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Herbal wine preparation from agricultural wastes

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Abstract
Preparation of herbal wine from different herbs, fruit and vegetable waste was carried out by simple fermentation process. The pineapple, beetroot and carrot leftover pulp as well as its peel are used with various herbs to make herbal wine. The herbs used are tulsi, amla, ginger, tea leaves, aloe vera, and peppermint. The fermentation was carried in two groups A and B. In group A all the herbs are used with pineapple, beetroot and carrot peels while in group B all the herbs are used with pineapple, beetroot and carrot leftover pulp obtained after extracting its juice. The fermentation process was carried out in presence of active yeast (Saccharomyces Cerevisiae) at room temperature for 10 days. After the fermentation process its pH, specific gravity and percentage of alcohol content were monitored. These herbal wines were found to be better in quality and due its various health benefits it can be widely used in medical application for preventing and treating various disorders.

Keywords: Herbal wine, Fermentation, Herbs, Leftover pulp, Peels, Health benefits

Introduction
Wine is an alcoholic beverages made from fermented foods. Generally in ancient times it is made from grapes, by fermenting grapes for specific duration of time, adding them in oak barrels followed by storage in wood barrels covered with leather cloth (Rathi, 2018) [2]. The earliest known winery is the 6100 year old Areni-1 winery in Armenia. Wine reached the Balkans by 4500 BC and was consumed and celebrated in ancient Greece, Thrace and Rome. Throughout history, wine has been consumed for its intoxicating effects (https://en.m.wikipedia.org). Wines are also produced from other fruits like apple, berries, apricot, kiwi, strawberry, cherry, mango, banana etc. Wine made from fruits contains alcohol content of 5.5- 15.5% of alcohol by volume. Wines are the healthful beverage that has been seen as a natural remedy for man's illness from early day and are said to aid recovery during convalescent period (Okonkwo and Dilar, 2016) [13].

Herbal wines are the wine having medicinal properties which is usually prepared with incorporation of different herbs and medicinal plants. The different types of herbs used for wine production are holy basil (Oscimum sanctum), peppermint (Menthe arvensis), ginger (Zinziber officinale), Indian gooseberry or amla (Emblica officinalis), aloe vera (Aloe barbadensis), tea (Camellia sinensis) etc. This herb plays a vital role for flavour enhancement and act as a preservative in wines (Rathi, 2018) [2]. The herb used in wine contains more tannins, polyphenols and lower titratable acidity. Tannins found in the herbs are astringent in nature; they have aroma enhancing and antioxidant properties. They contain hydroxyl groups and carboxyl groups to form complexes with proteins (Ashok *et al*. 2012a; Rathi, 2018b) [4, 2]. These antioxidants are found in flowers, fruits, steam, roots, bark and leaves. These day herbal infusions are trendy in wine. These herbs either in powder form or completely dry form are mix with base wine to increase its positive effect on health and over all body of human beings (Rathi, 2018) [2].

In this present study the herbal wine from fruits and vegetable leftover pulp as well as its peel has been reported. The agricultural waste generated in tonnes from beverages and fruit juice industries discard on daily basis. The leftover pulp generated after extracting juice from fruits and vegetable and its peels are used to make wine by fermentation process. These leftover pulp and peels contain valuable nutrients components of simple sugar such as sucrose, glucose and fructose. Lignocellulose is a major structural component of woody and non woody plants (Shilpa *et al.* 2013) [12]. The fermentation is a simple process in which conversion of sugar into alcohol and carbon dioxide takes place in presence of yeast. The pineapple, beetroot and carrot leftover pulp and it peels are used to make wine. The herbs are added to wine to increase its flavour and health benefits. The herbs used are tulsi, amla, peppermint, aloe vera, ginger and tea leaves.

The fermentation is carried out in two groups A and B in an anaerobic fermenter. In group A all these herbs and peels of pineapple, beetroot and carrot are used while in group B all these herbs and leftover pulp of pineapple, beetroot and carrot are used. The proper anaerobic conditioned should be maintained in both the fermenter to avoid bacterial growth.

