

Determining Level of Trans-Resveratrol in Wines produced from some of the Rare Georgian Red Grape Varieties

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Abstract— The interest in red wine is continuously growing worldwide. Customers' taste changes with years, but one thing remains the same – wine has to satisfy all the requirements, including combining health benefits with a pleasant taste and feeling it can induce. We are currently trying to merge the newest technologies with the knowledge gained through the centuries and traditional ways of winemaking.

The traditional technology of producing wine consists of keeping juice on pomace. During this process, phenolic and other aromatic substances are extracted from the grape's hard parts (grape pip, grape, skin, and stalk of grapes) in the juice and then into the wine. One of the most important phenolic compounds is Resveratrol (3,5,4' - Trihydroxystilben), a natural stilbene in wine and grapes. It also is a strong antioxidant and determines the healing properties of wine.

We determined Resveratrol levels by high-performance liquid chromatography in wines produced from five less known Georgian red grapevine varieties (Simonaseuli, Gabasha, Adreuli Shavi, Sreluri, and Saperavi). It turned out that all the mentioned varieties are rich in Resveratrol, which is a reason for a growing interest in the wines produced. All said above creates a solid foundation for growing wine assortment that will be capable of satisfying all the market requirements.

Keywords— Grape; Wine; Resveratrol; High-Performance Liquid Chromatography; Phenolic Compounds

I. INTRODUCTION

Our ancestors were aware of the beneficial properties of wine even without conducting any research. Aside from the rich aroma and taste, this beverage can have a tremendous healing effect due to the vitamins, amino acids, minerals, polyphenolic, and other beneficial substances it contains. Resveratrol is the representative of Stilbenes and the essential substance from the group of nonflavonoids. It is the indicator of the beneficial properties of the wine and stands out with its high activity. The existence of Resveratrol in wine indicates that the wine contains other flavonoids as well. The same goes for the grapes that contain Resveratrol[1].

Resveratrol exists as two isomers, namely, cis (Z) - and trans (E) - Resveratrol, in glycosylated and aglycone forms. Trans-Resveratrol is biologically more active. The influence of warm temperature and ultraviolet rays may transform trans isoforms to cis isoform[2].

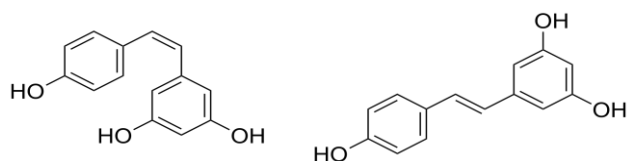


Figure 1. Chemical structures of cis-Resveratrol and trans-Resveratrol

Resveratrol is a secondary metabolite produced as a result of plant biosynthesis, and it is an essential product for plants as well as for humans. First of all, it protects the vine from biotic and abiotic stress factors[3]. It is a major phytoalexin. Its synthesis is conducted in the grape's skin and leaves, and it protects the plant from fungal disease, ultraviolet rays, and other outer influences[4]. It turned out that the vine varieties that are less prone to fungal disease produce more Resveratrol than the ones prone to them. The majority of the above-mentioned secondary metabolites are responsible for the organoleptic properties of wine. Other than that, these compounds represent a fantastic source of food supplements and pharmaceutical products[5].

There is plenty of data indicating that Resveratrol can influence the initiation, growth, and development stages of different genesis cancers. During the cancer initiation phase, Resveratrol acts as a free radical inhibitor and an anti-mutagen. Antimicrobial properties and protective qualities of Resveratrol against coronary disease are also well known[6,7].

The concentration of Resveratrol in red wines fluctuates between 0,1 and 14.3 mg/dm³[8]. It is confirmed that the high concentration of Resveratrol is mainly typical in the wines produced in cold climates and vice versa, the low concentration of this compound is seen in the wines produced in warm and dry climates[9]. Resveratrol

promotes an increase in the immune system, decreasing the risk of cardiovascular and Alzheimer's disease development. It is used to treat inflammation, regulation of lipids, treating diabetes, Parkinson's disease, etc. It has antibacterial, antiviral, and antifungal properties that also improve vision [10,11,12].

