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Production of Herbal Wine Using Herbs-A Review

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Abstract:
Herbal wine is a type of wine that is made by fermenting herbs with grape or fruit juice. This type of wine has gained popularity in recent years due to its health benefits and unique flavors. The production process of herbal wine involves the selection and preparation of herbs, followed by their infusion or decoction in grape or fruit juice. The mixture is then fermented using yeast or other microorganisms, and the resulting wine is bottled and aged for a period. Herbs used in the production of herbal wine can vary depending on the desiredflavor and health benefits. Common herbs used include Ginger, Basil, paper mint. These herbs are known for their antioxidant, anti-inflammatory, and antimicrobial properties, making herbal wine a healthy alternative to traditional wines. The production of herbal wineusing herbs is a growing trend in the wine industry, as consumers are increasingly interestedin natural and organic products.
Keywords: *Herbal wine, fermentation, antioxidant, anti-inflammatory, antimicrobial activity*

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I. INTRODUCTION

One of the foods that go through fermentation is wine. Wine is said to be the oldest and mostwell-known fermented product. Wine has been made from grapes since ancient times by fermenting them for a certain amount of time, aging them in oak barrels, and then storing them in leather-covered wood barrels. Grape juice is fermented with a variety of yeast, and the wine is aged to produce alcoholic fruit wine with various fruits like apples, kiwis, strawberries, and so on. are transformed into wine through yeast metabolic activity and through time [1,2]. These wines are made from a variety of fruits through partial or completefermentation [3]. Wine helps consumers maintain their health because it contains a variety ofpolyphenols and other constituents like bioactive compounds (bioactive peptides). During fermentation, these bioactive substances are released into wine (aqueous ethanolic solution), increasing the susceptibility and sensitivity of the polyphenols and bioactive components making them more bioavailable during absorption [4]. Wine relaxes organs that are necessaryfor metabolic processes like digestion and dietary absorption [1].

Basic classification of wine:
Classified to 4 major categories as
Table wine: It includes red wine, white wine, and cider (apple cider, for example), which arethe most well-liked and best-sellers. with sparkling wine that looks and feels like a carbonateddrink.
Medicinal wine: It is typically prepared with the addition of herbs and medicinal plants and has medicinal properties.
Fortified wine: It is referred to as aromatized wine with a special essence and includes vermouth, which is a sparkling wine with a flavor that is either flavored with herbs or anotherproduct that induces flavor. The vermouth may be sweet or dry.
Fruit wine: Made from apples, bananas, cherries, pear, plums, and other fruits in addition to grapes.
Classification of wine (based on herbs)
Grape wine: Grape wine is a type of table wine that is made through alcoholic fermentationwith grapes (which could be black or green) and yeast cultures. It consists of white wine and red wine [5-8].
Non grape wine: Depending on the fruit's climatic conditions and environmental support,fruits are produced worldwide. They are extremely nutritious and produced in excess in their respective growing regions. Fruits are exported and imported across borders due to their widespread consumption. During the overabundance time frame natural products break downunreasonably because of numerous undeniable reasons like high temperatures, dampness, ill- advised dealing with, swelling during taking care of and transportation, microbial defilements,bugs'

rodents attacking away region, and so forth. As a result, they cannot be eaten; these partially or completely rotten fruits are used to make wine. Not only do these fruits aid in the production of novel wine, but they also improve waste management [9, 10]. Fruits like banana, apple, kiwi, strawberry, cherry, pineapple, jackfruit, jamun, raspberry, lychee, peach, and pomegranate, among others, have already been used to make non-grape beverages.

Herbal Wine

People were treated with herbal formulations derived from plants before the revolution in themedical field and the rise of modern medicines [28]. Nowadays, herbal infusions are popular in wine. These herbs are either completely dry or in powder form. The human body and healthcan both benefit greatly from herbs. These herbs typically have antimicrobial properties; anti-cancer qualities Beyond the usual benefit, herbal formulations provide host health benefits. Physically and mentally, the host will benefit. The use of these herbal infusions in alcoholic beverages has been shown to lower blood pressure and improve overall body performance [29].

