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THE EFFECT OF GRAPE VARIETAL CHARACTER, APPELLATION, VINIFICATION TECHNIQUES ON RESVERATROL, MYRICETIN AND QUERCETIN CONTENT OF WINE

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Introduction. Wines contain a complex of phenolic components responsible for the overall color and flavor. Resveratrol is one of the phenolic compounds implicated in the health benefits associated with wine consumption. Moderate wine consumption has been shown to lower coronary artery disease, positively affect lipid levels in humans, and have cancer chemo preventive activity [1;2]. Since Siemann and Creasy identified resveratrol as a wine component in 1992, researchers have investigated many aspects of the winemaking process. However, winemaking is complex, many aspects in the process remain unexplored.

Resveratrol concentrations are high in red wines, while white wines contain less, because resveratrol is found in the skin of grapes and red wine is fermented on the skins [3]. The variety of grape plays an important role in resveratrol synthesis, which may be genetically controlled [4].

A number of epidemiological studies demonstrate the protective role of dietary flavonoids against cardiovascular and cancer diseases. The beneficial role of flavonoids for human health gave reason for assessment of their composition in food and beverages. Red wines are a very rich source of flavonoids. Flavonoid composition of red wines includes anthocyanins, catechins, and flavonols. The primary flavonols present are myricetin, quercetin, and kaempferol [5]. Quercetin is a naturally occurring phenol in grape skins and stems that developed to protect grapes from ultraviolet light damage. The more grapes are exposed to sunlight, the more quercetin they contain. Quercetin reacts with anthocyanins to make a deeper and more vibrant color. This process makes the color of the wine more stable though aging. There is a multitude of health benefits from quercetin, it has an anti-histamine and an anti-oxidant properties [6].

Two studies were designed to determine the effect of variety, enzyme addition, skin contact time and usage of oak chips on the resveratrol, myricetin, quercetin level of Georgian wines.

Methods of Analyses

Laboratory analyses were conducted in LTD „Wine Laboratory"

Total phenols: Folin-Ciocalteu Index; MA-E-AS2-10 "Varian" - Cary 50.

Chromatography equipment and procedure: Resveratrol, myricetin, quercetin levels were determined with HPLC instrumentation ("knauer"). Column. - LiChrospher (5µm), 250x4. RP-18; Elution order – isocratic; Oven temperature - 30°C. Flow rate - 0.8 ml/min; Detection mode – UV; Detection wave length – 280 nm and 360 nm; Analysis time - 25 minutes. A commercial standards of were purchased from Sigma Chemical.

Study 1. Grapes and wine. Georgian autochthonous grape varieties: „Aladasturi", „Ojaleshi", „Chkhaveri", „Otskhanuri Saphere" harvested in western part of Georgia (harvest date-2015) were used for this study. The wine was fermented in „Qvevri". The trial samples were prepared by „Kakhetian" technology - the whole grape clusters were crushed. The grapes were divided in two equal portion: one batch-fermented with pomac, until dryness (0° Brix) and pressed, the other batch, after reaching 0° Brix, was held during 15 weeks on the solid parts of grape. The must was pressed and the wine material was collected into carboys. The SO_2 addition, 30 mg/l, was carried out only the after completion of malo-lactic fermentation.

The results and discussion. Laboratory analysis were performed after 5; 10 and 15 weeks from the completion of the fermentation, the resulted are listed as follows:

