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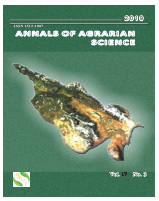

Georgian Autochthonous red grape and wine Antioxidant activity

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A B S T R A C T

Phenolic compounds, anthocyanins and their antioxidant activity of 7 autochthonous grape varieties of Western Georgia and wines produced from them (Aladasturi, Mujuretuli, Chkhaveri, Kabistoni Shavi, Mtevanddi, Mtredispekh and Ojaleshi) were studied. The largest amount of phenolic compounds in the studied grape varieties was found in Ojaleshi , Kabistoni Shavi, Mujuretuli, Otskhanuri Sapere ((5691.75 - 4091.05 mg / kg). kg), relatively less - in Usakhelauri , Kachichi, Aladasturi and significantly less in Chkhaveri, Mtredispekha, Mtevandidi (1340.1 - 3535.25 mg / kg). The content of anthocyanins in each variety has similar patterns: Otskhanuri Sapere (631.16 mg / kg) and Ojaleshi (576.29 mg / kg) are also dominant here; The total content of phenolic compounds in wine varies in different ways: Otskhanuri Sapere (3674.0 mg / kg), Kabistoni Shavi (3619.0 mg / kg), Ojaleshi (3566.32 mg / kg) have the highest content in this respect. During the production of wine, a certain amount of anthocyanins is transferred into it. Their transition from grape to wine is somewhat correlated. The largest amount of anthocyanins is observed in wines made from such varieties as Ojaleshi (485.0 mg / kg), Otskhanuri Sapere (400.9 mg / kg), Usakhelauri (397.1 mg / kg), Kachichi (390.8 mg / kg). There is a direct correlation between the content of phenolic compounds in grapes and its wines and their antioxidant activity. Ojaleshi grapes and wine have the highest antioxidant activity among these varieties.*Keywords:* Autochthonous Grape, Wine, Phenolic compounds, Anthocyanin, Antioxidant activity, Red Grape.

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Introduction

Grapes and natural wine, made from it, are a source of antioxidants [1]. The main representatives of antioxidants are polyphenols. Grapes are one of the fruits with a high content of phenolic compounds. Some of them, naturally, get into wine, prepared from these grapes [2]. Phenolic compounds are also found in grape skin, pulp and seeds [3]. The content of polyphenols in grapes and wine, made from it, is associated with color, aroma, taste and antioxidant activity, which is considered a good means of preventing ischemic diseases and arteriosclerosis [4]. The content of polyphenols in grapes and, accordingly, in wine depends on the type [2] and variety [3] of grape, as well as on the rules for the production and storage of wine [5]. Autochthonous varieties of grapes and, correspondingly, wine are of great interest [6, 7]. Polyphenols are one of the most common compounds found in fruits, vegetables and herbs. They are divided into several groups, although they are all biologically active and have antioxidant activity [8, 9]. In recent years, most attention has been paid to the antioxidant activity of grapes and wine, produced from it [10,11]. Obviously, they are involved in the prevention of many diseases caused by stress [12-14], and they also have anti-cold, anti-viral, anti-mutagenic and other actions [15]. The high content of phenolic compounds in red wine is associated with the peculiarity of production, when during fermentation the skin and grape seeds contact with each other for a long time in grape juice, and then they are extracted with alcohol [16].

According to some recommendations [17], moderate consumption of wine (150 ml per day for women and 300 ml for men) has a positive effect on human health. The positive effect is associated with the antioxidant activity of polyphenolic compounds

in wine [18]. Usually, the red wine contains more of them than the white one. Drinking wine reduces the risk of developing vascular disease [19, 20]. Many components of wine have antioxidant activity, so it is difficult to determine the activity of any one component taken separately. There are often deep internal connections between them [21]. Currently, antioxidant parameters for wines produced in Georgia are not defined (with a few exceptions, for example, our article on white wine [22], so commercial wines cannot use this important component for advertising.

1. The purpose of this study

Currently antioxidant parameters for wines produced in Georgia are not defined (with a few exceptions, for example, our article on white wine, so commercial wines cannot use this important component for advertising.

1.1 Samples

The object of the research was the widespread and popular autochthonous red and black grape of various varieties (Kabistoni Shavi, Otskhanuri Sapere, Aladasturi, Kachichi, Mujuretuli, Ojaleshi, Chkhaveri, Mtredispekha, Mtevandidi) and wine samples, prepared from them, grown in different regions. The grapes were harvested during the period of technical ripeness (period of mass harvest). The wine was prepared in the laboratory of the Batumi Shota Rustaveli State University using Kakhetian technologies. The grape mass was boiling on the "chacha" until the completion of wine fermentation.

