

## GRAPES AS A RAW MATERIAL FOR WINE PRODUCTION AND DETERMINATION OF PHYSICAL-CHEMICAL AND ORGANOLEPTIC PARAMETERS IN WINE

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### Abstract

The purpose of this study was to explore the physico-chemical properties of grapes, as well as the anatomical impact and structure of grapes. We also delved into the chemical and biochemical composition of grapes and wine, both during and after the fermentation phase. In the second part of the study, we elaborated in greater detail on water as the primary component of grapes, followed by sugars which are elementary and essential to the fermentation process and to achieving successful alcohol production. In the methodology section, we discussed the analysis that I made in the laboratory at "Sone Castle Vineyards and Winery", for each analysis we paused to describe the progress and applied methodologies. In the final section, we dexamined the questionnaire administered to 150 respondents. This questionnaire focused on wine consumption and the respondents' knowledge about wine and its significance. Our findings indicated that, in general, Albanian people do not yet have a strong tradition of wine consumption, partly due to the influence of various dominant religions. However, it is interesting to note that a majority of the respondents claimed to possess knowledge about the external evaluation of wine. Based on the responses, we realized that citizens are knowledgeable about perceiving wine products. Some individuals mentioned that they use it for entertainment at various family parties, for the end of the year holidays and others. In conclusion, the journey from production, processing to the end consumer involves multiple stages, all of which are necessarily to be met, so that we have a final wine with perfect taste and texture.

*Keywords:* Alcohols, sugars, flavonoids, consumers, production chain, wine color, its chemical nature.

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### 1. Introduction

#### History and Tradition of Viticulture and Winemaking in Kosovo

The art of cultivating vineyards and processing grapes in Kosovo resembles that of other Albanian and Balkan regions, with a history of over 2,000 years of wine cultivation in these areas. Historical data, place names, and numerous archaeological discoveries provide substantial of wine cultivation in these areas. One of the most notable archaeological findings consists of two inscribed plaques found in the village of Reti, Municipality of Rahovec. These plaques contain text related to wines, grape leaves, and grape clusters. Additionally, in a Tekke (Sufi lodge) located in Rahovec, there is a preserved "gravestone" (epitaph) dating back to the 1930s. Apart from the Latin text, a wine with grape clusters is also carved, bearing witness to the ancient cultivation of grapes for thousands of years. Furthermore, a large amphora is also on display in the Tekke, undoubtedly used for transporting wine from one location to another (MBPZHR).

## 2. Materials and Methods

This study was conducted from May to July 2022. For data collection and statistical analysis of the gathered information and questionnaire, I used social networks, but I also conducted physical surveys with various citizens, primarily residents of the Municipality of Peja, for which I am grateful for their voluntary cooperation which was provided without any external pressure. The questionnaire was created using Google Drive and distributed through various social networks, such as Messenger, WhatsApp, and Email. Additionally, I distributed physical copies of the questionnaire to citizens using printed flyers. The questionnaire consists of a total of 12 questions.

In an effort to engage as many citizens and students as possible, the questionnaire was distributed through phones, computers, and physical flyers. Additionally, the laboratory analyses were carried out at the MBPZHR-licensed laboratory located within the premises of 'Stone Castle Vineyards and Winery'.

After collecting both virtual and physical questionnaires over approximately one month, I started analyzing and processing them. As mentioned earlier, the questionnaire was created using the Google Drive platform and distributed through various networks, including physical interviews with different citizens.

