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Biochemistry

Physical and Chemical Characteristics of Wine, Fermented from Georgian Endemic Varieties

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ABSTRACT. In order to conduct the study less known and forgotten varieties of grapevine were chosen, which are spread in Georgia, on the area of Agricultural Research Center in the village Jigaura. These varieties of grapevine are: Simonaseuli, Gabasha, Meskhuri shavi, Sreluri. The Kakhetian technology was used to make wine from the mentioned varieties. For comparison we chose the Saferavi variety of grapevine and the vine obtained from it. Phenolic compounds in the seed and skin of the mentioned variety of grapevine were explored and studied, as the bioactive substances, determining the characteristic color, taste and bouquet of the future wine are extracted from seed and skin of grapes while processing them. Content of heavy metals was studied in experimental samples by means of atomic absorption spectroscopy. Summarizing the experimental results it can be concluded that with their physical and chemical indices, and organoleptic characteristics the wines obtained from less studied Georgian varieties of grapevine Simonaseuli, Meskhuri shavi, Gabasha and Sreluri can compete with the wine of popular and widely spread variety of grapevine Saperavi. Obtained results demonstrate that full extraction of the bioactive substances took place from the peduncles, berry skin and seeds of these varieties, which are responsible for wine color, taste and bouquet. Especially, the wines received from Simonaseuli, Gabasha and Meskhuri shavi distinguished by their intensive red color are worth mentioning. *© 2019 Bull. Georg. Natl. Acad. Sci.*

Key words: gene pool, anthocyanins, polyphenols, AAS

Grapevine variety significantly determines the nature and properties of wine. It is one of the main factors responsible for the raw material yield and quality used in wine industry. In old times selection of vine sorts of grape did not depend on external features, but on the quality of wine. Generally the migration of varieties took place from east towards west [1-3].

The purpose of the present study was determination of physical and chemical characteristics of red wine made from some less known varieties of grapevine, spread in Georgia, and their further comparison with the characteristics of the wine prepared from the traditional sorts of grape.

Red wine industry is the priority in many countries. That is why the demand for it increases every year. Besides the organoleptic

characteristics, red wines reveal significant biological activity [4-6].

Widely spread in Georgia endemic variety of grapevine Saperavi and less studied sorts (widely spread in early period Georgia) Simonaseuli, Sreluri, Meskhuri shavi (Meskhian black) and Gabasha served as test objects. The grape varieties were chosen according to their content of phenolic compounds. Experiments were performed on 15 unresearched varieties of grape and considering the above-mentioned criterion, only top 4 were selected.

Experimental samples were supplied by Jigaura nursery (the scientific-research center of agriculture), which is the owner of the unique gene pool of grapevine, comprising a great number of Georgian indigenous sorts of grapevine, collected throughout different regions of Georgia.

Simonaseuli is among those rare and distinguished 10 varieties of grapevine, which are in the center of attention today. It is Kakhetian sort, producing high quality table wine. Half a century ago it was mostly cultivated in Gurjaani and Sighnaghi regions. The sort reaches full maturity in the second decade of September and accumulates about 18-22% of sugars; acidity varies between 8.8-7.2 g/dm^3. It is not so often damaged by fungi and fairly easily resists drought and frost.

Sreluri is a red variety of grapevine from Kartli region. The sort enters full maturity at the end of September and accumulates about 17.7-18.5% of sugars; acidity is 9.0-6.5 g/dm^3. It is moderately disturbed by diseases and comparatively easily resists drought and frost.

Meskhuri shavi (Meskhian black) red sort of grapevine is a Meskhian by origin . According to the inventory of Sh. Tsikvadze of 1958 the sort was cultivated in the form of alley in Aspindza region. Berries accumulate about 15% of sugars; acidity – 13.0-11.0 g/dm^3. Meskhuri shavi is comparatively late variety.

Gabasha origin: Kakheti/Racha-Lechkhumi. The variety has moderate growth and development and fair productivity. Berries reach full maturity at the end of October and accumulate about 18-21% sugars; acidity is 8.6 – 15.0 g/dm^3. Its resistance to fungal diseases is moderate. The variety may be used for blending, preparation of red dry table wines and brand alcohol [7].

The extent of maturity of the processed grape, with its characteristic ratio of sweetness and titrated acidity, significantly determines the wine quality.

