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Original Research Article

PRODUCTION OF WINE FROM FERMENTATION OF WATERMELON (*CITRULUS LANATUS)* USING YEAST

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ABSTRACT

Background: Wine has always been linked in some way to the history of man, either because it is a beverage with its flavor and personality or because of the health benefits it brings. Wine when taken in a moderate amount, contributes to the health of the human organism, increasing the quality and the lifetime.

Aim: Fruits both in fresh as well as in processed form not only improve the quality of our diet but also provide essential ingredients like vitamins, minerals, carbohydrates, etc. Fruit wines are undistilled alcoholic

beverages usually made from grapes or other fruits, which are nutritive, tastier, and mild stimulants. In the present study, an effort was made to prepare wine from watermelon.

Material and Methods: The wine is prepared using watermelon (*Citrullus lanatus*) using yeast and other additives and further quality estimation of the prepared wine was done using standard procedures.

Results: The wine produced from watermelon contains 12% v/v alcohol. The pH of wine is was 3.4 after wine production. This pH remained constant throughout the fermentation and inhibited the growth of unwanted microorganisms. The total acidity of the wine is 5.25gm/10ml and the total acidity of the wine is 5.25gm/10ml.

Conclusion: Sensory evaluation revealed that the wine prepared from watermelon has an acceptable aroma/flavor and taste. The fruit wine fermentation with characteristic ability to complete fermentation; is probably due to its high ethanol tolerance; hence, resulted in the production of generally acceptable flavor, taste, and coloured wine from watermelon.

KEYWORDS

Watermelon, *Citrullus lanatus*, Wine, Beverages, Alcoholic preparations

INTRODUCTION

Fruit wines are undistilled alcoholic beverages usually made from grapes or other fruits such as peaches, plums or apricots, banana, elderberry or black current, etc. which are nutritive, and mild stimulants. These fruits undergo a period of fermentation and aging. Wine is composed of two main ingredients, water (generally over 80%) and ethanol (usually over 9%). Alcohol, the second major component of the wine, is primarily produced by yeasts during alcoholic fermentation. Ethanol in wine is the basic alcohol produced in the course of fermentation. On the other hand, ethanol can also be produced by grape cells in the course of carbonic maceration in small amounts[1,2]. Alcohol concentration of wine is important for various reasons. Besides its psychological and physiological effects on health, ethanol is indispensable for the aging, stability, and organoleptic properties of wine[1]. Grape wine is perhaps the most economically important fruit juice alcohol[3] and because of the commercialization of the product for the industry, the process has received the most research attention. However, any fruit with a good proportion of sugar may be used for wine production[4].

The introduction of watermelon "Citrullus" is a genus of four species of desert vines, among which *Citrullus lanatus* is an important crop. Species of watermelon are *C. ecirrhosus (Namib Tsamma)*, *C. colocynthis, C. lanatus,* C. *vulgaris* L. In general, we can mention as benefits of wine like prevention of heart and circulatory diseases; if drink together with the meal is the most beneficial for diabetics; favorable to the fight against obesity; provides greater longevity and quality of life; creates barriers to the development of dementia; the meal accompanied by wine results in better digestion; anti-infective effect; beneficial effects on women's health; are excellent for the skin; can prevent blindness; have anti-inflammatory action; can alleviate lung diseases; besides being a very pleasant drink[3]. High rate wastage of these fruits especially at their peak of production during their season necessitates the need for alternative preservation food forms towards an

enhanced utilization of these fruits. The nutritional value of watermelon per 100 g is shown in table no. 1 and vitamins composition in table no. 2

Table No. 1- Nutritional value of Watermelon per 100g

Nutritional Component	Approx. per 100 g
Energy	127 kJ (30 kcal)
Carbohydrates	7.55 g
Sugar	6.2 g
Dietary fiber	0.4 g
Fat	0.15 g
Protein	0.61 g

Table No. 2- Vitamin concentration of Watermelon per 100g

Vitamins	Approx. per 100 g
Vitamin A equiv. beta-carotene	(4%) 28 µg (3%) 303 µg
Thiamine (B1)	(3%) 0.033 mg
Riboflavin (B2)	(2%) 0.021 mg
Niacin (B3)	(1%) 0.178 mg
Vitamin B6	(3%) 0.045 mg
Pantothenic acid (B5)	(4%) 0.221 mg
Choline	(1%) 4.1 mg

MATERIALS AND METHODS

Method of wine formation

Collection of samples: Firstly, the Ripened, disease free and mature fruits are selected. Then, watermelons were harvested based on their ripeness is the first crucial step of winemaking that will later on influence the style of wine. In addition to ripeness, the decision of harvesting the watermelon can also be taken depending on the meteorological conditions.

