

Actual challenges and the need to produce alternative products from red grapes rich in phenols and antioxidants

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Abstract. The study explores alternative products from Ukrainian grape varieties: non-alcoholic wine from the Isabella variety and the grape concentrate "Dr. Grape" from the Odessa Black variety. Non-alcoholic wine retains beneficial polyphenols while reducing methanol levels, and the concentrate is rich in biologically active substances with antioxidant properties. In the context of climate change and evolving consumer trends, these products are relevant for the modern winemaking market.

1. Introduction

The global consumption of wine has undergone significant changes after several years of Covid-19, which was the beginning of a global crisis of the current century. This pushed some people to start looking for comfort and security as they felt that the world around them was losing these benefits. In most cases, this has led to them to idea of rethinking their lives to live better or continuing to stay true to their habits and lifestyles despite the pressure of changes. Alcohol in any form is a part of these reactions, leading to increased consumption in the early stages of a crisis, particularly in relation to anxiety.

In 2022, the global wine consumption was estimated at 232 million hectoliters, that means a decrease of 2 million hectoliters compared to 2021. The war in Ukraine and the related crisis, together with disruptions in the global supply chain, have led to a sharp rise in production and distribution costs. This has led to a significant increase of wine prices for consumers.

Governments are also paying attention to alcohol consumption, and in recent years, more restrictive regulations and liability have been introduced. At the same time, there have been publicity campaigns aimed at reducing alcohol consumption for social and personal reasons. Therefore, it is important for the grape and wine sector to respond to these political signals and to analyze the growing consumer interest in alternative products.

Also, at the beginning of the war, the situation for the Ukrainian wine industry was complicated by a complete interdiction by local military administrations of the sale of wine products in Ukraine for more than 40 days, which led to significant losses for wine companies that remained active. At that time, Ukrainian producers began to look for alternatives to wine, such as the production of non-alcoholic wines, vitamin drinks from grapes, considering the expansion of the range; products containing polyphenols-anthocyanins of red grapes with preservation of its biological and antioxidant activity while increasing the content of biologically active substances of natural origin.

The refusal from alcohol has the added benefit of reducing calories by around one third. The positive effects of red wine are also worth considering. The recent studies have shown that powerful antioxidants found in red wine can reduce the risk of heart disease in some people. These antioxidants, polyphenols, etc. Are also found in de-alcoholic red wine and food concentrate. Grape polyphenols are represented by two main groups of substances: flavonoids and non-flavonoids, which play an important role in biological reactions of the body [1]. They exhibit anti-inflammatory, antioxidant and anti-cancer properties, and help to protect the body from oxidative stress and various diseases.

2. Materials and methods

To produce grape food concentrate, red varieties of grapes were used, in particular Odessa Black. Raw

materials included fresh grape pomace, grape must, grape juice concentrate, and citric acid as a blending component.

The extraction of phenolic compounds from grape pomace was carried out by the maceration method using water as an extractant at a ratio of raw materials to extractant of 1:10. The main part of phenolic compounds was anthocyanins, catechins, leucoanthocyanins and other flavonoids. Maceration was carried out at a temperature of 20-25°C for 24 hours.

The obtained extract of phenolic compounds was blended with fresh grape must (up to 40%) or grape juice concentrate. Citric acid was added at the blending stage to stabilize the acidity of the product and increase its organoleptic properties. After blending, the concentrate underwent technological processing, including filtration, and was sent to rest to stabilize the aroma and taste.

The materials of the study were: red dry varietal wine material from grapes of the Izabella variety (Ukraine). Dealcoholization was carried out by vacuum distillation [2]. In the vacuum apparatus, a pressure of 6 kPa was created and the wine was heated to a temperature of 30..40 oC, under such conditions, the vapors passed into the gas phase and entered another tank, where they condensed and collected. Dealcoholization lasted 10 minutes, where 2.25 dm³ of distillate and 6.75 dm³ of dealcoholized wine were obtained from 9.00 dm³ of wine. After that, the alcohol-free wine was filtered through laboratory filter paper. Potassium metabisulfite was added to the wine material to a total free sulfur dioxide content of 35 mg/dm³ and poured into bottles with a volume of 0.75 dm³.

Tastings were conducted in a specially equipped room with individual booths and air conditioning at 20°C. The tasting was carried out by two independent tasting panels.

For the wine tasting, a standard tasting glass made of thin, clean, transparent glass with a capacity of 210-220 cm³ was used, allowing for 60-70 cm³ of wine to be evaluated comprehensively for all elements of quality.

Wine with alcohol and dealcoholized wine were evaluated according to the Standards of the International Organisation of Vine and Wine (Resolution OIV/Competition ECO 332A/200).

3. Results and discussion

The study focused on the production of grape food concentrate and de-alcoholized wine, analyzing their phenolic composition and sensory properties.

3.1. Grape food concentrate

The extraction of phenolic compounds from red grape pomace, especially from the Odesa black variety, led to a significant yield of anthocyanins, catechins, leucoanthocyanins and other flavonoids. Maceration with water as an extractant made it possible to achieve an effective concentration of these compounds, which contributed to the antioxidant potential of the product.

The blending process with fresh grape must or grape juice concentrate, followed by the addition of citric acid,

improved the acidity of the product and improved its flavor profile. The final product retained a high level of polyphenols, which contributed to its biological and antioxidant activity. The concentrate has been stabilized by filtration and aging, resulting in a well-rounded sensory profile.

3.2. Dealcoholized wine

Vacuum distillation of the Isabella grape variety effectively reduced the alcohol content below 0.5%, while retaining a significant portion of phenolic compounds, particularly flavonoids. The dealcoholization process, carried out at a pressure of 6 kPa and a temperature of 30-40°C, successfully separated alcohol from the wine without significantly affecting the aroma or taste. Also, the methanol content in dealcoholized wine decreased

Dealcoholized wine was evaluated by experts of the tasting committee. Sensory analysis showed that the wine retained key aromatic elements such as berry and fruit notes and displayed a balanced flavor profile with appropriate acidity and tannic structure despite the absence of alcohol.

3.3. Sensory evaluation

In a controlled tasting environment, both alcoholic and de-alcoholized wines were evaluated according to OIV standards. The dealcoholized wine showed a slight reduction in overall body and heat due to the removal of ethanol, but its flavor complexity, aroma intensity and mouthfeel remained favorable. Panelists noted that de-alcoholized wine retained much of the grape's original character, making it a viable alternative for consumers looking for lower-alcohol options.

The study highlights the successful production of both grape food concentrate and de-alcoholized wine, demonstrating their potential as innovative products in the context of growing consumer demand for healthier non-alcoholic alternatives.

4. Conclusions

Taking all these aspects into account, the Ukrainian Wine Institute has started the research and developed two alternative drinks from grape varieties native to Ukraine: non-alcoholic wine from the Isabella variety and food concentrate "Doctor Grape" from the Odesa Black variety. The process of alcohol extraction removes methanol, which is considered harmful to health, from Isabella wine, while retaining all the positive and beneficial properties of wine, namely the composition of polyphenols.

Food concentrate from the Odesa Black grape variety is produced to obtain natural biologically active substances, such as polyphenols and anthocyanins, which have antimicrobial, anti-radiation and antioxidant properties.

Regarding the climate change, the geopolitical context and changing consumer priorities, these types of beverages are becoming a relevant alternative for wine producers in the 21st century.

5. References

1. A. Zeb, *J Food Biochem*, 44(9) (2020).
2. C. Nurgel, G. Pickering. *Sensory Studies* 21, 505 (2006).