FRUIT WINE AND ITS THERAPEUTIC POTENTIAL: A Short Review

1.Abstract

Wine is defined as the undistilled fermented beverages product made with different variety of fruits. About 10-15% of alcohol content is found in the wine with numerous bioactive compounds such as phenols, catechin, quercetin and gallic acid, flavonoids, and resveratrol. The presence of these antioxidants is associated with the lower risk of cardiovascular diseases, free radical formation, and hyperglycemia in human body. Resveratrol present in red wine has potential chemo preventive activity. Generally, wine is prepared with the help of yeast mediated fermentation of grapes. However, various other tropical fruits such as plum, jackfruit, palm and pineapple can also be used for the wine production. Various herbs such as basil, ginger, amla and aloe-vera can also be infused into the wine, to enhance its therapeutic value. Herb-induced wines, commonly called as restorative wines can be of great importance to human health. This review provides a overview of different types of wines,the medicinal potential of wine for human health, as well as the diverse fruits utilized in wine production.

Keywords: Wine, Fruit wine, Herbs, banana wine, apple wine, vermouth, grape.

2.INTRODUCTION

Wine is one of the important undistilled fermented beverages(A and R, 2016). which is produced from grapes and various other organic raw materials such as peaches, plums, apricots, banana, and elderberry(Swami, Thakor and Divate, 2014). It is an alcoholic beverage that constitutes about 80-85% water and 9-15% alcohol. Organic acids, sugars, phenols, nitrogenous compounds, enzymes, vitamins, lipids, inorganic anions and cations, and a variety of other bioactive chemicals are present in the wine as minor ingredients. India is one of the significant makers of fermented beverages in the world(Swami, Thakor and Divate, 2014). Total market value of different fruit wines in India is represented in fig.1. According to the annual research, the demand of fruit wines is increasing day by day. Grapes and other fruits due to their aroma, flavor, nutritional values and phenol qualities and possible benefits for human health, are used for wine production. Historically, Wine has been used as an antibacterial, a pain reliever, and a treatment for a variety of dermatological and digestive ailments. Different fruits like apple, apricot, kiwi, and strawberry are fermented by yeast.

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Metabolic processes in yeast, converts the organic raw material into high value-added wine(A and R, 2016).Although the wine consumption has increases tremendously, the therapeutic potential of wine is underestimated by scientific research for non-substantial explanation(Čakar *et al.*, 2016).

3.Basic Classification of Wine

3.1 Table wine: It is the mainstream and most widely selling wines. table wines are red, white, and sparkling wines that have a touch and presence of carbonated beverage(A and R, 2016).

3.2 Restorative wine: Restorative wines are enriched with therapeutic properties, generally due to the presence of herbs and medicinal plant(A and R, 2016).

3.1.1 Fruit wine: It is produced from the organic products like apple, banana, cherry, pear, plum, pomegranate, and consolidation of various herbs and restorative plants(A and R, 2016).Ethyl alcohol, sugar, acids, top alcohols, tannins, aldehydes, esters, amino acids, minerals, vitamins, anthocyanins, and minor ingredients such as flavouring blends are all found in fruit wine. Dry wine, sweet table wine, solid point wine, champagne, muscat, and burgundy wines are trademark wines, whereas cake and clear wines are sweet wines, natural products, vermouth, and harbour wines(Swami, Thakor and Divate, 2014).

3.1.2 Sustained wine: It is known as aromatized wine with exceptional pith and include the vermouth, which could be dry vermouth or sweet vermouth(A and R, 2016).

3.1.3 Grape wine: Grape wine is a type of table wine that is created by the use of yeast and grapes during the alcoholic maturation process. Both black and green grapes are being used for the preparation of grape wine. Red wine and white wine are the two important examples of the grape wine(A and R, 2016) Red wine is produced using red and dark grapes. There are many kinds of red wines prepared by mixing the radiant red grapes in with a wide extent of scents, from oak and eucalypti or chocolate. The juice from dull grapes is greenish white, and the red hiding begins when anthocyanin hues appear in the skin(Swami, Thakor and Divate, 2014). White wine is another variety of grape wine. White wine isn't always white; it can be yellow, gold, or straw coloured depending on whether it's made from the grape's skin or just the juice. White wine can be prepared from non-concealed pound of green or gold conditioned grapes, or from red grape juice that has been plucked(A and R, 2016).