2. Methods

A Mettler Toledo UV-5 model UV–VIS spectrophotometer was used for Determination of phenolic compounds, anthocyanins and Antioxidant activity.

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3.1 Research methods

3.1.1 Total phenolics assay

The Folin–Ciocalteu method was used for the determination of the total phenolics. In brief, an aliquot (1 mL) of the appropriate diluted extracts was added to a 25 mL volumetric flask, containing 5 mL of distilled water. Then, 1.0 mL of Folin-Ciocalteu reagent was added and the contents mixed. After 3 min, 10 mL Na2CO3 solution of concentration 7% was added and made up to a total volume of 25 mL distilled water. Their absorbances were read at 765 nm against distilled water as the blank. A calibration curve was constructed using gallic acid standard solutions (0–100 mg/L). The concentration of total phenolics is expressed as the gallic acid equivalent (GAE) per 1 g of fresh sample. All samples were prepared in triplicate [23].

3.1.2 The total monomeric anthocyanin

The total monomeric anthocyanin content of the red wine was determined using the pH-differential method. The red grape extract and wine was dissolved in buffers of KCl (0.025 M, ph 1.0) and CH3COONa (0.4 M, pH 4.5) with a predetermined dilution factor. Absorbance (A) was measured using UV-Vis spectrophotometer at 520 and 700 nm, and the results were calculated as follows: The monomeric anthocyanin (MA) pigment concentration was calculated as: where represents the molar mass of malvidin-3-glucoside (493.5 g/mol), is the dilution factor, is molar extinction coefficient (28,000 L/mol cm), and is the cuvette optical path length (10 mm). The final anthocyanin concentration is expressed as milligram per 1000 mL or kg of red grape and wine of malvidin-3-glucoside. All analyses were done in triplicate [24, 25].

3.1.3 Antioxidant activity

Antioxidant activity (assay with DPPH) [25], The DPPH assay was done by using 1 mL of red grape extract and wine solution that was mixed with 1,5 mL of DPPH solution in methanol (0,02 mg mL-1), The mixture was homogenized for 30 min at room temperature and then the absorbance was determined at 517 nm. Antioxidant activity DPPH - 50% inhibition mg of samples was calculated using the following formula 1 and 2:

AA % inhibition = [A(DPPH) – A(sample)*100]/A(DPPH) (1),

Where A (DPPH) - Absorbance of 0.01 mM DPPH at 517 nm

A(sample) - Absorbance of sample at 517 nm
AA of mg sample = m*50*1000/V*AA% (2),
Where m – weight of sample,
V – volume of sample,
50 - % of inhibition,
1000 – unit conversion from gram to mg

4. Results

The largest amount of phenolic compounds in the studied grape varieties was found in Ojaleshi (5691.75 mg / kg), Kabistoni Shavi (4756.36 mg / kg), Mujuretuli (4350.65 mg / kg), Otskhanuri Sapere (4091.05 mg / kg). kg), relatively less - in Usakhelauri (3535.25 mg / kg), Kachichi (3456.52 mg / kg), Aladasturi (3269.27 mg / kg) and significantly less in Chkhaveri (2250.23 mg / kg), Mtredispekha (1411.9 mg / kg), Mtevandidi (1340.1 mg / kg). The content of anthocyanins in each variety has similar patterns: Otskhanuri Sapere (631.16 mg / kg) and Ojaleshi (576.29 mg / kg) are also dominant here; the amount of anthocyanins is comparatively less in Usakhelauri (481.96) and Kabistoni Shavi (480.79 mg / kg), a bit less, almost 2 times, - in Chkhaveri (399.5 mg / kg), Aladasturi (392.83 mg / kg) and Mujuretuli (391.69 mg / kg), and much less - in Mtevanddi (230.15 mg / kg) and Mtredispekha (191, 21 mg / kg).

The autochthonous grape varieties have been processing with natural yeast (to preserve varietal characteristics), until the chacha was completely settled (about 20 days). The analysis of wines was carried out on wines of one year old aging. The total content of phenolic compounds in wine varies in different ways: Otskhanuri Sapere (3674.0 mg / kg), Kabistoni Shavi (3619.0 mg / kg), Ojaleshi (3566.32 mg / kg) have the highest content in this respect. The transition of phenolic compounds in these wines is almost 60% of the original. Although the proportion of transitions is about the same, they are relatively less in Kachichi (3012.0 mg / kg), Mujuretuli (2914.48 mg / kg), Aladasturi (2613.60 mg / kg), Usakhelauri (2374.36 mg / kg). Chkhaveri (1899.7 mg / kg), Mtredispekha (1121.04 mg / kg) and Mtevandidi (1032.53 mg / kg) have significantly less phenolic compounds.