Preparation of fruit juice: After harvesting the Watermelon fruits were washed with water then peeled off and cut into small pieces. The cut pieces were crushed or grinded in a mechanical grinder and juice was collected in the beaker.

Fermentation: To the juice**,** Potassium Meta-bisulfide(KMS) was added in 0.90 mg/L for killing all unwanted microorganisms in must, and for chaptalization, 10gm/100ml sugar was added in for rapid fermentation(1gm

= 1˚Brix). After that, Diammonium phosphate (DAP) was added in 0.35gm/L. DAP provides a nitrogen source to Yeast.

Fermentation is an anaerobic process sugar is converted into alcohol acid and gas. Alcoholic fermentation is a biological process that converts sugars such as glucose, fructose, and sucrose into cellular energy, producing ethanol and carbon dioxide. Because yeasts perform this conversion in the absence of oxygen, alcoholic fermentation is considered an anaerobic process. A fermentation tank was placed at the cooling incubator. The temperature was maintained up to 16-18˚c.

Filtration: After 21 days of fermentation the wine was filtered through a muslin cloth and yeast lees removed. The winemaking process naturally sediments that can precipitate out of the wine. In winemaking, clarification and stabilization are the processes by which insoluble matter suspended in the wine is removed before bottling. This matter may include dead yeast cells (lees), bacteria, tartrates, proteins, pectin, various tannins, and other phenolic compounds, as well as pieces of fruit skin, pulp, stems, and gums. Clarification and stabilization may involve Filtration, Centrifugation, Refrigeration, Maturation, and Racking. The method followed for Clarification in this study was Centrifugation at 10000 rpm, 10 min, 4^0c.

Packaging and Storage: when clear wine is obtained then for packaging the bottles were sterilized with bleach and bathed in citric acid solutions to neutralize it. The wine was transferred in the wine to the bottles with minimal air exposure. At the same time, corking them immediately is highly advisable. Once filled, the bottles should be arranged with the cork pointing upwards and left in this position for 3 to 5 days. The scope of this practice is equalizing the pressure in the bottle and drying the cork. After 3-5 days, the bottles can be turned upside down and placed in a cool and dry location.

Chemical analysis of the Wine Sample

pH determination, total acidity, Volatile acidity, Total and free SO_2, and alcohol estimation of watermelon juice, as well as wine, was done which are as follows:

pH Determination- 10 ml of the wine was put into a sterile beaker, and the pH of the must determine using a pH a digital *pH* meter[6].

Total Acidity- Burette is filled with standardized 0.1N NaOH**.** 10 ml of wine sample was taken in 100 ml conical flask. 10 ml of Distilled water and 5 drops of phenolphthalein solution was added. Then titration was done against 0.1N NaOH till persistent pink colour was observed. Reading was noted down and total acidity were calculated by using formula[7]

$$TA = \frac{M1 \times N \times 0.075 \times 10}{M2}$$

Volatile Acidity- For measurement of volatile acidity burette is filled with standardization 0.1N NaOH. 10 ml of wine sample was taken in 100 ml conical flask. 10 ml of Distilled water and 5 drops of phenolphthalein

solution was added and titrated with 0.1N NaOH till the first persistent pink colour is obtained. Record the initial burette reading to two decimal points and total acidity was calculated by using formula[7]

$$\text{V.A.} = \frac{M1 \times N \times 0.060 \times 1000}{M2}$$

Total SO_2 and Free SO_2- 50 ml wine was Pipetted into a 250 ml Erlenmeyer flask. 5 ml of starch indicator was added in it also 5 ml of Sulphuric acid and a pinch of sodium bicarbonate to expel air. Titrated free and total SO_2 was measured rapidly using iodine solution. The endpoint was a blush colour that persisting for 1-2 mines.

