PERCEPTIONS OF WINE HEALTH BENEFITS AND EFFECTS OF WINE CONSUMPTION ON WELL-BEING

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ARTICLE INFO

Original Article

Received: *11 October 2022*

Accepted: *10 January 2023*

doi:10.59267/ekoPolj2301145S

UDC 663.2:159.938.363.6

Keywords:

moderate wine consumption, wine consumers' survey, health, well-being, Croatia

***JEL**: D01, D12, D 91, I19,I39, Q19*

ABSTRACT

he purpose of the survey was to identify and analyze moderate wine consumption of Croatian autochthonous wine varieties. The survey was conducted in 2019 and 2020 on the Croatian Science Foundation scientific project "Vinum Sanum". Dimensions of wine and health benefits, wine quality, labelling, positive and negative effects on wine labels and psychological well-being were assessed with a questionnaire from 374 participants. Results indicated that wine was perceived as a healthy beverage, consumed as part of healthy life style. Health benefits were perceived positively through cardiac, physical health and psychological well-being. Most important quality features were: origin; micro region, terroir, PGI/PDO (protected geographic origin/protected designation of origin), vintage, ageing and sugar content. This survey might be used as scientific evidence for developing health claims for wine, for producers to use health enhancing properties of wines and create packages and/or labels which may boost the positive perception of wine health benefits.

Introduction

The spreading awareness of the impact of the human diet on health, physical and psychological condition translates often to consumers' food and beverages choices. The expectations upon food and beverages in human diets result in consumers' interest about items that may have positive health effects and could prevent nutrition-related diseases.

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The health awareness and expectations of consumers' apply also to the impacts of wine as a dietary item that may also create positive health effects. Consequently wine became a topic of scientific interest ever since the discovery of the so-called 'French paradox' (a diet of high fat and cholesterol intake along with red wine that does not negatively impact health factors, such as cardiovascular risks) by Renaud and de Lorgeril (1992). Based on their empirical findings, similar studies were created for surveys of food items, e.g. olive oil, organic food (Roinen et al., 1999; Maechle et al., 2015; Ilak Peršurić, 2020; Rizzo et al., 2020).

Developing the established theories of food and health, the survey of Kaur & Paul Singh (2017) used the existing literature, reviewing the determinants of human behaviour towards functional foods. The most important factors were described as; personal factors (age, gender, education, income, marital status, health status, awareness/ familiarity, willingness to use functional foods, pleasure in eating); psychological factors (beliefs, motivations, perceived quality, benefits, risks, pleasantness); cultural and social factors (cultural and social norms, role of family, friends, presence of children at home, geographic location, ethnic origin, social status) and factors related to the product (ingredients/function, convenience, price, taste and other sensory measures, naturalness, health-full, brand, labelling, regulations, domestic production, innovativeness). These factors and their variables were also detected in studies that have concentrated on consumer perceptions of wine as a healthy product (Bariero-Hurlé et al., 2008; Samoggia 2016; Vechio et al., 2017;).

Health aspects and wine

Consumers' are aware about the effects that consumed food and beverages have on their health. In consumers' studies food and beverages were associated in a context of well-being (Ares et al., 2015; Diener et al., 1999, 2003; Guilemin et al., 2016) since the consumers estimated their personal well-being or behavior in relation to food and wine choices (Corduas et al., 2013; Higgins & Llanos, 2015). Some authors discussed the consumers' traditional food perception (Guirrero et al., 2010) associated to celebrations, seasons and traditional aspects and wine as a tradition, especially in the Mediterranean diet (Willcox et al., 2014). A literature review showed both positive and negative perceptions of wine (Guilford & Pezzuto, 2011) referring positively to cardiovascular health (Goldberg et al., 2001), gastrointestinal and neurological aspects (Reale et al., 2020), diabetes and immune parameters (Magrone et al., 2008). A consumers' study of Vecchio et al. (2017) showed that wine consumers believe that moderate wine consumption has positive effects on their health and believed it was beneficial in preventing diseases. Further, wine consumers were also interested in wines that contained more antioxidants. According to Barriero-Hurlé et al. (2008) wines with higher levels of bioactive substances, such as phenols, moreover stilbenes and especially resveratrol (being one of the main stilbenes found in wine) may be marketed as "functional wines" in the future. Wine consumers believed that production technology improves food quality, that food quality controls are reliable, information from producers trustworthy and that in the future a functional wine product can be produced.