- Pineapple contains bromelain; soluble and insoluble dietary fibre; vitamin A, C, B5 and B6; essential minerals such as manganese, potassium etc. It is anti-inflammatory in nature and helps to prevent cancer and heart diseases.
- Beetroot are low in calories and a great source of nutrients, including fiber, folate, vitamin C, nitrates and pigments that may help lower blood pressure and improve athletic performance. It improves digestion, boosts immunity and also increases haemoglobin content in the blood.
- Carrots are a particularly good source of beta-carotene, fiber, vitamin A and K, potassium and antioxidant. Carrot can help to reduce the risks of cancer and cardiovascular disease and improved eye health.
- Herbal wines have anti-cancerous, anti-microbial, anti-diabetic and anti- oxidant properties. It has many health benefits like reduction in ovarian cancer, strengthening the bones and overall skeleton, cancer cell deteoriation, prevention of hearth strokes by keeping he coronary arteries clean, elevating lung functionality (Rathi, 2018) [2]. India has rooted evidences of expertise in Ayurveda where herbs, herbal powders and liquid herbal formulation are proved effective against diseases from common aliments to fatal diseases (Jayasundar, 2010a; Rathi, 2018b) [3, 2]. Therefore these materials provide good adjuncts for herbal wine production having various health benefits and can be used to prevent diseases (Okonkwo and Dilar, 2016) [13].

Materials and Methods

Herbs, fruit and vegetable used

The pineapples (Ananas comosus) were brought from the local market. From the local vegetable store beetroot and carrot are also brought which are easily available in the market.

The herbs used in the process are holy basil/tulsi (Oscimum sanctum), peppermint (Menthe arvensis), ginger (Zinziber officinale), Indian gooseberry/amla (Emblica officinalis), aloe vera (Aloe barbadensis) and tea leaves (camellia sinensis) are also brought from the market.

Although, they are commonly found but, they have some uncommon and unmatched medicinal properties which makes them special and essential in this work (Shiradhonkar *et al*. 2014) [8].

Preparation of Raw Materials

The pineapple, beetroot and carrot are washed and peeled. After that the juice was extracted from pineapple, beetroot and carrot with help of juicer.

The remaining pulp left after extracting juice as well as its peels where used in this work.

All the herbs are clean and washed properly. The ginger and amla are cuts into small pieces were as from aloe vera its pulp is taken off. Now the extract of tulsi, peppermint and tea leaves were prepare in distilled water. The 200 ml distilled water is boiled in each beaker. After 15min of boiling of water proper amount of these leaves were added and soaked for 30 minutes.

The fermentation process is done in two groups A and B in a fermenter. In group A all the herbs with peels of pineapple, beetroot and carrot are used while in group B all the herbs with leftover pulp of pineapple, beetroot and carrot are used. The herbs in both the fermenter A and B are taken in same amount. The amount of herbs as well as leftover pulp and peel taken in this process are shown in table 1.

In group A fermenter the all the material with proper amount are added with 2500ml of distilled water where as in group B fermenter with all the material about 2000 ml of distilled water is added and mixed well.

Preparation of Yeast

The dry yeast (Saccharomyces cerevisiae) were brought form the bakery shop. For both the fermenter A and B separate activation of yeast is prepared in same quantity. For activation of dry yeast take 100 ml each of lukewarm water having temperature of 45-50 °C in both the beaker. Add 15 gms of sugar in each beaker and stir it till it gets dissolve in it. Now finally add 15gm of dry yeast in both beaker and stir it. Cover both the beaker with lid and keep it undisturbed for 10-15 min. After the 15 min the froth formed will ensure that the yeast is being activated and then add each to both the fermenters A and B.

Table 1:- Quantity of material used in both fermenter A and B

Sr.no.	Material used	Group A (peels are used)	Group B (leftover pulp are used)
1.	Tulsi leaves	10 gms	10 gms
2.	Peppermint leaves	20 gms	20 gms
3.	Tea leaves	10 gms	10 gms
4.	Ginger	20 gms	20 gms
5.	Aloe vera	80 gms	80 gms
6.	Amla	150 gms	150 gms
7.	Pineapple	200 gms	150 gms
8.	Beetroot	80 gms	150 gms
9.	Carrot	100 gms	150 gms

Fermentation of wine

The respective mixture of A and B was added in both fermentation bottles. Now add the prepared activated yeast in both jar at the room temperature of about 27 °C and the bottles are tightly closed with an outlet for CO_2 directed into the balloons to encourage anaerobic fermentation i.e. fermentation without oxygen. The fermentation was carried out at room temperature for 10 days.

After the fermentation for 10 days its pH, specific gravity and percentage alcohol content was measured of both the fermenter A and B respectively. From pH meter its pH is measured while from specific gravity bottle its specific gravity is measured.

Health benefits of Herbal Wine

The herbal wine prepared with incorporation of herbs possesses many health benefits. Herbs used act as enhancer, antioxidant and act as a preservatives in wine (Soni *et al.* 2009a; Rathi, 2018b) [2, 7]. It has natural anti-bacterial constituents. They have numerous properties like anti-diabetic, anti-cancerous, gastro-protectant, nerve soothing, pain killer (analgesic), good intestinal motility and cardiac activity (Rathi, 2018a; Stewart *et al.* 1991b) [2, 10]. It

possesses anti-microbial and anti-bacterial against food borne pathogen (Rathi, 2018a; Kumar *et al*. 2016b) [2]. The various health benefits of herbal wine is shown in table 2.