During the production of wine, a certain amount of anthocyanins is transferred into it (most of the anthocyanins in grapes are soluble in alcohol). Their transition from grape to wine is somewhat correlated. The largest amount of anthocyanins is observed in wines made from such varieties as Ojaleshi (485.0 mg / kg), Otskhanuri Sapere (400.9 mg / kg), Usakhelauri (397.1 mg / kg), Kachichi (390.8 mg / kg). Accordingly, the content of anthocyanins in wines, produced from other varieties, is relatively lower: Aladasturi (368.45 mg / kg), Mujuretuli (344.8 mg / kg), Chkhaveri (335.3 mg / kg), Kabistoni Shavi (315,7 mg / kg). It is almost 3 times less in Mtevandidi (161.4 mg / kg) and Mtredispekha (141.8 mg / kg) than in Ojaleshi, although more than 60% of anthocyanins are transferred from these grapes to wine.

There is a direct correlation between the content of phenolic compounds in grapes and wines, prepared from it, and their antioxidant activity. Ojaleshi grapes have the highest rate among varieties (3.17 mg of a sample can inhibit 50% 0.01 mM DPPH, i.e. the lower this characteristic is, the more active the product is). The same picture is observed among varieties and in wines as well. Wine, prepared from Ojaleshi variety, compared to grapes, has lower characteristics, however, compared to other wines, it has higher characteristics (8.7 mg). Kabistoni Shavi (4.1 mg), Otskhanuri Sapere (4.1 mg), Mujuretuli (4.18 mg / kg), as well as Kachichi (4.7 mg) and, therefore, the wines produced from them: Kabistoni Shavi (10.2 mg), Usakhelauri (11.93 mg), Kachichi (13.4 mg), Otskhanuri Sapere (13.47 mg) and Mujuretuli (17.1 mg) have high antioxidant activity. The rest of the wines (Chkhaveri (20.3 mg), Aladasturi (20.81 mg), Mtevandidi (25.74 mg) and Mtredispekha (37.26 mg) and, therefore, their raw materials have less AA (Chkhaveri (8.2 mg), Aladasturi (10.39 mg)), Mtevandidi (14.56 mg) and Mtredispekha (21.85 mg).

Samples	Grape			Wine		
	Total phenols mg/kg	Anthocyanins mg/Kg	Antioxidant activity DPPH - 50% inhibition mg of samples	Total phenols mg/l	Anthocyanins mg/l	Antioxidant activity DPPH - 50% inhibition mg of samples
Kabistoni Shavi Imereti, Municipality of Tsageri, Village Okhureshi	4756,36	480,79	4,1	3619,0	315,7	10,20
Otskhanuri Sapere Imereti, Municipality of Terjola, Village Zorvethi	4091,05	631,16	4,1	3674,0	400,9	13,47
Aladasturi - Imereti, Municipality of Bagdadi, Village Phersathi	3269,27	392.83	10,39	2613.60	368.45	20.81
Kachichi - Adjara, Municipality of Qeda, Village Kharaula	3456,52	441,08	4,7	3012,0	390,8	13.4
Mujuretuli - Racha, Ambrolauri municipality, Village Tola	4350,65	391,69	4,18	2914.48	344.8	17.10
Usaxelauri - Racha, Ambrolauri municipality, Village Tola	3535,25	481,96	4,12	2374.36	397.1	11.93
Chkhaveri - Guria, Municilality of Chokhatauri, Village Erkethi	2250,23	399,5	8,2	1899.7	335.3	20.3
Mtredispekha - Guria, Municilality of Chokhatauri, Village Erkethi	1411,9	191,21	21,85	1032.53	141.8	37.26
Mtevandidi - Guria, Municilality of Chokhatauri, Village Erkethi	1340,1	230,15	14,56	1121.04	161.4	25.74
Ojaleshi - Samegrelo, Municilality of Martvili, Village Salkhino	5691,75	576,29	3,17	3566.32	485.0	8.7

***Table 1**. Grape and Wine Phenolic Compounds, Anthocyanin and AA.*

4. Conclusion

Phenolic compounds, anthocyanins and their antioxidant activity of 7 autochthonous grape varieties of Western Georgia and wines produced from them (Aladasturi, Mujuretuli, Chkhaveri, Kabistoni Shavi, Mtevanddi, Mtredispekh and Ojaleshi) were studied. There is a direct correlation between the content of phenolic compounds in grapes and its wines and their antioxidant activity. Ojaleshi grapes and wine have the highest antioxidant activity among these varieties.

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