The awareness about the positive effects of resveratrol and other wine compounds on cardiovascular health and Alzheimer's disease were showed in medical surveys (Anekonda, 2006; Shen et al. 2015; Reale et al., 2020). Further, Magrone et al. (2008) showed the positive effects of wine on the immune system, while Flechtuer-Mors et al. (2004) demonstrated its effects on overweight persons. A suggestion upon moderate alcohol consumption (1 to 2 drinks a day – equals up to 60 mL of alcohol) responds to intake of wine since it is more beneficial than other alcoholic beverages. The findings of Goldberg et al. (2001) provided overall medical evidence about benefits of antioxidants present in wine (decreasing platelet aggregation, through prostaglandin and fibrinogen inhibition, tested "in vitro" on animals). Authors suggested that light to moderate consumption of any type of alcohol provides antithrombotic benefits similar to aspirin use. Adverse effects were associated with the intake of more than three servings of alcohol daily (fetal alcohol syndrome, cardiomyopathy, hypertension, hemorrhagic stroke, cardiac arrhythmia, sudden death).

Moderate wine consumption provides pharmacological, biological, and physiological benefits for human health, including blood pressure, cholesterol and lipids regulation, prevention of diabetes, obesity, atherosclerosis and cardiovascular diseases, as well as anti-inflammatory, antioxidant and antitumor effects (Khalil & Tazeddinova, 2020; Vaquero et al., 2007). In addition to the positive impact on physical health, the positive effect on mental health is also evident in protecting neuronal cells from damage, preventing neurodegenerative diseases, facilitating the treatment of depression, improving cognitive function, and increasing memory (Qi, et al., 2015). In comparison with other alcohols, healthy properties in wines are resulting with added value, which is largely associated with the presence of polyphenols, mainly resveratrol (Gutiérrez-Escobar et al., 2021). Additionally, some authors reported that moderate wine consumption may ensure peoples longer life expectancy, comparing to consuming wine in excess or not consuming wine at all (Ruf, 2003; Plunk et al., 2014; Gutiérrez-Escobar et al., 2021).

Within the frame of the moderate consumption wine may be perceived as a "healthy" food but also as "permissive" food in a hedonistic way (Fiore et al 2019; Higgins & Llanos 2015). From the general surveys on food and beverages, cross the surveys of positive health effects, in this paper we refer to the similarities of the recent findings and relate them to our survey about wine and the effect of moderate wine consumption.

Labelling health warnings on wine

Although wine has been surveyed as a heathy beverage as explained in the previous chapter of this paper, wine was also surveyed through possible negative effects on human health. Some authors expressed concerns about legislations which could hinder unintentional harmful effects of wine (Annunziata et al 2016; Jovanović & Atanasovska Cvetković, 2022). Warning labels inform consumers of risks associated with alcohol consumption and may reduce dangerous drinking behavior (Eurocare, 2013). In this way the awareness of negative impacts of wine may rise and wine as an item may be

recognized in human diets as a beverage which may also create negative health effects. Currently in Croatia there are no regulations related to labelling either positive or negative effects of wine on human health. The information on the Croatian wine labels show the production area and designation of origin, grape variety, vintage, awards showing. Therefore the goal of our survey was to detect future interest of consumers that may relate to information that is not currently present on wine bottles, particularly, nutritional information, number of glasses not to exceed due to health concerns, age and health limited consumption.

Explanations about negative effects of wine currently exist in some European countries (Eurocare, 2013, 2014), for example, some have statements (Germany) while others have pictures (Italy) describing that alcohol is not suitable for persons under age 18 and pregnant women. Findings in Italy showed that the necessity of labelling was connected to the socio demographic features of wine consumers, pointing that women and younger persons were more interested in wine label indications of positive and negative effects of wine (Annunziata et al., 2016).