3.3 Non grape wine: Non grape wine is extremely nutritious and is produced from

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Banana, apple, kiwi, strawberry, cherry, pineapple, jackfruit, jamun, lychee, or peach are examples of fruits(A and R, 2016). These wines have generally low liquor content than the industrially accessible wine. Industrially accessible wines are having high liquor rate and contain additives for enhancing shelf life(A and R, 2016). Grapes, apples, pears, apricots, berries, peaches, fruits, oranges, mangoes, bananas, and pineapples are just a few of the tropical and subtropical fruits that generate a lot of juice when extracted. These fluids can be fermented and turned into wines after they've been aged. Grapes, on the other hand, have shown to be an exceptional crude material for winemaking, however other natural products can also be used. The strategies utilized for the usage of other fruits for wine making was intently taken after the wine was produced using white and red grapes. It is becoming increasingly difficult to remove the sugar and other dissolvable elements from the mash of other fruits, and the juices derived from the great majority of natural products contain less sugar and more acid than grape juice. Below mentioned are the other fruits that can be used for commercial wine production.

4.JACKFRUIT: Jackfruit (*Artocarpusheterophyllus*) is an underutilized eatable organic product extensively found in the tropics and subtropics. The adaptable tree has served the requirements of rustic networks extensively by giving nourishment, sustenance, and numerous other customary medications to the individuals of the South-East Asia, Indonesia, Western part of Java and India. The jackfruit is a rich wellspring of phenolic and flavonoids which are well known for cancer prevention potential(Čakar *et al.*, 2016).

5.PALM: Palm (*Acrocomia Mexicana*) is native to tropical climates with palm trees, such as Africa, Asia, and South America.Palm juice from palm tree is a seasonal and low-priced drinking juice in many of the countries like India. The beverage has a vital role in the culture of the people in these locations. The freshly harvested sap is sweet in taste and colorless liquid containing 10-12% sugar. The lactic acid bacteria drop the initial pH of the juice from 7.4 to 6.8 throughout the fermentation process, and the pH is further reduced to as low as 4.0 after 48 hours.The ethanol levels as high as 4% with a pH 3.6(Saha, 2013).

6.PINEAPPLE: The pineapple (Ananascomosus L.) is a prominent tropical fruit with a high nutritional value and a plentiful supply of vitamins A, B, and C. Pineapple also contains a lot of other minerals like calcium, phosphorus, and

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iron. Pineapple juice has sugar of up to 22-25 Brix and can deliver wine with alcoholic content of 12-13%. Wine from pineapple squander is made in Hawaii and Philippines to make refined vinegar(Saha, 2013).

7.JAMUN: The jamun can be utilized to make dry wine of an adequate quality. Jamun with its invigorating pink to grayish substance, adjusted sugar, corrosive and tannin substances can appropriate be utilized in making dry wines of a high quality (Saha, 2013).

8.PAPAYA: Papaya (Carica papaya) is a tropical fruit native to tropical and subtropical regions around the world, including Australia, Hawaii, and Southeast Asia. In contrast to other calm fruits like peaches, papayas are strong in protein, fat, fibre, and starch. Vitamin A, potassium, and carotenoids are abundant in this fruit(Saha, 2013).

9.**Mango:** Mango (*Mangiferaindica*L.) is a popular tropical fruit that may be found all over the world. India is the world's leading mango producer, accounting for 54.2 percent of all mangoes delivered worldwide. Production of wine from mango is one of the elective approaches to utilize and change over surplus creation into a significant product. Mango contains proteinaceous substances, nutrients, minerals and is appropriate for production of wine(Saha, 2013).