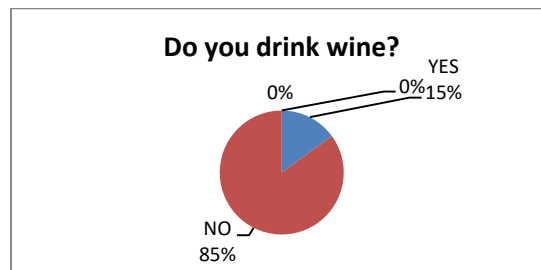
## 3. Results and Discussions

*3.1. Questionnaire Results:* In this study, a total of 150 participants participated. The majority of participants were females, 93 or 62%, while males constituted 57 participants or 38%. As mentioned earlier, the questionnaire was distributed both online and physically (107 participants took part online, while 43 participated physically). The participants included students, academic staff, and other individuals, whom I thank for their participation.

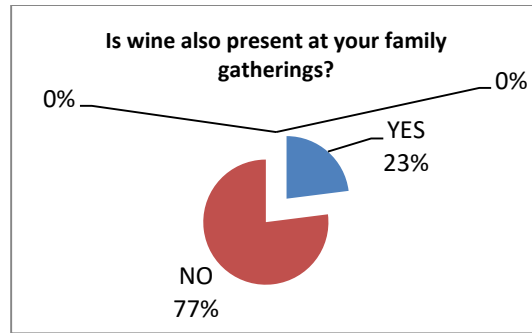
**Table 1.** Participation of respondents

Gender	Frequency	Percentage	Valid percentage
Males	57	38%	38%
Females	93	62%	62%
Total	150	100%	100%

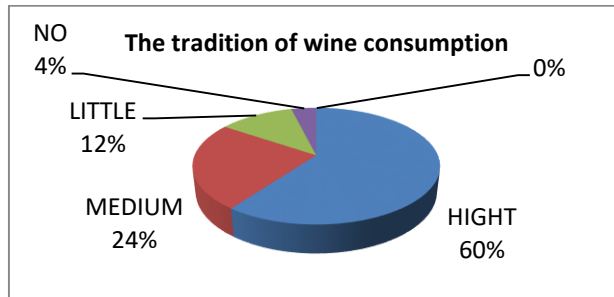
Regarding the participants' place of residence, 54.9% live in rural areas (villages), while 45.1% live in urban areas (cities). Regarding age, participants aged 18-22 years accounted for 54.4%, individuals aged 22-26 years accounted for 32%, and the remaining percentage consisted of individuals over 26 years of age. In terms of employment status, it was found that 76.7% were students, 15.5% were employed, and 7.8% were unemployed (a high percentage of students, as the majority of participants were students). In response to the question "Do you consume wine?" (YES/NO), it was found that 85% do not consume wine, while 15% do consume it. These results provide an overview of the demographic and consumption patterns among the surveyed participants.



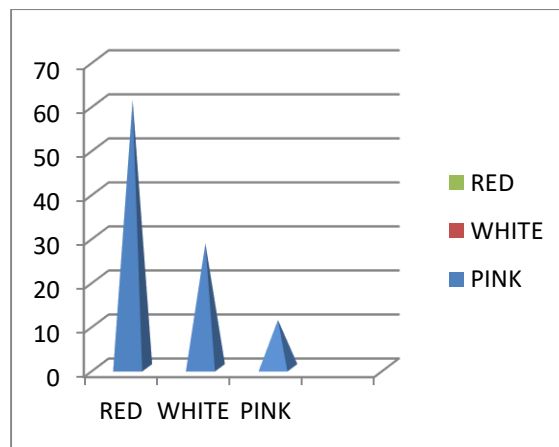
1. Regarding the question of whether wine (in comparison to other beverages) is present on your table during family gatherings or social events, the responses indicate that in 77% of cases, wine is not present, while in 23% of cases, it is present.