Wine quality

Wine quality may be perceived from the technical or productive point; objective product characteristics, consumer preferences, intrinsic (expected quality) and extrinsic attributes (experienced quality) (Verdu Jover et al., 2003). Quality measurements were also studied through dimensions of quality: hedonic (good, full rich taste), health (natural product, lower/higher cancer risk, positive/negative effects on gut/immune system), process (traditional, not GMO, good for environment) and convenience (price, save money) (Grunnert et al., 2000; Ilak Peršurić & Mann, 2019; Maehle et al., 2015).

The wine label contains diverse information on the bottle that informs consumers about the origin (land of production, terroir, geographical protection, producer), grape variety, harvest year, alcohol, sugar and sulphur content, that are prescribed by laws and regulations of each European country (Eurocare, 2013, 2014). Wine consumers evaluate information on wine labels as extrinsic attributes which assist them in wine choice, prior to purchase and consumption (Bernabeu et al., 2012). After wine consumption intrinsic attributes such as aroma, bouquet, colour, taste may be evaluated (Corduas et al., 2013). Further, consumers relate wine to their lifestyle adopting certain habits in consumption, preferences for certain wines, wine types or consumption frequency (Hristov and Kuhar, 2015; Corduas et al., 2013; Verdu Jover et al., 2003). Wine consumers may connect wine to moments, everyday enjoyment or social occasions, e.g. festivities, birthdays, new Year's (Yang and Li 2019).

Materials and methods

Data collection was performed with a sample of Croatian wine consumers during 2019 and 2020 on the Croatian Science Foundation scientific project "Vinum Sanum" "Influence of different vinification technologies on the qualitative characteristics of wines from Croatian autochthonous varieties: the role of wine in human diet".

Participants were invited by a public call, via the website of the Institute of agriculture and tourism in Poreč, and by personal contacts of the authors using the snowball effect. After the initial written agreement to participate in the survey, the participants gave their written informed consent for participation on the project and in the survey. Through this process of application more female than men participants applied. In total 25 different groups were formed. Consumers consumed wines in a moderate way 2 dl daily during a six week trial, according to the propositions of healthy moderate wine consumption (adopted from literature; Flechtuer-Mors et al., 2004., and Golderg et al., 2001, and Eurocare 2013,2014). The wines consumed were produced of Croatian autochthonous white and red grapevine varieties: Malvazija istarska, Pošip, Plavac mali, Teran (see appendix). The wines were obtained from the experimental production at the Institute of agriculture and tourism in Poreč; the Malvazija istarska wines were produced in vinification treatments: (MC) control treatment without maceration, (TAN) treatment without maceration with the addition of tannin, (M1) pre-fermentatitive cold 1-day maceration, (M7) 7 days maceration, (M21) 21 day maceration and (LH) late harvest grape vinification. Three of these wines were aged in barrique barrels and named M7B, M21B, LHB. The Teran wines were produced in vinification treatments: TPHT 48h prefermenative heating at 45 degrees, followed by 8 day clasical maceration, (TM7) control treatment with 7 days of maceration, (TM10) prolonged 10 day maceration, (TM21) prolonged post-fermentative 21 day maceration. These wines were aged in barrique barrels and named TPHTB, TM7B, TM10B, TM21B. The wines bought from the open market were from different parts of Coastal Croatian regions: Hrvatska Istra subregion MF (Malvazija fresh), MA (Malvazija aged), TF (Teran fresh), TA (Teran aged), and Central and Southern Dalmatia sub region PF (Pošip fresh), PA (Pošip aged), PMF (Plavac fresh), PMA (Plavac aged).

The survey with the questionnaire was performed at the Institute of agriculture and tourism in Poreč and at the Faculty of Humanities and Social Sciences in Rijeka. The questionnaire was administered to adult wine consumers (over age 18) and the informed consent was obtained from all participants involved in the study. The study was carried out in accordance with the Declaration of Helsinki developed by the World Medical Association and was approved by the Ethics Committee of the Clinical Hospital Center Rijeka (Croatia). No incentive was given to participants. In total 374 questionnaires were obtained. The questionnaire about wine was designed to examine four aspects of moderate wine consumption; wine and health benefits, wine quality, labelling positive and negative effects on wine labels.