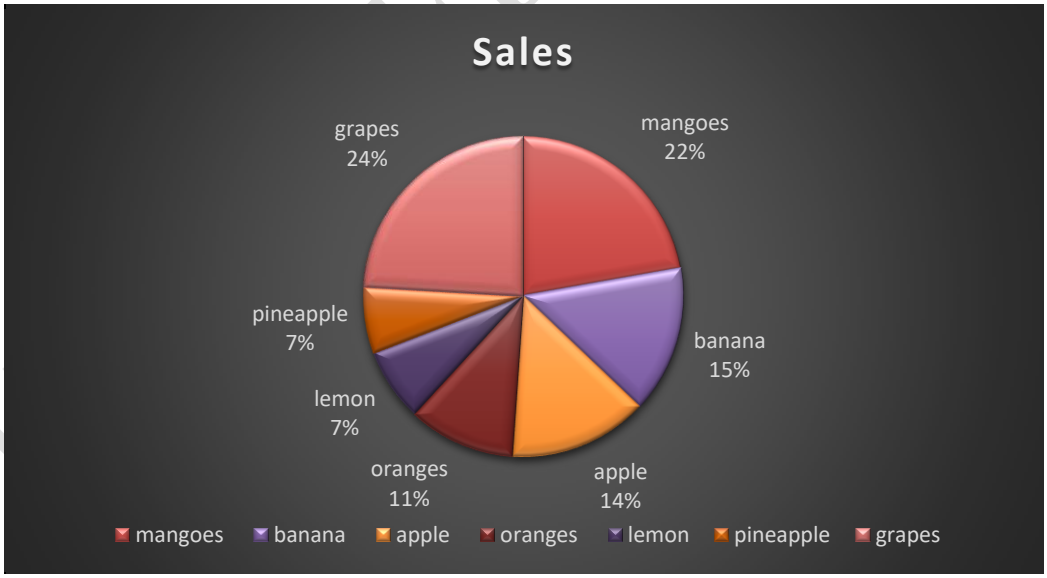

Fig. 1. Figure represents the total market value and sales of different fruit wines in India.

10. **THERAPUTIC EFFECT OF WINE**

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Wine has also been discovered to decrease muscle fits and joint pain-related firmness as a sedative diuretic, slowing the development of any form of diabetes and cardiovascular disease(Kaustav Chakraborty, Joyjit Saha, Utpal Raychaudhuri, 2014). Homemade wine with herbal fuse of amla, aloe-vera, ginger and basil has been known to induce various health benefits. Moderate consumption of wine is related to decrease in Alzheimer's disease. In- vitro studies have shown the antidiabetic potential of wine. The consumption of wine is related to the better digestion(Ahmed *et al.*, 2017). The presence of various antioxidants such as polyphenols, flavonoids and resveratrol is associated with the reduced cardiovascular complications. Polyphenols present in red wine acts as neuroprotective agents(Krishna Kumar, Bhavyashree Kokila and Chauhan, 2012). Various antioxidants present in the red wine have innate chemo preventive activity. Polyphenols in the wine lowers the risk of rectal cancer(Costantino *et al.*, 2008).Procyanidin B present in red and white wine is has potent chemo preventive activity against breast cancer. Catechin, quercetin and gallic acid present in wine have potent activity to neutralize various free radicals produced in the human body(Kaustav Chakraborty, Joyjit Saha, Utpal Raychaudhuri, 2014). Studies have shown that hyperglycemia and problems related to the undigested starch can be well managed by the consumption of moderate quantities of wine. In vitro studies provide enough evidence for the successful management of type 2 diabetes, hyperglycemia induced pathogenesis and cellular oxidation stress by the wine consumption(Ahmed *et al.*, 2017).

