madan Mohan Gunda

Department of Microbiology, Government Degree and P.G. College, Siddipet, Telangana, India

ABSTRACT

Apple wine is an alcoholic beverage produced by the fermentation of apple juice using yeast. It is rich in nutrients, antioxidants,and organic acids that contribute to its flavour and health benefits.The present study focuses on the preparation and fermentation of apple wine under controlled laboratory conditions.Fresh apples were washed, crushed, and filtered to obtain juice, followed by the addition of sugar and yeast for fermentation. The fermentation process was carried out for several days at room temperature. Physicochemical parameters such as pH ,alcohol content, color, aroma, and taste were analyzed. The results indicatedsuccessful fermentation with pleasant sensory characteristics and acceptable alcohol production. Apple wine can be considered a nutritious and economically valuable fermented beverage with potential commercial importance.

KEYWORDS:

Apple wine, Fermentation, Yeast, Alcohol production, Beverage

INTRODUCTION

Apple wine is a fermented alcoholic beverage prepared from fresh apple juice through the action of yeast. Apple are rich in sugars, vitamins, minerals, and antioxidants, making them suitable raw materials for wine production. Fermentation converts the natural sugars present in apples into alcohol and carbon dioxide. The most commonly used microorganisms for wine fermentation is *Saccharomyces cerevisiae.*

The scientific basis of fermentation was first clearly explained by (Louis Pasteur 1857), who demonstrated that alcoholic fermentation is a biological process carried out by living microorganisms. Later (Emil Christian Hansen 188)developed the pure culture technique for yeast, which greatly improved the quality and consistency of fermentation industries. Further advancements was made by *(Eduard Buchner 1897),* who proved that fermentation can occur biological catalyst.

Fruit wines have gained popularity because of their nutritional value, pleasant flavour, and relatively low production cost. Apple wine possesses antioxidant properties due to the presence of polyphenols

and organic acids. The quality of wine depends on factors such as apple variety sugar concentration, fermentation temperature, and yeast activity. The present study was conducted to prepare apple wine and evaluate its fermentation characteristics and quality parameters.

MATERIAL AND METHODS

Table:1 Ingredients Used for Apple Wine Preparation

S.No	Ingredients	Quantity
1	Apple juice	1L
2	Sugar	200g
3	Yeast	5g
4	Distilled water	100ml

Preparation of Apple Juice

Fresh apples were washed thoroughly with distilled water to remove dirt and impurities. The apples were peeled, cut into small pieces, and crushed using a blender. The juice was filtered through muslin cloth to remove solid particles.

Figure 1: Crushed apple pulp prepared for juice extraction

Preparation of must

The extracted apple juice was transferred into a fermentation flask. Sugar was added to increase concentration required for fermentation. The mixture was stirred properly

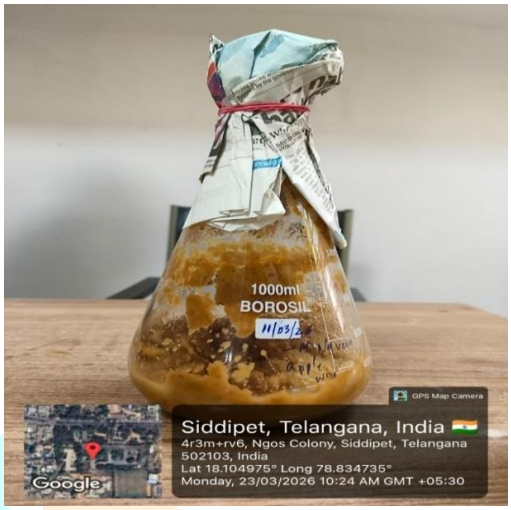

Figure 2: Preparation of apple must for fermentation

Inoculation and Fermentation

Activated yeast culture was added to the mixture. The flask was sealed with an air lock and kept at room temperature for 7-14 days for fermentation.

Figure 3: Inoculation and fermentation of apple must

Monitoring of Biochemical Parameters

Samples were collected periodically during fermentation to analyze:

pH, Total soluble solids, titratable acidity

Table 2: Initial Composition of Apple Juice

Parameters	Initial value
pH	4.2
Total soluble solids	18
Titratable Acidity	0.35

Quality assurance measures

Quality assurance procedures included:

Sterilization of fermentation containers, maintenance of hygienic conditions, Monitoring microbial contamination, sensory evaluation of wine, proper storage conditions.