The methodology was adopted from the survey of Kaur et al. (2017) and Guilemin et al. (2016) based on the determinants of human behavior towards functional foods. The methodology of measuring consumers' perceptions of wines quality was adopted from Verdu Jover et al. (2003) while the measurement of wine consuming frequency was adopted from Yabin & Li (2019). The wine quality dimensions were evaluated by extrinsic and intrinsic attributes which were included in the same scale (similar to Verdu Jover et al., 2003) whereas extrinsic attributes were: reputation, region, appellation d'Origine, advertising and propaganda, distribution channels, bottling and labelling, brand, price, while intrinsic

were: age, harvest, alcohol content, varieties, taste, aroma, colour. From the measurement of attitudes toward healthy food (Roinen & Tourila, 1999), measures of health related and taste factors were used (general health, natural products, food as reward, pleasure).

Our starting hypothesis was that some changes of participants' opinions were expected at the beginning and at the end of the moderate wine consumption. The obtained two sets of data (before and after the consumption period) were compared to single out those items that showed significant differences between observed groups after the consumption period. Additionally due to the fact that we had 25 different groups we set a second hypothesis; different wines consumed may affect different opinions and attitudes of participants, also in terms of two time points of measurement. Therefore the data processing was performed in order to observe differences in the changes of consumers' attitudes for each item between the first and the second measurement. In data processing we have used descriptive analysis, correlation between variables and analysis of variance (One-way analysis of variance (ANOVA) and correlation analysis was performed to examine the differences between specific consumer groups. The average values of each item were compared using Fisher's Least Significant Difference (LSD) test at the level of $p<0.05$. using Statistica v.13.2 software (Stat-Soft Inc., Tulsa, OK, USA). The measurement scale used in the survey was a Likert type scale which ranged from one (totally disagree) to five (totally agree) which measured wine consumers attitudes toward wine items (the scale was defined as an evaluation of a particular entity with some degree of favor or disfavor, adopted from Ilak Peršurić & Mann, 2019). Measurements of some psychological aspects used the General Well-Being Schedule with a self-assessment measure, aimed at examining subjective feelings of general well-being, psychological well-being, and distress (adopted from Dupuy 1978 and Diener et al., 1999). The measurement scale of subjective well-being was measured with a Likert type scale which ranged from one to five, for general feeling (one excellent, to five very low), nervousness (1 extremely much so I could not work, to five not at all), stress, pressure (one unbearable, to five not at all), being happy, satisfactory, full of life (one extremely happy, to five very unhappy), being anxious, worried, upset (one extremely anxious, to five not at all).

In order to test the hypothesis if all participants shared some similar opinions and attitudes, regardless the two referent time points (before/after) about wine and health benefits, wine quality, labelling, positive and negative effects of wine and psychological well-being a factor analysis was carried out through exploratory factor analysis (EFA). The factor dimensions were calculated by using Cronbach alfa coefficients which have reduced the number of items and dense the factors in the factor matrix. The maximum likelihood extraction method was used. From 18 wine quality items 7 remained (micro region, terroir, producer, recommendations of friend, sales person, waiter, own knowledge, label and package attractiveness, awards, quality label – PGI, PDO (protected geographic origin/protected designation of origin), wine complexity, taste, color and smell of wine, sugar content, ageing, harvest/vintage, price, price discounts). All positive health benefits entered in the factors matrix, counting 9 items (heart health, blood vessels health, cholesterol levels in blood, psychological health and memory, blood sugar levels, neuro vegetative diseases, body weight, physical condition (energy),

metabolism). From six psychological items (happy, good feeling, emotional stability, feeling nervous, under pressure/stress, anxious) four entered the factor matrix. The risks of wine consumption had 5 items from which 2 remained (do not drink and drive, do not consume with medicine, not for persons under age 18, not for pregnant women, consume in a moderate way).