Serial number	**Steps involved**
1	Ripe grapes
2	Removal of stems
3	Crushing
4	Filling jar upto 3/4th
5	Addition of sugar 20-24%
6	Adjusting of pH (0.6- 0.8%)
7	Addition of preservatives (1.5g/10kg grapes)
8	Keep for an hour
9	Addition of wine yeast (Saccharomyces*cervisae*)(20ml /5kg grapes)
10	Primary fermentation (2 days@22-28 ^{0}C)
11	Filtration

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12	Secondary fermentation (10 days)
13	Racking
14	Finning and filtration
15	Aging (6-8 months)
16	Bottling
17	Crown cooking
18	Pasteurization (82 ^{0} C/2min)
19	Cooling

Table 1.1 Table represented the steps involved during manufacturing of grape wines in industrial scale [Srivastava and Kumar 2002]

11. CONCLUSION

Wine is one of the important fermented beverages that are produced commercially. It has a low alcoholic content and is endowed with bounty of nutritional and bioactive compounds that makes it a healthy drink. Different fruits can be fermented by the yeast to convert them into wine. The matured wine is related to the improving human health due to the presence of phenols,catechin, quercetin and gallic acid, flavonoids and resveratrol. However, the moderate dosage of wine is recommended. The wine production is commercially a viable option trapping the nutritional content of fruits.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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12. References

1. A, P. and R, B. (2016) 'Practice Patterns and Outcomes in Patients with Esophagitis', *Journal of Hepatology and Gastrointestinal disorders*, 02(01). doi: 10.4172/2475-3181.1000113.

2. Ahmed, N. *et al.* (2017) 'Review on Development of Wine and Vermouth from the Blends of Different Fruits', *Journal of Food Processing & Technology*, 08(01). doi:

10.4172/2157-7110.1000646.

3. Čakar, U. D. *et al.* (2016) 'Phenolic profile of some fruit wines and their antioxidant properties', *Hemijska Industrija*, 70(6), pp. 661–672. doi: 10.2298/HEMIND150722002C.

4. Costantino, H. R. *et al.* (2008) 'Intranasal administration of acetylcholinesterase inhibitors', *BMC Neuroscience*, 9(SUPPL. 3), pp. 1–5. doi: 10.1186/1471-2202-9-S2-S6.

5. Kaustav Chakraborty, Joyjit Saha, Utpal Raychaudhuri, R. C. (2014) 'Tropical fruit wines: A mini review', *Natural products*, 7(10), pp. 219–228. Available at: http://www.publicationhosting.org/toc/article.php?id=3118.

6. Krishna Kumar, H. N., Bhavyashree Kokila, G. and Chauhan, J. B. (2012) 'Phytochemical screening and antibacterial activity of Stachytarpheta indica', *Global Journal of Pharmacology*, 6(1), pp. 4–7.

7. Saha, B. (2013) 'GC-MS Head Space and Consumer Preference Evaluation of Wines with Reduced Ethanol Content', p. 187.

8. Swami, S. B., Thakor, N. J. and Divate, A. D. (2014) 'Fruit Wine Production: A Review ', *Journal of Food Research and Technology*, 2(3), pp. 93–100. Available at: www.jakraya.com/journa/jfrt.

9. Holt, H.E., Francis, I.L., Field, J., Herderich, M.J. and Iland, P.G., 2008. Relationships between berry size, berry phenolic composition and wine quality scores for Cabernet Sauvignon (Vitisvinifera L.) from different pruning treatments and different vintages. Australian Journal of Grape and Wine Research, 14(3), pp.191-202.

10. KWON, Y.I., Apostolidis, E. and Shetty, K., 2008. Inhibitory potential of wine and tea against α-Amylase and α-Glucosidase for management of hyperglycemia linked to type 2 diabetes. Journal of Food Biochemistry, 32(1), pp.15-31.

11. Salaritabar, A., Darvishi, B., Hadjiakhoondi, F., Manayi, A., Sureda, A., Nabavi, S.F., Fitzpatrick, L.R., Nabavi, S.M. and Bishayee, A., 2017. Therapeutic potential of flavonoids in inflammatory bowel disease: A comprehensive review. World journal of gastroenterology, 23(28), p.5097.

12. Ahmad, A., Kaleem, M., Ahmed, Z. and Shafiq, H., 2015. Therapeutic potential of

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flavonoids and their mechanism of action against microbial and viral infections—A review. Food Research International, 77, pp.221-235.

