The Multielement Composition Tracing of Georgian Wines from Grapes of Different Wine Microzones

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Since early ancient times fermented grape juice has been a major component in the human diet. Beside biologically active substances (e.g. ethanol, organic acids, phenolic compounds, sugars, perfumed substances, carbon dioxide, polysaccharides, proteins) playing an important role in formation of wine organoleptic features, taste and bouquet, wine is also rich with vitamins and minerals. The daily consumption of wines in moderate quantities significantly contributes to the requirements of the human organism for essential elements (Na, K, Ca, Co, Cr, Cu, Fe, K, Mg, Zn etc.) that define its dietary, nutritional and health qualities.

All around the world certain regions are known for their high-quality wines, making them famous for its wines. The started around 8000 years ago story of winemaking in Georgia is preserved till nowadays as the diverse natural conditions in country create the best environment for the development of high quality winemaking. As wine quality is associated with regional typicality, the challenge is how to measure this typicality. The wine provenance and authenticity can be recognized by typical minerals and trace elements using modern analytical methods. The latest studies have shown that the measurement of the wine elemental fingerprint, i.e., the elemental composition provides important information about the characteristics and quality of the wine and can be used for the grapes and wine traceability.

As the territory of the Georgia is divided into zones, subzones and microzones differed by grape varieties, wines and used winemaking technology as well, the challenge is to study wines microzonal typicality in terms of grape varieties and winemaking technology. Such comparison will give possibility to obtain chemical content-based classification rates for the concentration in trace elements for the wines from different microzones and represents first attempt for traceability of Georgian wine products.

The aim of the present study is to assess and compare the multielemental composition of wines of different grape varieties (Rkatsiteli and Saperavi) made by either traditional or European technology in the different microzones of Georgia (in particular, Mukuzani, Kvareli and Nafareuli) in order to determine the contribution of different factors (microzone - technology of winemaking - variety) to the wine multielemental patterns.

13 elements (Cu, Zn, K, Ca, Na, Mg, Mn, Fe, Cl, Cd, Al, Pb, As) composition was measured by the inductively coupled plasma - optical emission spectrometry (ICP-OES) in the wine samples from Mukuzani, Kvareli and Nafareuli microzones. The statistical significance of differences and factors' interactions were assessed by SPSS Two-Way ANOVA.

The performed analyses revealed that the wines from Mukuzani micro-zone are the richest regarding their elemental composition. It has been shown that the wine-making technology affects the multielemental composition of wine. Moreover, there is the cumulative effect of both the microzone and wine-making technology, which provides the highest elemental composition in Mukuzani wine made by traditional technology. The difference in grape varieties does not affect the multielemental content of wine. While the microzone defines the presence of the most of the elements in wine, there are exceptions, namely microelements Al, Pb and As, which are equally distributed in all the microzones.

The obtained results generate the new perspectives for the further study of Georgian wines elemental fingerprints and regional traceability in line with soil composition and other microclimate factors.