Herbs of all kinds and from all over the world are important for improving flavor and makingwine. The herbs used to make herbal wine have lower titratable acidity, more polyphenols, andmore tannins. Because of their abundance of esters and aldehydes, herbal extracts are both nutritional and therapeutic. The herbs' tannins are astringent in nature; They have antioxidantand aroma-enhancing properties. They form strong complexes with proteins thanks to the presence of hydroxyl and carboxyl groups [30]. Enhancers, preservers, and antioxidants are just a few examples of the polygamous functions of these. These cancer-prevention agents aretracked down in blossoms, natural products, stems, roots, bark and leaves. Numerous studies have demonstrated that drinking red wine can slow the aging process and protect against a variety of diseases [31]. The components of herbal wine have a pleasant aroma and help humans and animals stay healthy. Home grown wine has numerous medical advantages like decrease in ovarian disease, fortifying the bones and in general skeleton, malignant growth cells deterioration, counteraction of heart strokes by keeping the coronary supply routes clean, hoisting the lung usefulness. In a nutshell, these herbs have the potential to provide beneficialantimicrobial, antibacterial, and antimutagenic properties [32].

History of Herbal Wine

Herbal remedies were tried on people to heal and soothe their bodies when modern medicine was not in use. China and the Middle East provided the first reports of plant additives in fermented beverages. The results of an earthenware chemical analysis demonstrated the presence of herbs in ancient alcoholic beverages. Additionally, it was reported that the additionof tree resin to wine safeguarded consumers against wine disease. In China, there were reportsthat the alcoholic formulation contained evidence of tree fragrance additives as well as nativespecies like rice, wheat, and millets [33,34]. In order to produce herbal formulation, vegetables,fruits, and roots-bulbs like ginger, garlic, and onion were fermented in an aqueous medium. Herbal flavors are extracted by macerating, steeping, and straining these components together.These ingredients, which are effective against common ailments like the common cold, cough,and fever [35], are still used in the production of Egyptian wine. Chemical and botanical evidence, such as herbal extracts found in alcoholic beverages, have begun to be reported by scientists. At the same time, Abydos wine, a Spanish fermented emmer wheat barley beverage,a herbal drink made with native rosemary, mint, and thyme, came into focus [36].

Table 1: Non grape wines prepared from fruits other than grapes

Fruit (substrate)	Botanical name	Result(%alcohol)	Reference
Apple	*Malus domestica*	-	Wang et al. [5]
Banana	*Musa sapientum*	5 11.28	Akubor et al. [11] Kaur and Kaur [12]
Black raspberry	*Rubus occidentalis*	-	Jeong et al. [13]
Cherry	*Prunus cerasus*	10.81	Sun et al. [14]
Custard apple	*Annona squamosa*	11.90	Jagtap and Bapat [10]
Elder berry	*Sambucus nigra*	13.20	Schmitzer et al. [15]
Guava	*Psidium guajava*	8.3	Sevda and Rodrigues[16]
Jamun	*Syzgium cumini*	6 9.9-11.8	Chowdhury and Ray [17]Joshi et al. [18]
Kiwi	*Actinidia delicious*	13.5	Soufleros et al. [19]
Lychee	*Litchi chinensis*	12.42	Alves et al. [20]
Mango	*Mangifera indica*	8.5	Reddy and Reddy [21]

Orange	*Citrus sinensis*	90.38	Selli et al. [22]
Papaya	*Carica papaya*	55.23	Lee et al. [23]
Peach	*Prunus persica*	13.9	Davidović et al. [24]
Pineapple	*Ananas comosus*	10.2	Pino and Queris [25]
Pomegranate	*Punica granatum*	9.05	Mena et al. [26]
Raspberry	*Rubus idaeus*	74.4	Duarte et al. [27]

Flavor Extraction of Herbs

Direct extraction

The first step is to weigh the herbs, then add the desired herb to the base wine and let it sit forseveral hours; allowing the herb's full flavor to enter the base wine [37] It is preferable to produce fine herb powder in order to enhance the flavor flow from the herbs into the base wine.While moving on, the base wine that had been spiced or flavored with herbs or spices could be heated or kept at room temperature. Heating wine is typically preferred for better flavor mixing with base wine [38].