13. Li, Y. and Ding, Y., 2012. Minireview: Therapeutic potential of myricetin in diabetes mellitus. Food Science and Human Wellness, 1(1), pp.19-25.
14. Choi, D.Y., Lee, Y.J., Hong, J.T. and Lee, H.J., 2012. Antioxidant properties of natural polyphenols and their therapeutic potentials for Alzheimer's disease. Brain research bulletin, 87(2-3), pp.144-153.
15. Kosseva, M.R., Joshi, V.K. and Panesar, P.S. eds., 2016. Science and technology of fruit wine production. Academic Press.
16. Joshi, V.K., Panesar, P.S., Rana, V.S. and Kaur, S., 2017. Science and technology of fruit wines: an overview. Science and technology of fruit wine production, pp.1-72.
17. Cakar, U., Grozdanic, N., Petrovic, A., Pejin, B., Nastasijevic, B., Markovic, B. and Dordevic, B., 2017. Fruit wines inhibitory activity against α-glucosidase. Current pharmaceutical biotechnology, 18(15), pp.1264-1272.
18. Heinonen, I.M., Lehtonen, P.J. and Hopia, A.I., 1998. Antioxidant activity of berry and fruit wines and liquors. Journal of agricultural and food chemistry, 46(1), pp.25-31.
19. Matei, F. and Kosseva, M.R., 2017. Microbiology of Fruit Wine Production. In Science and Technology of Fruit Wine Production (pp. 73-103). Academic
20. Okeke, B.C., Agu, K.C., Uba, P.O., Awah, N.S., Anaukwu, C.G., Archibong, E.J., Uwanta, L.I., Ezeneche, J.N., Ezenwa, C.U. and Orji, M.U., 2015. Wine production from mixed fruits (pineapple and watermelon) using high alcohol tolerant yeast isolated from palm wine. Universal Journal of Microbiology Research, 3(4), pp.41-45.
21. Dias, D.R., Duarte, W.F. and Schwan, R.F., 2017. Methods of evaluation of fruit wines. In Science and Technology of Fruit Wine Production (pp. 227-252). Academic Press.
22. Saranraj, P., Sivasakthivelan, P. and Naveen, M., 2017. Fermentation of fruit wine and its quality analysis: a review. Australian Journal of Science and Technology, 1(2), pp.85-97.
23. Dongmei, A., 2007. Advance in Processing Technology of Fruit Wine. Journal of Anhui Agricultural Sciences, 35(19), p.5859.
24. Yang, Y., ZOU, H.T. and CHEN, S.J., 2006. Research on and Development of Natural Fruit Wine. LIQUOR MAKING SCIENCE AND TECHNOLOGY, 10(148), p.82.

