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Physical and chemical properties of Madžun (grape molasses) produced from Vranec grape variety by traditional and industrial techniques

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INTRODUCTION

Grape molasses is one of the popular and traditional food in North Macedonia for the last 10 years. It is produced in the traditional way and is represented on the market as Grape honey and popularly Madžun. According to legends, the name Madžun comes from the Turkish word meaning boiled fruit with a certain density. Grape production which occupies the most important place in every period of Macedonian history, grape molasses which is made with grapes, and many other products are required to be made in conformity with the standards and quality. In North Macedonia, Madžun is produced mainly from the Vranec red wine variety, but also from the table varieties Cardinal, Muscat hamburg, Afuz Ali (Dattier de Beyrouth), etc. Grape molasses (Madžun) is produced traditional and industrial technique of different flavor, structure and appearance in North Macedonia. Grape molasses are a good energy and carbohydrate source due to its high sugar content (up to 50%-80%) in the form of glucose and fructose; therefore, it easily passes into the blood without digestion (Karababa, E., Develi Isikli, N., 2005). The average energy value of grape molasses is 293 kcal 100 g-1 (Yoğurtçu, H., Kamişli, F., 2006). Phenolic compounds in grape molasses (Madžun) are affected by many factors, such as properties of the varieties, cultivation conditions, the location of the production area and the degree of ripeness of the grape (Kelebek H., at all., 2012). Titratable acidity is inversely proportional to pH. Acidity may vary depending on the grape variety and producing regions. According to grape pekmez notification (TMFAL 2007 and 2016), is classified as sweet pekmez if their pH range is from 5 to 6, and they are classified as sour pekmez when their pH range is from 3.5 to 5. Grape molasses are very rich minerals. Some minerals (such as calcium, iron, potassium, and magnesium) found in molasses contain enough to cover a significant portion of a person's daily needs. Molasses contains (+2) valuable iron minerals that can easily be absorbed in the human digestive system (Batu, A., 2006).

MATERIALS AND METHODS

Supply of grape molasses (Madžun) samples

In this study, a total of five grape molasses (Madžun) samples were used for analysis, one of which is produced by industrial methods (vacuum technology) and four of which were produced by traditional methods. All samples are produced from the Vranec grape variety. Vranec is a dominant wine grape variety in the assortment structure in North Macedonia. The traditional grape molasses (Madžun) samples (V2, V3, V4, V5) were taken from a local producer in Tikvesh wine region. The industrial grape molasses sample (V1) is purchased from a local supermarket. All the samples used in the study were produced in the 2022 year. The samples were packed in glass jars.

Methods

The total sugar content of grape molasses samples was determined according to official method 929.09 (AOAC 2005).

Identification and quantification of sugars separated: glucose, fructose, sucrose and maltose in molasses samples were determined using High Performance Liquid Chromatography (HPLC), version 1, SOP 728 (Harmonized Methods of the International Honey Commission, 2009).

The soluble dry matter content of the grape molasses (Madžun) samples was determined according to official method SOP 345 (Institute for Standardization of the Republic of Macedonia, 2010).

The content of total phenols (TFC) was determined using the Folin-Ciocalteu method (spectrophotometer Paro 300 Merck Germany). The TFC was expressed as mg equivalents of GA per g of dry matter (mg GAE/g).

Titratable acidity was estimated in titration with 0.1 N NaOH to the titration point of pH 8.3, monitored with a pH meter and expressed as tartaric acids content (g/L), and the pH was determined using a pH meter (Mettler Toledo Seven Compact pH/ion S220, Switzerland) with bromothymol blue indicator.

The HMF (hydroxymethyl furfural) was determined according to the official method 890.23 (AOAC 2005), based on the colorimetric reaction between barbituric acid, p toluidine and HMF, which forms a red-colored complex. The intensity of the red color was measured at 550 nm using a UV-Vis-NIR-5000 spectrophotometer.

Sensory analysis of the samples was carried out by a committee consisting of 7 members. All members are women with experience in sensory evaluation of plant-based foods. There were 5 preparations for each member (V1,V2,V3,V4,V5), and each was packed in 100 g glass jars. The following sensory characteristics and maximum number of points were evaluated: color (2), smell (2), flavor (4), sweetness (2) sourness (2), texture (4) and aftertaste (4). The maximum number of sensory evaluation points that the sample can get are 20. The procedure was performed according to methods described in ISO 6564, ISO 8587 and ISO 11036.

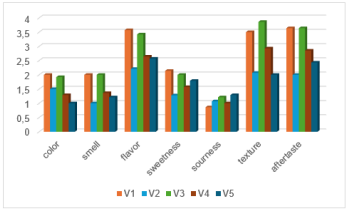
RESULTS AND DISCUSSION

Table 1 Content of total and individual sugars and soluble dry matter in samples (%)

Sample	Fructose (%)	Glucose (%)	F/G	Sucrose (%)	Maltose (%)	Total (%)	Soluble dry matter (%)
V1	29.43	29.91	0.98	<0.1	<0.15	59.34 ±2.56	73.13±3.15
V2	33.67	24.40	1.38	<0.1	0.31	59.38±2.57	75.17±3.24
V3	36.20	35.92	1.01	<0.1	0.30	72.42±3.13	73.90±3.19
V4	35.22	33.69	1.04	<0.1	0.18	69.09±2.99	70.80±3.05
V5	23.10	23.95	0.96	<0.1	0.22	47.27±2.04	61.67±2.66

Table 2 Content of total phenols, total acids, pH value and HMF in grape molasses samples

Sample	Element			
	Total phenols (mg/L)	Total acids (g/L)	pH	HMF (hydroxymethyl furfural) (mg/kg)
V1	1767±6.11	7.52±0.03	3.65±0.01	5.1±12
V2	1119±2.08	6.34±0.04	3.69±0.13	710.20±56.81
V3	960±27.43	3.85±0.05	4.05±0.10	827.84±66.22
V4	1471±1.15	5.41±0.01	3.65±0.02	805.30±64.42
V5	808±2.08	11.1±0.06	3.12±0.02	620.30±49.62



Graph 2 Values of the sensory parameters of the sample grape molasses

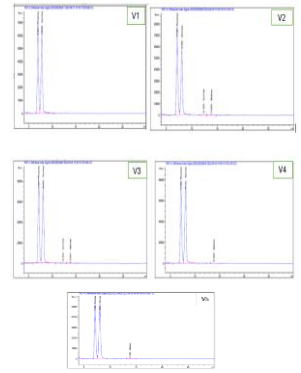


Figure 1 HPLC chromatograms of individual sugars in grape molasses samples

Graph 3 The total points from sensory evaluation of the grape molasses samples

CONCLUSION

This study explored the differences in five molasses sample from Vranec grape variety, through chemical characteristics (soluble dry matter, sugar, total phenolic, total acids, HMF) and sensory evaluation.

With the use of traditional methods to the production of grape molasses, the quality of the molasses is decreased, and compound that is harmful to human health, such as HMF, is also formed in large amounts. To produce better quality molasses, standardization in production should be applied by using modern technology, and traditional production should be adapted to this technology (vacuum technology).