Concentrate extract method

Extract is made by putting the spices and herbs outside in a vessel and then passing the base wine through that vessel until the base wine has the full flavor [39].

Maceration

Putting herbs and spices in solvents like ethanol (or any other solvent) and extracting the flavorof the herbs, or macerating the mixtures of herbs in sherry at 60 degrees Celsius and letting itstand for three to four weeks. Decanted wine and herbs are left to stand for ten days [40].

Sonication assisted or microwave assisted extraction

This method includes standard of maceration alongside microwave or ultrasound waves to remove the home-grown seasons to abbreviate the extraction time. Most of the time, this method is used to extract small amounts of materials on a large scale [40].

Infusion

An extraction system where home grown material is drenched in the hot or cold fluid for alittle time of span to create weaken fluid readiness [40, 41].

Decoction

By boiling the medicinal plant or herbs in water to release their entire aroma and flavor [40].

Other methods

Involves crushing and grinding the herbs, boiling them in water, or putting the herbs in hot water [42]. The base wine could be flavored with commercially available flavoring wine or brandy that has been extracted directly or through a concentrate method [42]. To reduce volatile loss, the extraction is typically carried out in one or two sealed vessels [43].

Herbs Used in Making Herbal Wine

Spices go about as enhancer, cell reinforcements, additive in wine. Herbs support healthy weight management and cardiovascular exercise. There are examples of herb use from the Paleolithic era, when herbs were steeped and strained to extract flavor and kept for fermentation or mixing with alcoholic beverages like beer. India has established confirmationsof mastery in Ayurveda where spices, natural powders and fluid home grown plans were demonstrated viable against illnesses from normal afflictions to deadly sicknesses [44]. Sincethe spread of diseases to the planet, herbal formulations—herbs in liquid form—have been used for treatment. The various kinds of herbs used to make herbal wine are listed in Table 2.

Health Benefits of Herbal Wine

There are numerous health benefits to herbal wine made with herbs. Herbs naturally contain antibacterial compounds. Most of the herbs have anti-inflammatory, anti-diabetic, andanti-cancer properties. A single herb, such as amla or holy basil, is used to make herbal wine.or it could be made by combining a number of herbs, such as aloe-amla and aloe-ginger wine[47]. Wine's polyphenols are the only ones that boost probiotic bacteria's growth and eliminateharmful bacteria from the human microbiota, ultimately benefiting the host's health [55]. Coriander has been traditionally used in a number of medical prescriptions to treat piles, or blood in the stool, and historical evidence supports its addition to beer or any sweet formulation, such as honey or flax.