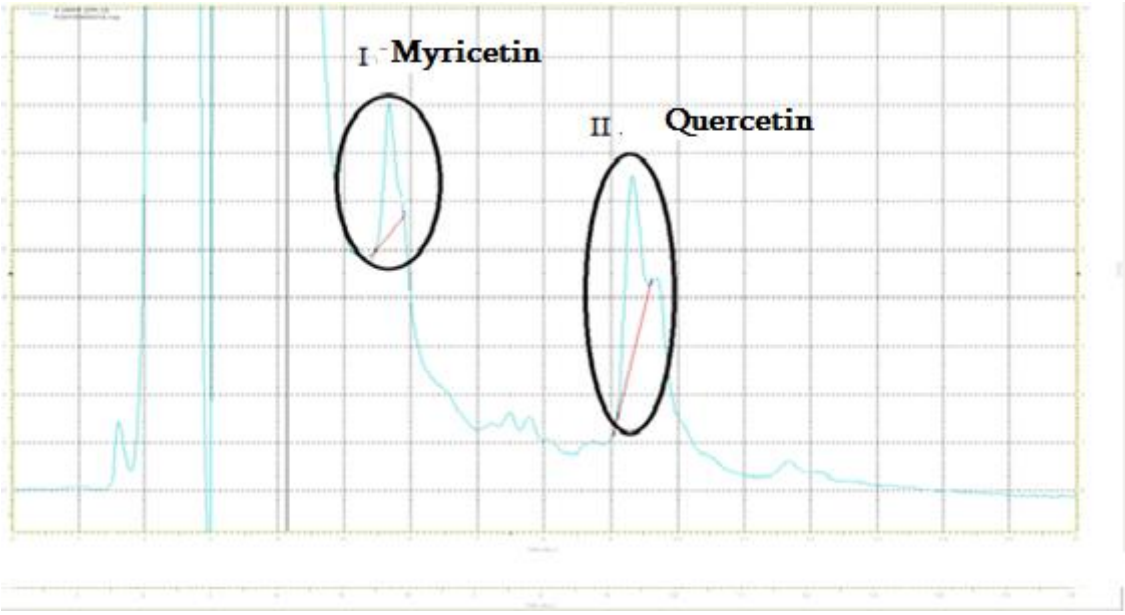
The amount of total phenols, resveratrol, myricetin and quercetin in trial samples.

Table 1.

Grape variety	Time Length of post fermentation Maceration	The steps of Laboratory research	Cis-Resveratrol Mg/l	Trans-Resveratrol Mg/l	Myricetin Mg/l	Quercetin Mg/l	Total Phenols Mg/l
,,Aladasturi “	PFM was not conducted	I	n.d.	n.d.	n.d.	n.d.	1134
		II	n.d.	n.d.	n.d.	n.d.	875
		III	n.d.	n.d.	n.d.	n.d.	728
	5 weeks	I	170	n.d.	n.d.	n.d.	1175
	10 weeks	II	n.d.	200	n.d.	n.d.	1075
	15 weeks	III	n.d.	n.d.	n.d.	n.d.	764
,,Chkhaveri”	5 weeks	I	n.d.	n.d.	n.d.	n.d.	1087
	10 weeks	II	20	20	n.d.	n.d.	935
,,Ojaleshi”	PFM was not conducted	I	1700	1000	650	342	1820
		II	230	450	300	80	1092
		III	230	450	300	80	1092
	5 weeks	I	1700	1020	1120	650	2082
	10 weeks	II	350	900	360	350	2015
	15 weeks	III	300	650	310	140	2008
,,Otskhanuri Saphere”	PFM was not conducted	I	320	90	750	1350	1786
		II	0.090	0.070	0.740	0.600	1695
		III	50	45	170	280	1500
	5 weeks	I	920	280	1400	1400	2008
	10 weeks	II	0.050	0.120	0.360	0.300	2000
	15 weeks	III	780	80	530	380	1870

The results have shown that the wines made from grape varieties ,,Otskhanuri Saphere” and ,,Ojalashi” are rich with antioxidant compounds. Besides, obtained data confirmed, that post fermentation maceration technique enhances the extraction of phenolics. The production of health benefit wine might be achieved by the proper selection of grape sort and ten weeks length post-fermentation maceration. On the pictures 1;2 are shown chromatograms of ,,Otskhanuri Saphere”.

Picture 1.-Chromatogram, Myricetin and Quercetin Content in „Otskhanuri Saphere" Wine.



Picture 2.-Chromatogram, Myricetin and Quercetin Content in „Ojaleshi" Wine.

Study 2.

The grape and wine. Grape sort „Saperavi" harvested (2016) in viticulture zone of „Mukazani" (eastern region of Georgia-„Kakheti") was used for this study. Thus, appellation of controlled origin (AOC) wines were prepared for this research. The usage of oak barrels or its alternative materials: chips, staves, oak wood extract is common practice for „Mukuzani" wine production. The research aimed to study the impact of pre-fermentation maceration (with addition of pectolytic enzymes) and participation of oak chips during primary and malolactic fermentation on resveratrol, quercetin, myricetin levels in AOC wine-„Mukuzani".

Materials: The medium roasted oak chips (dosage 4g/l) and pectolytic enzyme preparation „Extrazyme", produced by Institutute Oenologique de Champagne.