Experimental wine samples were prepared from 10 kg of grapes (solid parts of the cluster – berry seeds, skin and peduncle took part in alcoholic fermentation as well). The initial temperature of must mass was 18ºC, relative humidity – 75-85%. The sweet mass was mixed 4-5 times a day before fermentation has begun. Fermentation prolonged 12 days. The experiment was set in the laboratory of the faculty of agricultural sciences and biosystems engineering of the Georgian Technical University.

Following indices were studied in the prepared wine and solid parts of grapes (peduncle, skin, seeds): density, active, titrated and volatile acidities, sweetness, contents of alcohol, extract, sulfur dioxide, iron and copper [8, 9].

Sweetness of the wine was determined refractometrically. GOST 28562-90; Content of alcohol in % of volume; GOST 13191-73; Concentration of titrated acids was calculated by tartaric acid; GOST 26188-84; Concentration of volatile acids by GOST 13193-73; Concentration of reduced sugars was calculated in g/l, using Bertrand's method; GOST 13192-73; Concentration of the extract was determined by GOST 51654; Concentration of the free and total sulfurous acid by GOST 14351-73; pH – GOST 26188-84; Content of total phenols was determined with Folin – Ciocalteu reagent, spectrophotometrically; AAS (atomic absorption spectrophotometers) was used for determination of iron and copper concentrations in wine. Number of factors are responsible for the composition of polyphenols and phenolic complexes, their amount

and antioxidant properties of wine; in particular, these factors are grapevine variety, vineyard location, climatic conditions, soil type and wine-making technology [10, 11].

Red grape is the abundant source of phenolic substances. Their content in particular parts of the grape plant is different. Solid parts of the grape: berry skin, seeds and peduncles are distinguished with the amount of phenols. These substances do present the main biologically active compounds of grape, wine and juice [12].

According to literary data accumulation of phenols takes place in berry skin, seeds and pulp, while in the process of grape processing the bioactive substances, which are responsible for characteristic color, taste and bouquet of the future wine, and distinguish red wines from other ones, are transmitted to sweet juice [13, 14].

Experimental results are demonstrated in Table 1.

From the obtained results it is clear that variety Simonaseuli has demonstrated almost identical to Saperavi data. Among wines especially the products received from these two varieties should be mentioned, which are distinguished by their intensive red color. This was indication to the full extraction of phenolic substances in juice.

Physical and chemical indices of the experimental samples of wines were determined and they were studied organoleptically as well. Experimental results are demonstrated in Tables 2 and 3.

Table 1. Content of phenols (mg/dm^3) in experimental varieties

Sample variety	Total anthocyanins content	Polyphenols content in skin	Polyphenols content in seeds	Total polyphenols content
Saperavi	1724.67	2909.13	81.17	2990.30
Simonaseuli	1698.79	2891.94	79.97	2971.91
Meskhuri shavi	1488.51	1627.42	23.73	1651.15
Gabasha	1474.03	1610.79	23.27	1634.06
Sreluri	1268.92	1308.44	20.05	1328.49

Table 2. Physical and chemical indices of experimental wines

Sample variety	Titrable (tartaric) acidity (g/L)	Volatile(acetic) acidity (g/L)	pH	Total phenolics (g/L)	Total extract (g/L)
Saperavi	6.15	0.3	3.73	1.7231	29.0000
Simonaseuli	7.95	0.396	3.74	1.9389	28.5000
Meskhuri shavi	6.48	0.363	3.63	1.1691	27.8382
Gabasha	5.025	0.3	3.78	1.3610	26.2723
Sreluri	5.175	0.486	3.83	1.4862	24.2858

From Tables it is clear that among the experimental varieties Simonaseuli and Sreluri have high content of phenols, while by the content of soluble sugars the leading wines are Gabasha and Sreluri. The total extractability is high in Simonaseuli, Meskhuri shavi and Gabasha. By the content of phenols, Simonaseuli and Sreluri stay on the second place after Saperavi. This indicates that during the technological process phenolic substances (among them the coloring agents) were fully transferred in wine.

Thus, wines of the tested varieties of grapevine, which are not as widely spread and as popular as Saperavi reveal high physical and

chemical, as well as sensorial (organoleptic) characteristics and may compete with the popular red-grape varieties.

Table 3. Content of heavy metals in experimental varieties of grapevine

Sample variety	Iron contentration (mg/L)	Copper contentration (mg/L)
Saperavi	1.1086	<0.01
Simonaseuli	1.1045	<0.01
Meskhuri shavi	1.1155	<0.01
Gabasha	1.0938	<0.01
Sreluri	1.1435	<0.01

In order to determine the quality of wine, the quantity of inorganic compounds, including heavy metals should be detected and measured [15].