Name of the herb	Medicinal usage of herb	Quantity	Parts of herb or plant used	Result (%Ethanol/Remarks)	Reference
Holy basil *(Oscimum sanctum)*	Therapeutic properties against common ailments like cold, cough, chronic dysentery. Anti-cancerous, anti-oxidant, anti-diabetic and good gastro-intestinal effect.	15 gm herb in 200 ml water Giving 200 ml of extract	Stem, leavesof holy basil	Wine made from holy basil extractreceived the best views for flavourscored 15/20	Shiradhonkar et al. [41]
		Leaves were boiled water in	Stem, leavesof holy basil	Wine with 5.51% of ethanol produced	Kaur and Kaur [12]
Lemon grass *(Cymbopogon citratus)*	Medicinal properties against stomach disorders,fever, anti-cancerous	15 gm in 200 ml Giving 200 ml of extract	Herb itself	Pleasant aroma, scored max. Points 16/20 in aroma	Shiradhonkar et al. [41]
Peppermint (*Menthe arvensis*)	Antibacterial, antifungal ,antiviral. Effective against respiratory congestions and common ailments like cough and cold	10 gm of leaves in 200 ml of water	Herb itself	-	(Shiradhonkar et al. [41]
		1%,3%,5%,7%,9 % extracts used	Herb used	-	Joshi et al. [45]
Ginger r (*Zingiber officinale*)	Antioxidant, regulation of glucose and lipid levels, anti-cancerous and antifungaleffects. Effective against respiratory congestions and common ailments like coughand cold.	10 gm of rootsCut into pieces Boiled with 200 ml of water	Roots	-	(Shiradhonkar et al. [41]
Indian gooseberry (ANOLA) (*Emblica officinalis*)	Regulation of bowel movements, effective against constipation and stomach disorders. Good for eye sight and hair growth. Rich source of vitamin C	100 gm	berry	Ethanol:11.4%	Nanda Gopal andNair [46]
		1%,3%,5%,7%,9 % extracts used	Dried anole used	9% alcohol	Joshi et al. [45]
		-	Whole berry	12% alcohol	Soni et al. [47]
		-	berry	10% alcohol has highest polyphenols content. Gooseberry wine was better in terms of all sensoryand biochemical aspects, withstand all quality parameters	Rana and Singh [48]
Aloe vera (*Aloe Barbadensi s*)	Antibacterial, antifungal, antiviral, anti-inflammatory, tissue healing properties, gastro-intestinal effect, anti- arthritic effect.	100 ml of aloe vera juice	Aloe leaves and transparentslime	8.52 % ethanol	Trivedi et al. [49]
Garl ic (*Allium Sativum)*	Effective against cardiovascular disease, Alzheimer's disease, hyperlipidemia and against hypertension. Anti-cancerous, antimicrobial, good dermatologic applications.	1%,3%,5%,7%,9 % extracts used	Whole garlic by peeling off outer skin	Garlic wine has the highest yeast growth inhibiting property	Joshi et al. [45]
Hops(*Humulus Lupulus)*	Relaxing and sleep-inducing activity, anti-inflammatory, against menopause symptoms, anti-HIV 1 viral activity, anti-acne activity, aids in weight loss and effective in elevating cardiovascular health.	1%,3%,5%,7%,9 % extracts used	By boiling the female flowers within apple wine so that flavor come in wine at 50-55˚C	-	Joshi et al. [45]

Table 2: Different types of herbs used in making herbal wine

The body's blood sugar levels can be lowered by these herbal wines. Additionally, they controlthe body's glucose level. The results showed that the herbs were so effective in the body that they helped regulate enzyme secretion. Herbal wine has anti-diabetic, anti-oxidant, gastro- protective, analgesic, painkiller, nerve-soothing, good intestinal motility, and cardiac activity properties [56-58]. Herbal wine has antimicrobial and antibacterial properties against pathogens that can be spread through food [59]. Herbs can penetrate the nerve to protect against radiation-induced chromosomal damage, and these herbal wines and medicines are reaching the DNA level [60]. All of the health benefits of herbal wine are shown in Table 3.