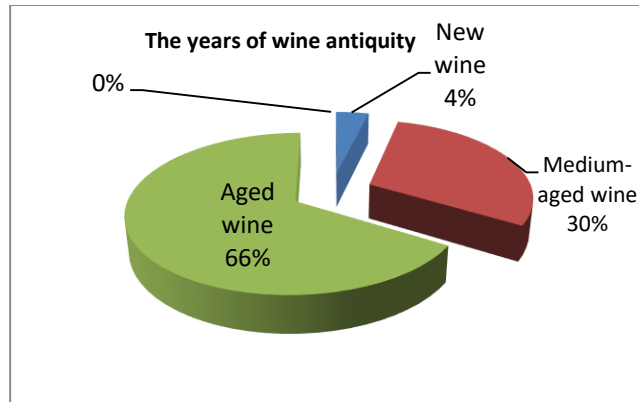


2. Furthermore, we can observe that Albanians, on average, have a moderate tradition of wine consumption. Specifically, 60.2% of respondents state that there is an average tradition of wine consumption, 24.3% say it is somewhat present, 11.7% declare it to be very present, while 3.9% state that it is not present at all.

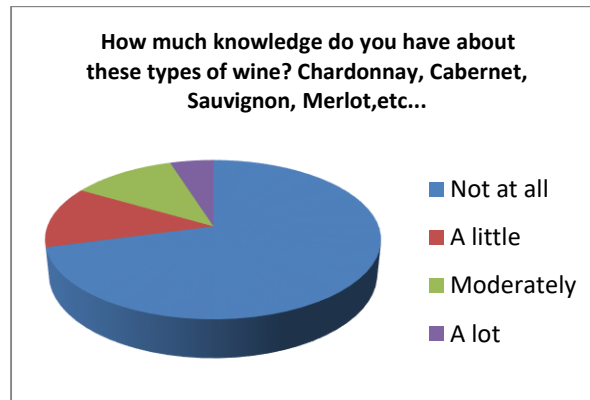


3. In the above figure, we have presented the most commonly consumed types of wine. Based on the formulated questionnaire, it is observed that the most consumed type of wine, representing the majority (60.9%), is red wine, followed by white wine (28.3%). Rosé wine, on the other hand, remains at the lowest percentage (10.9%). One of the reasons for its lower consumption is that it is still in its early years of production and trade in our country, resulting in a lack of sufficient awareness among the majority of individuals regarding this type of wine.



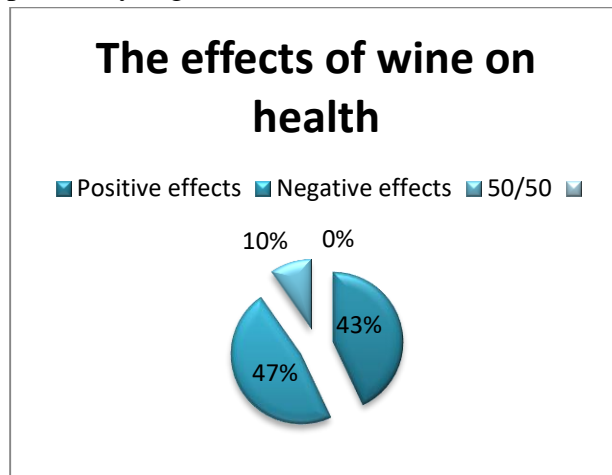


4. The figure further relates to the aging period, also known as maturation, in wine production technology. In the question directed to participants in the questionnaire regarding their preference for wine types based on aging time, the dominant portion (66.7%) state a preference for aged wine, while 30% prefer moderately aged wine, and 3.8% prefer new wine. Let's delve into some clarifications regarding this question. Firstly, for red wine, a specific aging time (approximately 2.5 years) is required, as an insufficient aging time affects the development of aromas from tannins and the pronounced color from anthocyanins. On the other hand, an extended aging period for red wine is not preferred because it would result in a dark red color that might not be appealing to consumers. As for white wine, it does not require aging for years since prolonged aging would cause it to turn into a deep golden color, which would be unsuitable for consumption. Therefore, it is preferred for this type of wine to be implemented in the market for consumption immediately after the bottling process. Additionally, red wines are often paired with certain food products, especially red meats, while white wines are paired with white meats, fish, and others.