RESULTS

Apple wine was successfully produced through the fermentation of apple juice using *Saccharomyces cerevisiae* as the fermenting organism. Fresh apples were processed to obtain clear juice, which served as the substrate for fermentation. The prepared must consisted of 1 L of apple juice supplemented with 200 g of sugar and inoculated with 5 g of activated yeast culture. Fermentation was carried out under controlled conditions at room temperature for a period of 7–14 days.

The initial physicochemical characteristics of the apple juice were evaluated before fermentation. The pH of the fresh apple juice was recorded as 4.2, indicating a moderately acidic environment suitable for yeast growth. The total soluble solids (TSS) content was measured at 18°Brix, reflecting the availability of fermentable sugars required for alcohol production. The titratable acidity of the juice was found to be 0.35%, contributing to the flavor profile and stability of the final product (Table 2).

Throughout the fermentation process, active yeast metabolism was observed, as evidenced by the formation of carbon dioxide bubbles and changes in the appearance of the fermentation medium. The air-lock system effectively maintained anaerobic conditions, preventing contamination while allowing the release of fermentation gases. The gradual utilization of sugars by yeast resulted in the conversion of fermentable carbohydrates into ethanol and other secondary metabolites responsible for the characteristic aroma and flavor of apple wine.

Periodic monitoring of biochemical parameters revealed changes in pH, total soluble solids, and titratable acidity during fermentation. A decrease in total soluble solids was observed due to the consumption of sugars by yeast cells, while titratable acidity increased slightly as a result of organic acid production. These changes indicated successful fermentation and biochemical transformation of the apple must.

Quality assurance measures, including sterilization of fermentation vessels, maintenance of hygienic conditions, monitoring for microbial contamination, and proper storage conditions, ensured the production of a stable and acceptable wine product. Sensory evaluation of the fermented wine revealed

desirable characteristics such as a pleasant fruity aroma, clear appearance, balanced sweetness, and acceptable taste, indicating the successful production of apple wine under laboratory conditions.

Table 3: Biochemical Changes During Fermentation

Fermentation day	pH	Titratable Acidity (%)
O	4.2	0.35
3	3.9	0.48
7	3.6	0.62
10	3.4	0.75
14	3.3	0.82

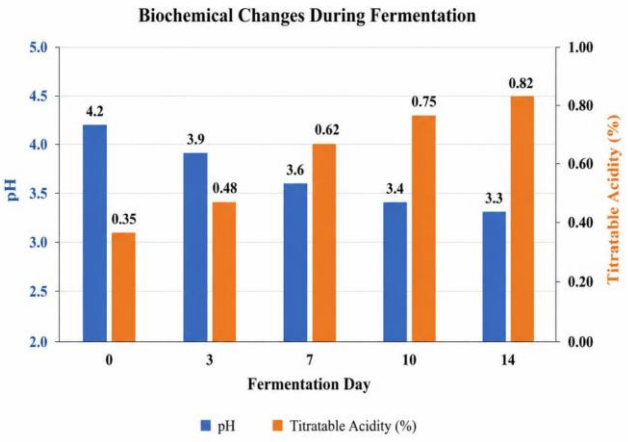

Figure 4: Changes in pH and Titratable Acidity During Apple Wine Fermentation

Table 4: Sensory Evaluation of Apple Wine

Quality Parameter	Observation
Color	Golden yellow
Aroma	Fruity and pleasant
Taste	Mild acidic and sweet
Clarity	Clear
Overall acceptability	Good

DISCUSSION

The fermentation process showed significant biochemical changes in apple wine. The pH gradually from 4.2 to 3.3 due to organic acid production. Total soluble solids decreased continuously as sugars were utilized by yeast during fermentation.

Alcohol content increased progressively and reached 11% by the 14th day. Titratable acidity Increased due to acid formation during fermentation. The Final apple wine showed pleasant aroma, golden color, and acceptable Sensory properties.

Microbial contamination was absent due to proper sterilization and hygiene handling during production.