Purple sweet potato (*Ipomoeo batatas)* blending with 18 different herbs	Rich i n anthocyanin andpossess anti-oxidant activity.	100 gm	Root of purple sweet potato used and all the herbs were used as powder	Ethanol: 8.61% Wine has the medicinal flavor and dark color was attractive. The wine is rich in antioxidants such as anthocyanin and phenols and possesses remedies for common ailments like cold, cough, skin diseases anddysentery.	Panda et al. [50]
Tea(*Camellia sinensis)*	Rich in polyphenols and astringent compounds like flavonoids that aids in protection against common ailments like cough, cold and fever. Anti-cancerous and anti-ageing property.	4 gm	Tea extract used	8.82% alcohol and wine possessed antimicrobial activity against E. coli, *enterococcus faecalis*	Kumar et al. [51]
Hibiscus petal (*Hibiscus rosa sinensis)*	Antifertility, wound healing, anti- depressant, anti-oxidant and anti-diabetics activity.	_	Dried crushed flower's petals	Ethanol: 11.50% MTCC no. 178 was found most potent of all the produced wine.	Tiwari et al. [52]
Blue water lily (*Nymphaea lotus)* used withcassava starch	Used for dysentery and dyspepsia, mainly used to treat indigestion. Its leaves act as cooling medicine in cutaneous diseases. Therapeutic effect against liver and urinary disorders along with menstrual problem.	1 gm of dried weight	Bud and stamen	Ethanol: 14% Nymphaea-cassava wine was the best among all the wines prepared combinations and had the most anti- oxidative properties. Good DPPH activity and TPC were detected from herbal wines prepared from the bud of Nymphaea lotus.	Amornpitak et al. [53]
Wild berries *Embolic officialism Berberis lyceum; Pyrus pasha; Actinidia delisiosa; Syzigium zambos; Prunu s cerasoidus; Rubus ellipticus; Cratagus spiecies; Citrus karne*	When ingested in small concentrations they show positive results. Possessed effects of antifertility, wound healing, anti- depressant, anti-oxidant and anti-diabetic activity. Reduced increased kappa and pitta, helpful in conception by preparing and strengthening uterus. Effectiv e dermatological properties.	1 kg	Berries used	Wine prepared from *Embolic officialism* has highest number of polyphenols measured as total phenol count. Wine prepared from *Embolic* and *Prunus ceratodus* hadshown the best results among all herbal wines prepared	Rana and Singh [48]
Base wine used as juice (orange juice, apple must,cane juice etc.)					
Holy b a s i l , Lemongrass, Peppermint ,Ginger (Supplemented withorange juice)	Antioxidant, regulation of glucose and lipid levels, anti-cancerous and antifungal effects. Effective against respiratory congestions and common ailments like cough and cold.	15 gm	Leaves	Lemon grass herbal wine had pleasant aroma and marked the best in all sensory parameters appreciation in taste.	Shiradhonkar at al. [41]
Aloe vera (Supplemented with cane sugarjuice)	Anti-microbial properties, anti-ageing, laxative effect, effect on ulcers, dermatological effect and other cosmetic uses		Leaves	The wine has antimicrobial activities against foodborne pathogens and it provides digestive benefits and good intestinal health.	Trivedi et al. [49]
Tea (Apple juice)	Decreased Atherosclerosis, reduced risk of CHD, enhanced endothelial function, anti-inflammatory effect	4 g/100 ml	Tea extract	Best results with apple juice concentrate as sugar source, DAPH used as nitrogen source and showed anti-microbial activity.	Joshi and Kumar [54]

Table 3: Health benefits of herbal wine

Herbal Wine: A Better Approach

The alcohol content of homemade wines is lower than that of commercially available wines. Preservatives are used to store the high alcohol content of commercially available wines. Because the herbs serve as preservatives in homemade herbal wine formulations, neither preservatives nor additives are used. As a result, these herbal wines are safe for dailyconsumption and do not pose a health risk. Secondary compounds or

allelochemicals, such asalkaloids, glycosides, phenolics, and steroids, which are beneficial to human health, are amongthe metabolically active chemicals found in plants. Consumers can experience a wide range ofprofound phenotypic and genotypic shifts thanks to numerous metabolically active secondaryplant compounds. These secondary compounds found in plants occasionally aid in human survival and health. Biochemical medicine is closely related to human metabolic biology [68].When these parts of plants or herbs are taken into the body, they do things all the time, like clean blood, kill bacteria, improve cardiovascular health, and keep weight off. Herbal interactions with human cells and enzymes function dynamically, reaching down to the tiniestelectron for human benefit; acting as functional foods that provide additional health benefits than usual.