As the concentration of Resveratrol in wines widely fluctuates, and the highest level of this compound is found in a well-known Saperavi, we decided to measure the level of Resveratrol in the wines that are produced from less studied Georgian grape varieties, such as Simonaseuli, Gabasha, Adreuli Shavi, Sreluri, and Saperavi. Our research also had the intention to popularize these varieties in Georgia, as well as in Europe.

II. RELATED WORK

It is known that Resveratrol concentration in the wine is heavily dependent on the grape variety, meteorological factors, the composition of the soil, agrotechnical arrangements, harvesting time, ripeness level of grapes, microbiological pollution, and other factors [13,14].

The grapes, aimed to produce the wine intended for research, were harvested from the same land (Jighaura Agricultural Scientific Research Center) in the period of full ripeness.

The level of Resveratrol in wine is mainly determined by high-performance liquid chromatography, as this method has high accuracy and requires little time to be performed.

III. METHODOLOGY

The research objects represented the wines produced from the following grapevine varieties that we chose: Simonaseuli, Gabasha, Adreuli Shavi, Sreluri, and Saperavi

All solvents used were HPLC grade. Standard solutions of Acetonitrile, Methanol, Ethanol, Acetic Acid, and Resveratrol were from Merck's brand.

Wine samples were produced from 10 kg of grape (by including hard parts – grape pip, grape, skin, and stalk of grapes in the fermentation process). To produce the wine that will be rich in natural antioxidants, the technology of maceration is dependent on the temperature regimen and duration of the contact between pomace and liquid phase, as exactly these factors have the fundamental role in enriching the wine with phenolic compounds, which are the main determinants of aroma [15].

The maceration process occurred on 13-14 °C, for eight days, boiling is mainly happening on 22-24 °C, and in 75-85 % humidity conditions, the process of mixing juice was taking place 4-5 times a day before boiling started. The boiling process continued for 12 days. The wine was kept on pomace for five days before boiling begun, and then the wine was raked. In these research wines, the Resveratrol levels were measured six months after the production.

The levels of Resveratrol were mainly determined by high-performance liquid chromatography (Model: DCL-20P). Venusil MP-C18 column (250mm×4.6mm, 5.0µm) was used as a stationary phase, mobile phase (Eluent) was represented by water/acetonitrile/acetic acid with the ratio of 70/29,9/0,1; flow rate: 1 ml/min, the volume of every sample is 10 µl; the detection was conducted on 306 nm wavelength, the time of detection – 15 min. Before starting the analysis, wines were stored in a refrigerator at a temperature of 5 °C. During the analysis temperature in the room was 22 °C. Every sample was tested in the chromatograph three times. The accuracy of the analysis is $r^2=0,9978$.

In order to determine the amount of trans-Resveratrol, the calibration curve was created using the standard solution. Methanol was used for preparing the standard solutions. Samples and standard solutions are stored in the dark to avoid the transformation of trans-Resveratrol to cis-Resveratrol. The statistical processing of the data was done with MS Excel 2019.

IV. RESULTS AND DISCUSSION

Studying Resveratrol in the less researched Varieties of Georgian Grapevine showed us that this compound concentration in the wines fluctuates between 2,7 mg/dm³ and 13,8 mg/dm³.

The best index had the Saperavi wine. It turned out that the index of Simonaseuli was very similar to Saperavi, Indexes of Meskhuri Shavi, Gabasha and Sreluri were similar but a little behind than Saperavi and Simonaseuli. These results are shown in Table 1.

Table 1. Concentration of trans - Resveratrol in wines, mg/dm³

Sample	Trans - Resveratrol
Saperavi	13,8
Simonaseuli	13,6
Meskhuri Shavi	13,1
Gabaha	11,2

V. CONCLUSION AND FUTURE SCOPE

Research conducted about Resveratrol concentration in the less studied varieties of red wine showed us that the varieties such as Simonaseuli, Meskhuri Shavi, Gabasha, and Sreluri contain a very similar amount of this compound as very well-known and popular wine variety Saperavi. It means that they have a similar beneficial effect on human health as Saperavi, which gives us a great reason to study the mentioned less popular grapevine varieties in a more detailed manner. It is a pity to disregard the varieties that can satisfy the market requirements, increase Merchandise assortment, and offer a quality wine to the consumer. This article's relevance is clear, as, in the given economic circumstances, a focus is being directed on researching the rare and less known varieties of grapevine and popularizing the wines produced from them.

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