Table 2:- Health benefits of raw material used for preparation of herbal wine

Sr. No.	Material used (herbs, fruit and vegetable)	Parts of herb or plant is used	Medicinal usage	Reference
1.	Holy basil/tulsi (Oscimum sanctum)	Leaves of tulsi	Therapeutic properties against common ailments like cough, cold, chronic dysentery, anti-cancerous, anti-oxidant, anti-diabetic and good gastro-intestinal effect.	(Shiradhonkar *et al*. 2014) ; (Kaur and Kaur, 2015) [8, 1]
2.	Peppermint (Menthe arvensis)	Mint leaves	Stimulating, stomachic and carminative properties like indigestion, gastro-intestinal, antiemetic, lowers cholesterol and lower the activity in liver enzyme.	(Shiradhonkar *et al*. 2014) ; (Joshi *et al*. 2014) [8, 6]
3.	Tea (Camellia sinensis)	Leaves	Rich in astringent compounds like flavonoids that aids in protecting against cough cold, fever. Anti-cancerous, anti-diabetic and weight loss properties.	(Kumar *et al*. 2016) [14]
4.	Aloe vera (Aloebarbadensis)	Transparent slime	Anti-fungal, anti-bacterial, anti-viral, anti-inflammatory, anti-arthritic, gastro-intestinal, tissue healing properties.	(Trivedi *et al*. 2012) [11]
5.	Ginger (Zinziber officinale)	Roots	Effective against respiratory congestions and common aliment like cough and cold. Anti-oxidant, anti-fungal, anti-cancerous.	(Shiradhonkar *et al*. 2014) [8]
6.	Indian gooseberry (Emblica officinalis)	Berry	Rich source of vitamin C, good for eye sight and hair growth, effective against constipation and stomach disorder.	(Nandagopal and Nair, 2013) ; (Soni *et al*. 2009); (Rana and Singh, 2013) [5, 7, 9]
7.	Pineapple (Ananas comosus)	Fruits peels and its waste after extracting juice	Improves bone and eye health, aiding in digestion, prevent arthritis, cancer and heart diseases, boosts immunity.	(www.organicfacts.net)
8.	Beetroot (Beta vulgaris)	Root peels and its waste after extracting juice	Lowers blood pressure, increased exercise capacity, boosts digestion, prevent anemia, boosts blood detoxification, prevent skin, lung and colon cancer, strengthens heart and reduces cholesterol.	(www.organicfacts.net)
9.	Carrot (D. carota)	Roots peels and its waste after extracting juice	Reduced cholesterol, lower risk of heart attacks, improve eye health, weight loss friendly, detoxify the body and improves skin, boost the immune system and oral health.	(www.organicfacts.net)

Results and Discussion

After the 10 days of fermentation, both groups A and B wine formed is monitored and its pH, specific gravity and alcohol content were estimated. From the pH meter its pH is measured while from specific gravity bottle its specific gravity is measured.

The initial specific gravity of both the groups A and B was found to be 1.04 at initial temperature of 27 ℃. While after the fermentation the specific gravity of A and B was found to be 0.96 and 0.92 respectively.

The pH of both the wine A and B was found to be 5.5 and 5.3 respectively.

The alcohol content of both the herbal wine was calculated by the basic formula used by most home brewer to determine the alcohol content in the beverages is:

ABV = (OG - FG) * 131.25

Were ABV = alcohol by volume,

OG = initial or original specific gravity, and

FG= final specific gravity.

The alcohol content in ABV of both the group A and B was found to be 15.75% and 10.5%. The fermentation parameter of both the group A and B is shown in table 3.

Table 3:- Fermentation parameter for both the herbal wine

Sr.no.	Parameters	Group A (peels are used)	Group B (waste pulp are used)
1.	pH	5.5	5.3
2.	Specific gravity	0.96	0.92
3.	Alcohol content (ABV)	15.75%	10.5%
4.	Temperature	28 °C	28 °C

Conclusion

The production of herbal wine with utilization of fruit and vegetable waste pulp as well as its peel has been studied. The alcohol content is found to be more in the herbal wine containing peels than that of herbal wine from waste pulp. Both the herbal wine formed is of red colour. The herbal wine formed is having many health benefits which can help in preventing various diseases and has wide medicinal application.

Therefore this herbs and waste material may provide good adjuncts for wine and alcohol production. This can reduce seasonal losses of the fruits and vegetables as well as reduces waste in the environment.

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