Content of heavy metals was studied in experimental samples by means of atomic absorption spectroscopy. Only traces of copper and lead were detected in tested variants, while increased amount of iron was found in Sreluri and Meskhuri shavi.

Summarizing the experimental results it may be concluded that wines obtained from less studied Georgian varieties of grapevine: Simonaseuli, Meskhuri shavi, Gabasha and Sreluri by their physical and chemical indices, as well as by organoleptic characteristics can compete with the wine of popular and widely spread variety of grapevine Saperavi. Obtained results demonstrate that full extraction of the bioactive substances took place from peduncles, berry skin and seeds of these varieties, which are responsible for wine color, taste and bouquet. Especially, the wines received from Simonaseuli, Gabasha and Meskhuri shavi, are distinguished by their intensive red color.

Conclusion

Our experimental results have revealed that wines obtained from less studied Georgian varieties of grapevine: Simonaseuli, Meskhuri shavi, Gabasha and Sreluri by their physical and chemical indices, and organoleptic characteristics can compete with the wine of popular and widely spread variety of grapevine Saperavi. Obtained results demonstrate that full extraction of the bioactive substances took place from peduncles, berry skin and seeds of these varieties, which are responsible for wine color, taste and bouquet. Especially, the wines made from Simonaseuli, Gabasha and Meskhuri shavi, which are distinguished by their intensive red color.

ბიოქიმია

ზოგიერთი ქართული ენდემური ჯიშებიდან მიღებული ღვინის ფიზიკურ-ქიმიური მაჩვენებლების განსაზღვრა

ლ. გურგენიძე*, თ. ყანჩაველი*, ვ. უგრეხელიძე*, ნ. მამარდაშვილი*, გ. ქვარცხავა*

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ექსპერიმენტული სამუშაოს შესრულების მიზნით, შერჩეულ იქნა სოფლის მეურნეობის სამეცნიერო კვლევითი ცენტრის ბაზაზე არსებული მცხეთის მუნიციპალიტეტის სოფელ ჯიღაურას ვაზის საკოლექციო ბაზაზე გაშენებული დღეისათვის მივიწყებული აბორიგენული ვაზის წითელყურძნიანი ჯიშები – სიმონასეული, გაბაშა, მესხური შავი, სრელური. აღნიშნული ჯიშებისგან კახური ტექნოლოგიით დამზადდა ღვინოები. შესადარებლად აღებული გვქონდა ვაზის ჯიში საფერავი და მისგან დამზადებული ღვინო. გამოკვლეულ და შესწავლილ იქნა აღნიშნული ჯიშის ყურძნის კანსა და წიპწაში საერთო ფენოლური ნაერთები, რადგანაც ყურძნის გადამუშავებისას მარცვლის კანიდან და წიპწიდან ხდება იმ ბიოლოგიურად აქტიური ნივთიერების გადასვლა, რომლებიც განსაზღვრავს მომავალი ღვინის დამახასიათებელ ფერს, გემოსა და ბუკეტს. საკვლევი ნიმუშები გამოვიკვლიეთ აგრეთვე მძიმე მეტალების შემცველობაზე, რომელსაც ვსაზღვრავდით ატომურ-აბსორბციული სპექტროფოტომეტრული მეთოდით. დღეისათვის მივიწყებული ყურძნის ისეთი ჯიშები, როგორიცაა სიმონასეული, მესხური შავი, გაბაშა და სრელურიდან დამზადებული ღვინოები თავისი ფიზიკურ-ქიმიური და ორგანოლეპტიკური მაჩვენებლებით არ ჩამოუვარდება დღეისათვის ფართოდ გავრცელებულ ყურძნის ჯიშს – საფერავისაგან დამზადებულ ღვინოს. ღვინოებიდან განსაკუთრებით აღსანიშნავია სიმონასეული, გაბაშა, მესხური შავი ჯიშის ყურძნის ღვინოები, რომლებიც გამოირჩეოდა ინტენსიური წითელი შეფერვით. აქედან გამომდინარე, შესწავლილი ვაზის ჯიშები შეიძლება გამოყენებულ იქნეს წითელი მაღალხარისხიანი ღვინის წარმოებისათვის.

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