Alcohol Estimation- For determination of alcohol concentration from wine sample by using potassium dichromate, firstly the standard solution of Alcohol i.e.0%, 2%, 4%, 6%, 8%, 10% were prepared**.** Volumetric flask numbered volumetric 1 to 8 and filled them with alcohol as increasing concentration by 2% in each starting from first which is zero. In 7 and 8, Numbered volumetric flask 1ml of wine was added. Water was added to all the flasks to make up the final volume. 25ml potassium dichromate was added to each of the volumetric flasks along with 20ml of distilled water. Then all volumetric flasks were incubated in the water bath of 60˚c for 20 min**.** The volumetric flask was removed from the water bath and cooled it and 4ml distilled water was added and make of a final volume of 50 ml. Reading was taken at 600nm.

RESULTS

The sensory evaluation of the wines produced from the fermentation of watermelon juice revealed no significant difference between colour, and tingly (carbonations) flavor. While in terms of fruity and sweet flavor evaluation, both juice and wine revealed significant differences with watermelon juice have fruity sweet flavour compared to that of watermelon wine. During this study, analytical assays were carried out. pH determination, total acidity, volatile acidity, alcohol content, and sulfur dioxide were also evaluated as shown in table no.3. The pH of both the watermelon juice and wine sample**s** were 3.8 and 3.4 respectively while alcohol percentage is 0 % for juice and 12 % for wine samples.

Table no. 3- Result of Chemical analysis of Watermelon juice and Wine samples

Properties	**Juice**	**Wine**
pH	3.8	3.4
Total acidity	3.2 gm/L	5.2 gm/L
Volatile acidity	1.8 gm/L	3.2 gm/L
Total SO_2	732 mg/L	342 mg/L
Free SO_2	407 mg/L	249 mg/L

Alcohol in %	0%	12%

DISCUSSION

This definition is sometimes broadened to include any fermented alcoholic beverage except wine. For historical reasons, mead, cider, and Perry are also excluded from the definition of fruit wine. Watermelon juice can be made into wine or blended with other fruit juices. Fruit wines have traditionally been popular with home winemakers and in areas with cool climates such as North America and Scandinavia; in Africa, India, and the Philippines, wine is made from water-melon. In a 100 gram serving, watermelon fruit supplies 30 calories and low amounts of essential nutrients. Only vitamin C is present in appreciable content at 10%. Watermelon fruit is 91% water, contains 6% sugars, and is low in fat. The amino acid Citrulline is produced in watermelon rind. Watermelon pulp contains carotenoids, including Watermelon wine is known to contain a special pigment antioxidant, which is the derivative of lycopene.

The wine produced from watermelon contains 12% v/v alcohol. This alcohol concentration was produced after the 12th day of fermentation. The yeast could utilize the reducing sugars present in the melon and ferment into alcohol. The pH of wine is was 3.4 after wine production. This pH remained constant throughout the fermentation and inhibited the growth of unwanted microorganisms. Studies have shown that during fermentation of fruits, low pH is inhibitory to the growth of spoilage organisms but creates a conducive and competitive advantage environment for the growth of desirable organisms[8]. The total acidity of the wine is 5.25gm/10ml which increased during fermentation. Increased total acidity is observed due to the initial presence of acidity in watermelon fruit which is further enhanced during fermentation. The volatile acidity of the wine is 1.8/10ml. it is the result of the production of acetic acid in wine. Free SO_2 present in wine is 64ppm resulting from the metabolism of yeast which produces sulfur compounds. As fermentation proceeds SO_2 level in wine increases as wine yeast produces SO_2 to inhibit the growth of bacteria. Total SO_2 present in wine is 166.4ppm. Sugar percentage drops and alcohol percentage increases as fermentation proceeds. As sugar levels decrease, the rate of fermentation and rate of alcohol production increases. Reports have shown that the fermentation of fruit juices using yeast from different sources creates a variety in flavor and varying levels of alcoholic contents in wines[9].

CONCLUSION

Wine is one of the oldest beverages, has always been related to the history of man, and presents benefits to human health. In this context, it is possible to associate wine consumption with health benefits associated with healthy eating and quality of life, but this only happens if it is consumed in a certain quantity. Being fruit based fermented and undistilled product, wine contains most of the nutrients present in the original fruit juice. Fruits are among the most important foods of mankind as they are not only nutritive but are also indispensable for the maintenance of health. Fruits both in fresh as well as in processed form not only improve the quality

of our diet but also provide essential ingredients like vitamins, minerals, carbohydrates, etc. Being fruit based fermented and undistilled product, wine contains most of the nutrients present in the original fruit juice.

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