Since currently in Croatia there are no regulations that relate to labelling either positive or negative effects of wine on human health (NN32/19) we wanted to test how wine consumers respond to the possibility of applying statements or pictures of health warnings about possible negative effects of wine. The idea was drawn from recent European documents and surveys which tackle labelling of alcohol and presence of ingredients and allergens on the labels (Eurocare 2013). Positive statements on the wine label were questioned: consumers' interest, such as nutritive, anti-oxidative effects, benefits for general, heart, blood vessels health and diminishing cholesterol levels (modified from Goldberg et al. 2001; Eurocare 2013). Statements about driving and drinking, taking alcohol with medicines, avoiding drinking during pregnancy and banning alcohol for children of age below 18 were used (modified from Annunziata et al. 2016).

The aim of this survey was to verify how wine consumers respond to wine attributes, to either positive or negative health benefits (regarding effects of wine on human health), and to the possibility of applying statements or pictures of health warnings on wine labels (since no such surveys exist in Croatia and no regulations exist currently regulating this information).

Results

The sample consisted of the respondents whose sociodemographic features are shown in Table 1. and were in majority female (62.1%), and in minority males (37.9%). The sociodemographic structure was a consequence of the chosen methodology and the free will application of participants. Most respondents had between 26 and 54 years of age (73%). According to their employment status the majority were employees (58.8%), and the minority were entrepreneurs/self-employed, managers, unemployed/retired, students/pupils. They have obtained in ¾ of cases higher education level (75.7%), while ¼ of participants had secondary education or less (24.3%).

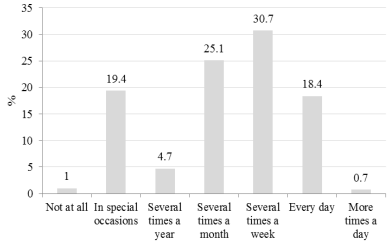
Table 1. Sociodemographic features of the survey respondents (N = 374)

Gender	Age (years)	Education	Occupation	Monthly personal income
Female (62.1%)	20-29 (18.9%)	Elementary (0.6%)	Entrepreneur/ Self-employed (14.0%)	≤ 333 € (4.2%)
Male (37.9%)	30-40 (24.1%)	Secondary (23.7%)	Manager (10.6%)	334–533 € (11.0%)
	41-50 (17.1%)	University (75.7%)	Employee (58.8%)	534-933 € (39.9%)
	50-60 (26.7%)		Retired (3.9%)	≥ 1001 € (14.2%)
	≥61 (13.2%)		Pupil/student (8.4%)	
			Unemployed (4.3%)	

Source: Authors survey

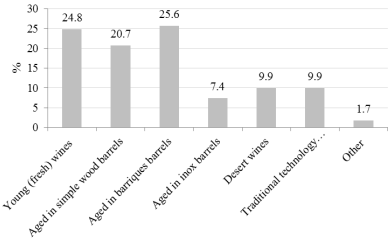
According to their usual habits of wine consumption (Figures 1-4), half of the respondents were consuming daily 2 dL of wine, one third was consuming 1 dL daily, while less than 10% consumed 3 and more dL wine daily. Half of the respondents preferred dry wines, each fifth preferred semidry, each tenth preferred semisweet and sweet wines, while less than 10% preferred sparkling and special, liquor wines. Considering the frequency of wine consumption, one third consumed it several times a week, a quarter several times a month, and about equal share of them consumed wine daily, several times a year or in special occasions.

Figure 1. Wine consumption frequency



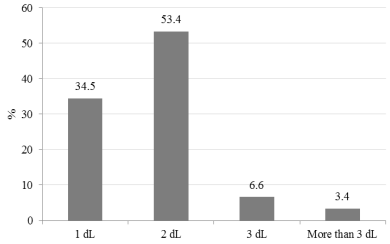
Source: Authors survey

Figure 2. Preferences to wine types



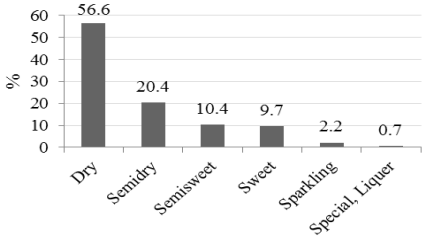
Source: Authors survey

Figure 3. Daily wine consumption



Source: Authors survey

Figure 4. Preference to wine sugar content



Source: Authors survey

Survey participants were asked about the degrees of importance of several health aspects of wine, quality aspects of wine (Table 2.). Participants estimated that wine was as a healthy beverage and its anti-oxidative compounds as very important and important in three quarters of cases.