Effect possessed by herbal wine	**Findings and remarks**	**Reference**
Antimicrobial activity	Phenolic compounds found in amla wine or all the herbal wines (apple wine, *Ludwig octovalvis wine)* are anti-microbial in nature, with increase in phenols concentration in wine, antibacterial activity get increased detected by various bacterial assays like zoneof inhibition, disc diffusion method, Broth micro dilution method	Gayon and Glories [61]; Allah et al. [62];Yakob et al. [63]; Cohen [55]; Kumar et al. [51]
	Antibacterial activity against food borne bacteria like *Typhimurium, S.aureus, E.coli* (food borne pathogens) and probiotic strains detected through MIC,MBC and time dependent bacterial assay values in aloe amla- aloe ginger wine and hibiscus petalsherbal wine Antibacterial activity in apple tea wine possessed due to fermentation of apple naturallyand in presence of yeast *Saccharomyces cerevisiae* that led to antimicrobial activity	Trivedi et al. [59]; Tiwari et al. [52] Kumar et al. [51]
	Antimicrobial activity possessed by herbal wine prepared by *Ludwig oxalis* checked on *E.coli strain 0157:H7* (most pathogenic strain) and some other pathogenicbacteria like *Bacillus spizizenii* and *Pseudomonas aeruginosa* detected by disc diffusion method, Broth micro dilution method.	Yakob et al. [63]
	Aloe vera based herbal wine not only possess the antibacterial activities but alsosupport and maintain the persistence of lactobacilli in the wine fed animal gut	Trivedi et al. [49]
Anti-oxidant activity	Phenolic compounds in wine prepared from amla possess antioxidant activity	Gayon and Glories [61]
	Bioactive compounds present in herbs of herbal wine have antioxidant activity which is effective in free radical scavenging activity that leads to anti-ageing as free radicalsare responsible for cell ageing and death.	Sharma et al. [64]; Trivedi et al. [59]
	Herbal wine prepared from different herbs like ginger, amla, tulsi, peppermint, lemongrass and starchy compounds like cassava starch, purple sweet potato also possess antioxidant activity	Amornpitak et al. [53]; Rana and Singh[48]; Yakob et al. [63]; Panda et al. [50]
Anti-cancerous	Herbal wine prepared from alma, tulsi, ginger, aloe vera is effective against cancer andhas been likely to reduce cancer chances.	Seo et al. [66]; Panda et al. [50]
Source of vitamins	Wine yeasts like *Brettanomyces, Saccharomyces cerevisiae var. Ellipsoids, Brewer'syeast, Pineapple yeast* are good source of all B complex vitamins; fat soluble and water-soluble vitamins.	Reed, [67]
Medicinal and therapeutic properties	Polyphenols present in herbal wine has beneficial effects against human diseases likecardiovascular diseases, cancer, diabetes, etc.	Seo et al. [66]; Panda et al. [50]
	Holy basil herbal wine has therapeutic properties like anti-cancerous, against common ailments like cough, cold and sore throat infections. It is good option for pure fermented herbal beverage. This herbal wine is effective against inflammation, neurological disorders, and diseased lungs.	Kaur and Kaur [12]
	Wine prepared from purple sweet potato possess therapeutic properties againstcommon ailments like cold, cough, chronic dysentery Increasing the functionality of liver	Panda et al. [50]
	Herbal wine prepared by using tulsi, ginger, lemongrass and peppermint has positiveeffect on body in treating diseases like diarrhea, migraine, diabetes. Wine was gastro-protectant, good for cardiac activity and to treat nervous inflammation.	Shiradhonkar et al. [41]; Stewart, John etal. [56]; Craig [57]; Prakash and Gupta, [58]
	Moderate consumption of wine leads to protective action against Alzheimer's disease	Seo et al. [66]
Treating the various body disordersand dysfunctionality at DNA and chromosomal level	Herbal holy basil wine has protection against radiation induced chromosomaldisorders by two water soluble flavonoids orientin and vicenin of *osmium*	Uma Devi et al. [60]
	Protective role of aloe vera wine against oxidative stress induced by salmonellainfection on animal murine model This oxidative stress was measured by hepatic superoxide dismutase activity and	Trivedi et al. [59]

	reduced glutathione levels.	

Table 4: Health benefits of herbal wine

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