The fermentation process showed a decrease content and an increase in alcohol production due to yeast activity. The deceased while titratable acidity increased, improving the flavour and microbial stability of the apple wine. Proper quality assurance practices such as sterilization, hygiene handling, and regular monitoring helped maintain good product quality and prevented contamination. The final apple wine showed acceptable Sensory characteristics including Good taste, aroma, and clarity

CONCLUSION

Apple wine production involves several important biochemical changes, including sugar reduction, alcohol formation, acid production, and pH reduction. These changes significantly influence the quality and stability of the final product. Proper quality assurance measures such as hygienic handling, monitoring fermentation parameters, and microbial control ensure safe and acceptable Apple wine production. The study confirms that Apple wine can be successfully produced with good sensory quality and storage through controlled fermentation practices.

ACKNOWLEDGEMENT

The authors express their sincere gratitude to the faculty members and laboratory staff of the Department of Microbiology for their valuable support. Guidence , and cooperation throughout this work. We are especially thankful to Prof. G. Sunitha, principal, for providing laboratory facilities, instutional support, and constant encouragement for the successful completion of this study.

CONFLICTS OF INTREST

The author declares no conflict of interest

REFERENCES

1. Al-Dairi M, Pathare PB, Al-Yahyai R, Jayasuriya H and Al-Attabi Z (2023), Postharvest quality, technologies, and strategies to reduce losses along the supply chain of banana: A review, *Trends Food Sci. Technol.* 134: 177–191. https://doi.org/10.1016/j.tifs.2023.03.003
2. Anagnostopoulos DA and Tsaltas D (2019), Fermented foods and beverages. In *Innovations in Traditional Foods*. pp. 257–291. Woodhead Publishing. https://doi.org/10.1016/B978-0-12-814887-7.00010-1
3. Aycicek H, Oguz U and Karci K (2006), Determination of total aerobic and indicator bacteria on some raw eaten vegetables from wholesalers in Ankara, Turkey, *Int. J. Hyg. Environ. Health* 209(2): 197–201. https://doi.org/10.1016/j.ijheh.2005.07.006
4. Berenjian A (2019), *Essentials in Fermentation Technology*. Basel: Springer.

5. Cheesebrough M (2000), *District Laboratory Practice in Tropical Countries, Part 2*. Cambridge University Press.
6. Dhar P, Das S, Banerjee S and Mazumder S (2013), Production of banana alcohol and utilization of banana residue, *IJRET* 2(10): 466–471.
7. Egbere JO, Odu CE, Onyimba IA, Ngene AC, Yusuf AE, Ogaji AO, Dashen MM, Hemen WN and Entonu EE (2021), Microbiological and organoleptic quality characteristics of laboratory produced date fruit-based Kunun-zaki, *European J. Biol. Biotechnol.* 2(3): 97–104.
8. Entonu EE, Ngene AC, Odu CE, Ogaji AO, Nguhemen HW, Ochiheche EG, Coulthard OD and Egbere JO (2023), Evaluation of antifungal effect of *Parkiabiglobosa* and *Vitellariaparadoxa* against selected pathogenic fungi, *MYCOPATH* 21(1).
9. Ezemba CC and Archibong EJ (2017), Comparative studies of wine produced from coconut (*Cocos nucifera*) and mango fruit (*Mangifera indica*) using yeast isolated from palm wine, *Int. J. Pharma Bio Sci.* 4(8): 44–49.
10. Ezenwa MO, Eze JI and Okolo CA (2020), Proximate, chemical compositions and sensory properties of wine produced from beetroot (*Beta vulgaris*), *Chem. Rev. Lett.* 9(33): 58–66.
11. Fu J, Wang L, Sun J, Ju N and Jin G (2022), Malolactic fermentation: New approaches to old problems, *Microorganisms* 10(12): 2363.
12. Ghoshal G (2018), Emerging food processing technologies. In *Food Processing for Increased Quality and Consumption*. Academic Press. pp. 29–65. https://doi.org/10.1016/B978-0-12-811447-6.00002-3
13. Idise O and Odum E (2011), Studies of wine produced from banana (*Musa sapientum*), *Int. J. Biotechnol. Mol. Biol. Res.* 2(12): 209–214.
14. Joshi VK, Panesar PS, Rana VS and Kaur S (2017), Science and technology of fruit wines: An overview. In *Science and Technology of Fruit Wine Production* 1: 1–72. https://doi.org/10.1016/B978-0-12-800850-8.00001-6
15. Kaur P, Ghoshal G and Banerjee UC (2019), Traditional bio-preservation in beverages: Fermented beverages. In *Preservatives and Preservation Approaches in Beverages*. Academic Press. pp. 69–113. https://doi.org/10.1016/B978-0-12-816685-7.00003-3
16. Kumari M, Singh P, Nataraj BH, Kokkiligadda A, Naithani H, Ali SA, Behare PV and Nagpal R (2021), Fostering next-generation probiotics in human gut by targeted dietary modulation: An emerging perspective, *Food Res. Int.* 150: 110716. https://doi.org/10.1016/j.foodres.2021.110716
17. Lyumugabe F, Kamaliza G, Bajyana E and Thonart PH (2010), Microbiological and physico-chemical characteristics of Rwandese traditional beer "Ikigage", *African J. Biotechnol.* 9(27): 4241–4246.
18. Machamangalath R, Arekar C and Lele SS (2016), Exotic tropical fruit wines from *Garcinia indica* and *Musa acuminata*, *J. Inst. Brew.* 122(4): 745–753. https://doi.org/10.1002/jib.379
19. Maicas S (2020), The role of yeasts in fermentation processes, *Microorganisms* 8(8): 1142. https://doi.org/10.3390/microorganisms8081142
20. Mamauag JC (2022), Development and acceptability of mead wine with banana fruit flavor, *Plant Sci. Today* 9(2): 486–490. https://doi.org/10.14719/pst.1296
21. Maseko KH, Regnier T, Meiring B, Wokadala OC and Anyasi TA (2023), *Musa* species variation, production, and the application of its processed flour: A review, *Sci. Hortic.* 325: 112688. https://doi.org/10.1016/j.scienta.2023.112688