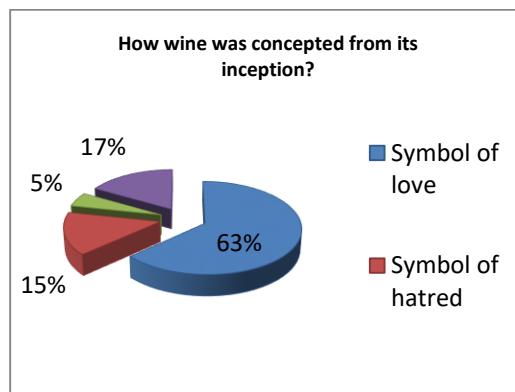


5. Regarding the knowledge about specific wine varieties, based on the received responses, only a small percentage have knowledge about them, while the vast majority (70.9%) have no knowledge at all. This is due to the fact that some individuals do not consume wine at all, with some stating personal reasons and the majority citing ethical reasons (religion). The presented wine varieties in the questionnaire included Chardonnay, Cabernet Sauvignon, Merlot, Zambaku i Kosovës, Lulëkuqja e Kosovës, Shiriaz, etc. The following figure presents the effects of wine on health, where among other things, we have a similar value regarding the perception of positive or negative effects of wine consumption. Approximately 43% expressed the opinion that wine consumption has positive effects on the body, while 47.3% held the opposite view, stating that wine consumption has negative effects on the human body. The only negative effect that wine consumption has on the body is liver damage, which would occur only if consumed without control. Let's familiarize ourselves with the positive effects of wine consumption:

- Wine consumption is associated with increased longevity.
- Drinking wine promotes a healthy heart function.
- Nutrients in wine may prevent Alzheimer's disease.
- Wine can contribute to healthier skin.
- Wine consumption can help prevent obesity.
- Wine also aids in strengthening the immune system.
- Wine contributes to improved eyesight.



6. Regarding the question about how wine was perceived 6,000-7,000 years ago, we received various responses. The majority (73.3%) stated that wine was initially used as a symbol of love, respect, understanding, and similar values. Some mentioned that it was used as a symbol of hatred, while a smaller number mentioned its use to quench thirst (usually after long journeys). Additionally, some perceive wine as a product of luxury and elegance, as it outwardly represents generosity and gentleness, while its red color symbolizes elegance and brilliance.



#### 4. Conclusions

Alcohols are byproducts of the metabolism of various yeast strains, mainly *Saccharomyces cerevisiae*, with the most important alcohols produced being ethanol and methanol. Acids, on the other hand, result from yeast metabolism but can also come from grape skins and other grape components. Phenols in wine are divided into two chemical groups: flavonoids and non-flavonoids. The color of red and white wine and the importance of wine's presence in the wood's compounds have also been discussed. To further explore the

oxidative-reductive reactions in wine, we specifically discussed the role of oxygen as an oxidizing agent. We also touched upon aldehydes, ketones, and macromolecules of great importance, such as carbohydrates, proteins, lipids, vitamins, minerals, and more. Continuing with gases in wine (which are byproducts of yeast, such as CO<sub>2</sub>), we explored the redox or protective role of SO<sub>2</sub> in wine, and the role of O<sub>2</sub>, which as the driving force for various processes. In the section on work methods, we discussed the analyses conducted in the laboratory at "Stone Castle Vineyards and Winery," where we detailed and discussed the progress and applied methods for each analysis. During practical work in the laboratory, we familiarized ourselves with several previously unknown and applied devices for various analyses. Finally, we discussed the conducted questionnaire and the responses of 150 respondents in this survey (which is about wine consumption and their knowledge about wine and its importance). From the questionnaire, we observed that the Albanian population, in general, still lacks a tradition of wine consumption, primarily due to different dominant religions. However, it is noteworthy that the majority of respondents in the questionnaire claimed to have knowledge regarding the external evaluative aspects of wine.

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