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25. de Souza, A.C., Fernandes, A.C., Silva, M.S., Schwan, R.F. and Dias, D.R., 2018. Antioxidant activities of tropical fruit wines. Journal of the Institute of Brewing, 124(4), pp.492-497.
26. Ko, S.H., Choi, S.W., Ye, S.K., Cho, B.L., Kim, H.S. and Chung, M.H., 2005. Comparison of the antioxidant activities of nine different fruits in human plasma. Journal of medicinal food, 8(1), pp.41-46.
27. Jin, B., Xie, L., Guo, Y. and Pang, G., 2012. Multi-residue detection of pesticides in juice and fruit wine: A review of extraction and detection methods. Food research international, 46(1), pp.399-409.
28. Jucá, M. M., CysneFilho, F. M. S., de Almeida, J. C., Mesquita, D. D. S., Barriga, J. R. D. M., Dias, K. C. F., ... &Vasconcelos, S. M. M. (2020). Flavonoids: biological activities and therapeutic potential. *Natural product research*, *34*(5), 692-705.
29. Rupasinghe, H.V. and Clegg, S., 2007. Total antioxidant capacity, total phenolic content, mineral elements, and histamine concentrations in wines of different fruit sources. Journal of Food Composition and analysis, 20(2), pp.133-137.
30. Hui, Y.U. and Xianchang, Z.H.O.N.G., 2008. Development of Guava fruit wine [J]. China Brewing, 13.
31. Rahman, M. H., Akter, R., Bhattacharya, T., Abdel-Daim, M. M., Alkahtani, S., Arafah, M. W., ...& Mittal, V. (2020). Resveratrol and Neuroprotection: Impact and its Therapeutic Potential in Alzheimer's disease. *Frontiers in Pharmacology*, *11*.
32. Salehi, B., Machin, L., Monzote, L., Sharifi-Rad, J., Ezzat, S. M., Salem, M. A., ...& Cho, W. C. (2020). Therapeutic potential of quercetin: New insights and perspectives for human health. *Acs Omega*, *5*(20), 11849-11872.
33. Pechanova, O., Dayar, E., &Cebova, M. (2020). Therapeutic Potential of Polyphenols-Loaded Polymeric Nanoparticles in Cardiovascular System. *Molecules*, *25*(15), 3322.
34. Salehi, B., Sharifi-Rad, J., Cappellini, F., Reiner, Ž.,Zorzan, D., Imran, M., ... &Maroyi, A. (2020). The therapeutic potential of anthocyanins: current approaches based on their molecular mechanism of action. *Frontiers in Pharmacology*, *11*.
35. Sanches-Silva, A., Testai, L., Nabavi, S. F., Battino, M., Devi, K. P., Tejada, S., ...&Farzaei, M. H. (2020). Therapeutic potential of polyphenols in cardiovascular diseases: Regulation of mTOR signaling pathway. *Pharmacological research*, *152*, 104626.
36. Sharma, N., Tiwari, N., Vyas, M., Khurana, N., Muthuraman, A., &Utreja, P. (2020).
UNDER PEER REVIEW

An overview of therapeutic effects of vanillic acid. *Plant Arch*, *20*(2), 3053-3059.

37. Chelluboina, B., &Vemuganti, R. (2020). Therapeutic potential of nutraceuticals to protect brain after stroke. *Neurochemistry International*, *142*, 104908.
38. Kasiri, N., Rahmati, M., Ahmadi, L., Eskandari, N., &Motedayyen, H. (2020). Therapeutic potential of quercetin on human breast cancer in different dimensions. *Inflammopharmacology*, *28*(1), 39-62.
39. Bankefa, O.E., Oladeji, S.J., Gabriel-Ajobiewe, R.A., Akinyele, H.A. and Samuel, S.M., 2021. HARNESSING THE NUTRITIONAL QUALITY OF PAWPAW AND PINEAPPLE FRUITS FOR PILOT SCALE PRODUCTION OF WINE. Journal of microbiology, biotechnology and food sciences, 10(4), pp.663-668.
40. Chen, S., Zhou, H., Zhang, G., Dong, Q., Wang, Z., Wang, H. and Hu, N., 2021. Characterization, antioxidant, and neuroprotective effects of anthocyanins from NitrariatangutorumBobr. fruit. Food Chemistry, p.129435.
41. Jucá, M.M., CysneFilho, F.M.S., de Almeida, J.C., Mesquita, D.D.S., Barriga, J.R.D.M., Dias, K.C.F., Barbosa, T.M., Vasconcelos, L.C., Leal, L.K.A.M., Ribeiro, J.E. and Vasconcelos, S.M.M., 2020. Flavonoids: biological activities and therapeutic potential. Natural product research, 34(5), pp.692-705.
42. Losso, J.N., 2021. Food Processing, Dysbiosis, Gastrointestinal Inflammatory Diseases, and Antiangiogenic Functional Foods or Beverages. Annual Review of Food Science and Technology, 12.
43. Kumar, S. S., Manoj, P., Giridhar, P., Shrivastava, R., &Bharadwaj, M. (2015). Fruit extracts of Basellarubra that are rich in bioactives and betalains exhibit antioxidant activity and cytotoxicity against human cervical carcinoma cells. *Journal of Functional Foods*, *15*, 509-515.

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