Quality aspects of wines, such as sugar, were very important/important to 90%; quality (PGI/PDO, protected geographic origin/protected designation of origin) and vintage to 60%. The positive effects were estimated by health effects through general positive effects on human health, heart and blood vessels health and rise of mood by approximately 65% of participants. Positive effects on psychological health and memory were very important/important to roughly half of the participants. Wine was perceived also important as a remedy for a rest after work obligations, very important/ important to a half of participants.

Table 2. Importance of wine and health items

Importance (in %) N = 374	Not at all	Low	Neither important or unimportant	Important	Very important
Heart health	(3.0%)	(8.3%)	(31.0%)	(32.1%)	(25.5%)
Blood vessels health	(2.2%)	(8.0%)	(26.0%)	(38.5%)	(25.2%)
Cholesterol levels in blood	(6.1%)	(15.0%)	(32.4%)	(30.5%)	(16.1%)
Psychological health and memory	(7.2%)	(11.1%)	(36.0%)	(28.8%)	(16.9%)
Blood sugar levels	(9.7%)	(13.9%)	(36.4%)	(26.1%)	(13.9%)
Neurological diseases	(10.0%)	(11.6)	(39.3%)	(22.4%)	(16.6%)
Body weight	(5.5%)	(17.5%)	(35.5%)	(21.6%)	(10.0%)
Physical condition (energy)	(15.5%)	(13.0%)	(38.8%)	(20.2%)	(12.5%)
Metabolism	(8.3%)	(14.1%)	(36.6%)	(27.1%)	(13.9%)
I consume wine as part of healthy lifestyle	(5.9%)	(18.5%)	(33.6%)	(28.6%)	(13.4%)
Positive general effect on human health	(2.8%)	(7.5%)	(23.6%)	(40.3%)	(25.8%)
Wine is a natural beverage	(2.8%)	(2.8%)	(18.6%)	(40.0%)	(35.8%)
Rest after work	(7.8%)	(12.2%)	(27.1%)	(33.2%)	(19.7%)
Rise of mood	(3.3%)	(8.8%)	(24.3%)	(39.5%)	(24.0%)
Wine complexity - bouquet	(1.4%)	(3.6%)	(18.1%)	(37.0%)	(39.8%)
Anti-oxidative compound	(4.5%)	(7.3%)	(22.1%)	(28.8%)	(37.4%)
Micro region - vineyard	(7.5%)	(10.3%)	(35.8%)	(29.6%)	(16.8%)
Terroir	(7.9%)	(10.7%)	(37.4%)	(30.9%)	(13.2%)
Ageing	(4.2%)	(9.5%)	(29.9%)	(37.4%)	(19.0%)
Harvest/vintage	(5.3%)	(10.9%)	(25.1%)	(40.5%)	(18.2%)
Sugar content	(0.0%)	(3.8%)	(4.6%)	(21.4%)	(70.2%)
Quality (PGI/PDO)	(5.0%)	(8.4%)	(26.0%)	(42.5%)	(18.2%)
Consumption with medicine	(5.0%)	(6.4%)	(9.2%)	(19.5%)	(59.9%)
Pregnancy	(6.4%)	(7.8%)	(18.1%)	(18.6%)	(49.2%)
Drinking and driving	(2.8%)	(4.2%)	(8.1%)	(14.7%)	(70.3%)
Perception (in %) N = 374	**Not at all**	**A little**	**Pretty much**	**Very much**	**Extremely**
Good-happy personal feeling	(6.4%)	(5.0%)	(44.0%)	(16.9%)	(5.1%)
Feeling nervous	(70.2%)	(21.4%)	(4.6%)	(3.8%)	(0.0%)
Feeling anxious	(81.2%)	(10.2%)	(7.5%)	(0.8%)	(0.3%)
Feeling under pressure/ stress	(6.4%)	(20.6%)	(23.9%)	(44.0%)	(5.1%)