AOC product „Mukuzani" was produced by two different wine making techniques:

Preparation of trial wine. Grapes were processed, destemmed, crushed and SO_2 solution (30 mg/l) was supplemented. The pectolytic enzyme preparation was added at a rate of 4 g/hl of must and held for at 12°C. After 12 hours, the temperature of must was increased up to 23 °C and yeast was inoculated. The Oak chips bag was placed in the tank and fermentation was conducted at 25 °C. After completion of

primary fermentation, the must was pressed. According to regulations in force, only the blend of free run and first fraction was used for „Mukuzani" wine making. The chips bag was transferred in the vessels, where wine was placed for malolactic fermentation and subsequent aging, 3 month.

Preparation on control wine. Grapes were processed, destemmed, crushed, SO_2 solution (30 mg/l) was supplemented and yeast culture was inoculated. Primary fermentation was conducted at 25 °C. After completion of primary fermentation, the must was pressed and according to established rules only the blend of free run and first fraction was used. The first Racking was conducted after of malolactic fermentation (6 weeks), the second racking and SO2 addition (30 mg/l) were carried after 3 month of aging.

Results and Discussion. The wines in this study were produced to determine how common winemaking procedures affect the resveratrol, myricetin and quercetin levels of finished wine. Enzyme addition was used to break down the pectin in the cell wall of grape clusters, to promote juice release from the flesh and to extract phenolic compounds from the skin. The used technology methods have significantly increased total phenols level in „Mukuzani" wine.