22. Matei F and Kosseva MR (2017), Microbiology of fruit wine production. In *Science and Technology of Fruit Wine Production*. Academic Press. pp. 73–103. https://doi.org/10.1016/B978-0-12-800850-8.00002-8
23. Medina R (2019), *Fermentation Technology*. Scientific e-Resources.
24. Ngene AC, Onwuakor CE, Aguiyi JC, Ifeanyi VO, Ohaegbu CG, Okwuchukwu CP, Kim EG and Egbere JO (2019), Screening of some lactic acid bacteria isolated from selected Nigerian fermented foods for vitamin production, *Advances in Microbiology* 9(11): 943–955. https://doi.org/10.4236/aim.2019.911060
25. Nya E and Etukudo O (2023), Industrial potentials of *Saccharomyces cerevisiae*, *BJMAS* 4(2): 23–46. https://doi.org/10.37745/bjmas.2022.0152
26. Onyema VO, Amadi OC, Moneke AN and Agu RC (2023), A brief review: *Saccharomyces cerevisiae* biodiversity potential and promising cell factories for exploitation in biotechnology and industry processes—West African natural yeasts contribution, *Food Chem. Adv.* 1(2): 100162. https://doi.org/10.1016/j.focha.2022.100162
27. Onyimba IA, Chomini MS, Job MO, Njoku AI, Onoja JA, Isaac DC, Isaac IC and Ngene AC (2022), Evaluation of the suitability of tigernut milk and tigernut-cow composite milks for yoghurt production, *European J. Biol. Biotechnol.* 3(2): 38–44.
28. Rahman MS (2020), *Handbook of Food Preservation*. CRC Press.
29. Ramesh MN (2020), Pasteurization and food preservation. In *Handbook of Food Preservation*. CRC Press. pp. 599–608.
30. Steensels J and Verstrepen KJ (2014), Taming wild yeast: Potential of conventional and nonconventional yeasts in industrial fermentations, *Annu. Rev. Microbiol.* 68(1): 61–80. https://doi.org/10.1146/annurev-micro-091213-113025
31. Zhao Y, Liu S, Yang Q, Han X, Zhou Z and Mao J (2022), *Saccharomyces cerevisiae* strains with low-yield higher alcohols and high-yield acetate esters improve the quality, drinking comfort and safety of huangjiu, *Food Res. Int.* 161: 111763. https://doi.org/10.1016/j.foodres.2022.111763