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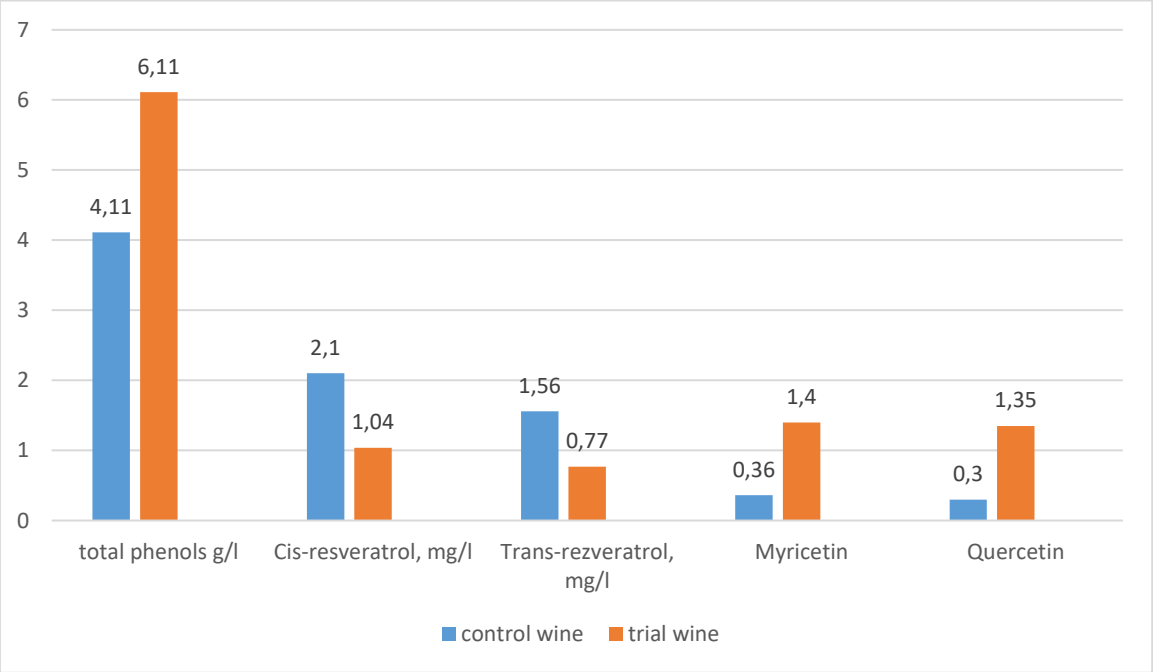
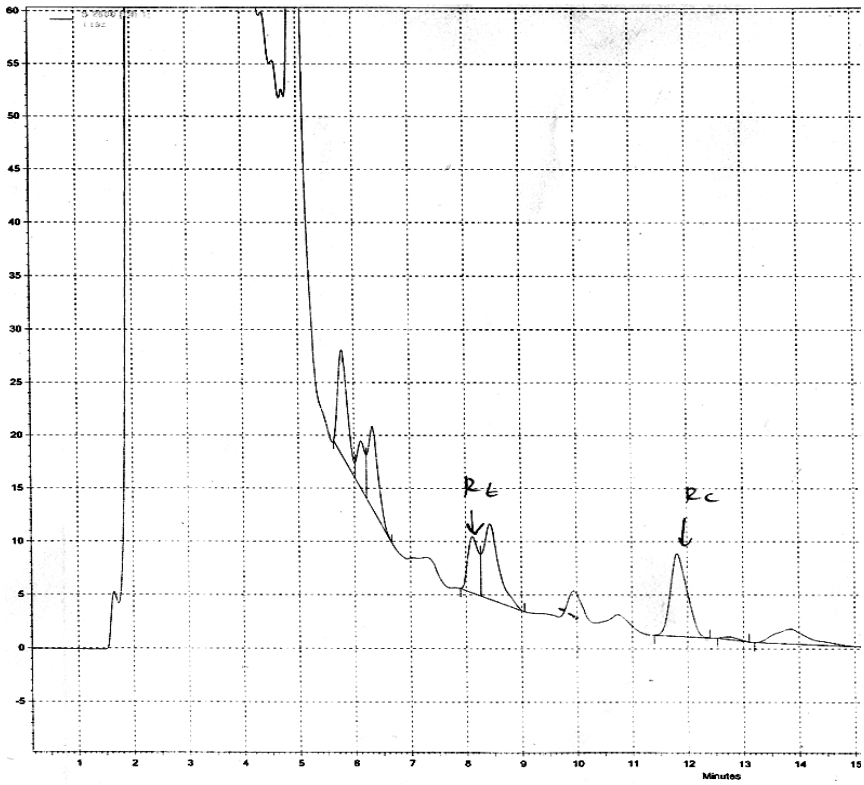
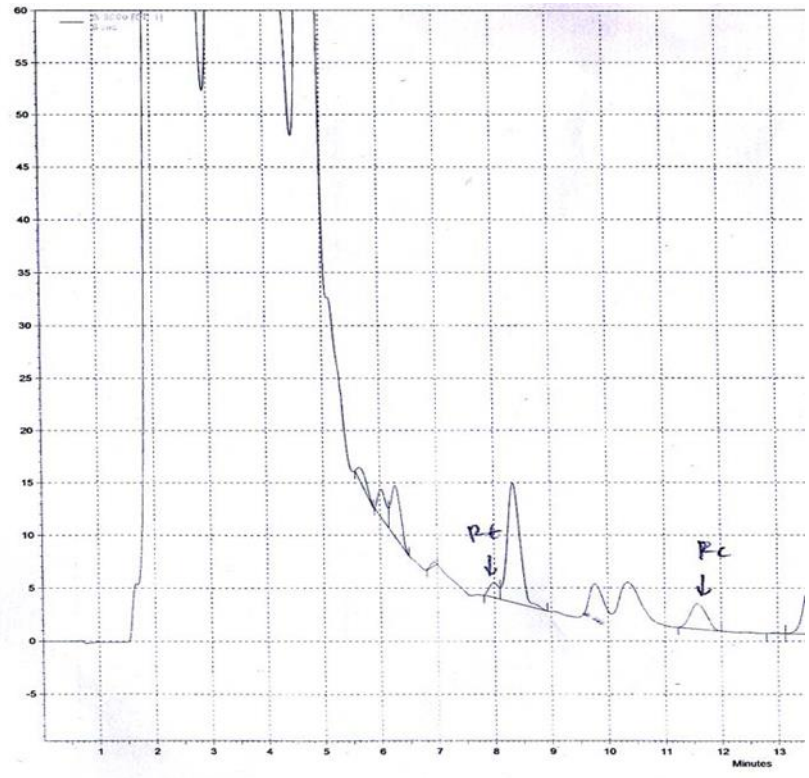


Fig. 1. Content of phenolic compounds in „Mukuzani" wine

Compare to control sample, trial sample contents 48,6 % more total phenols, 49 % more cis and trans resveratrol, 3,8 times more myrecetin and 4,5 times more quercetin. On picture 3;4 4 are shown chromatograms of „Mukuzani" wine.



Picture 3. Resveratrol content in „Mukuzani”- trial sample.



Picture 4. Resveratrol content in „Mukuzani”- control sample.

Conclusions

The obtained results confirmed that grape variety, the year of production, terroir, technology methods, oenological products influence the resveratrol, myricetin and qurcetin level of the
Wine. The management of skin contact time and usage of oak chips are effective methods for production of the wine, with rich content of health benefit compounds.

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