Source: Authors survey

The items in Table 2., were compared with ANOVA at the beginning of the 6 week trial and at the end for consumers groups who consumed experimental Malvazija istarska and Teran wines and groups who consumed Malvazija istarska, Teran, Pošip and Plavac mali market wines (codes are listed in methodology). Data processing with ANOVA showed no statistical significant changes for all Malvazija istarska experimental

groups. The starting hypothesis about the possible differences at the beginning and end of the trial was not supported for the participants of Malvazija istarska experimental groups. Therefore we proceeded with ANOVA to estimate if the differences (end minus beginning grades) would show any significance for Teran. In the case of experimental Teran wines, two items showed statistically significant differences among groups: blood vessels health and micro region, and we observed both the increase and a decrease of the consumers' attitudes towards those items. For both items, in TM7, TM21, TM10B and TPHTB groups the attitudes increased, while in other consumers groups the attitudes decreased after consumption. However, the only significant difference was observed between TM7 and TPHT for blood vessel health, and in the case of micro region, between TM7, TM21, TM10B and TM21. Our starting hypothesis about the possible differences at the beginning and end of the trial was partly supported for the participants of Teran experimental groups.

For open market wines considerable more statistically significant differences occurred for wine items: natural beverage, general positive benefits, rise of mood, psychical condition (energy), pregnancy, and quality (PGI/PDO), regarding consumer's attitudes. In the case of general positive benefits item, consumer's attitudes increased after the consumption period in almost all consuming groups (MF,MA,TF,PF,PA,PMF,PMA). Similar results were obtained with the rise of mood item that showed an increase in several consuming groups (MA,TF,PA,PMF,PMA), while other groups showed a decrease in consumers' attitudes for the mood rise. For psychical condition (energy) few groups attitudes increased, MF, TF, PF, PA, PMA. For item pregnancy almost all groups increased except MA, TA. Regarding quality (PGI/PDO) item, consumers attitudes increased in almost every group (MA, TF, PF, PA, PMA, PMF). Therefore the starting hypothesis about the possible differences at the beginning and end of the trial was partly supported for the participants of the market wines experimental groups.

From the participants point of view the most important feelings that affected them during the six week trial of moderate wine consumption were both positive and negative feelings. The negative feelings were feeling anxious, feeling nervous, and feeling under pressure, while the positive feeling was feeling happy, a sense of personal good feeling. We assumed that there some correlation might exist between the positive and negative feelings with health benefits of wines. We also assumed that these correlations might be different and statistically significant among groups of moderate wine consumers, because they consumed different types of wines, therefore we have proceeded the data processing with correlations of wine health benefits and perceptions of negative and positive feelings.

There was no evidence supporting the starting hypothesis about the possible differences at the beginning and end of the trial for all the participants and their feelings. We presume that a six week period is too short to measure effects of wine on either negative or positive human feelings. Considering the negative feelings of anxiety, two consumer groups were more frequent in expressing positive health benefits of wines, namely the group MF and MC. The group MF and MC were more positive to general positive benefits (Cc=0.644, p=0.018; Cc=0.604; p=0.021), positive benefits on

neuro vegetative diseases (Cc=0.702, p=0.001; Cc=0.619; p=0.014), and rise of mood (Cc=0.639, p=0.022; Cc=0.579; p=0.036), while group MF perceived wine benefits also through blood sugar levels (Cc=0.641, p=0.020), while the group MC perceived positive benefits for memory (Cc=0.619, p=0.032).

The correlation of feeling nervous and positive health benefits of wine was most frequent for group M21. The group M21 consumed wine as part of healthy lifestyle (Cc=0.722, p=0.050) and estimated positive health benefits of wine through general positive benefits (Cc=0.729, p=0.048), hart health (Cc=0.753, p=0.020), blood vessels health (Cc=0.755, p=0.019), psychological health and memory (Cc=0.791, p=0.015), cholesterol levels in blood (Cc=0.671, p=0.021), body weight (Cc=0.818, p=0.003) and psychical condition - energy (Cc=0.824, p=0.002). The second most frequently correlated group was group MF for wines providing rest after work (Cc=0.738, p=0.002), providing general positive benefits (Cc=0.762, p=0.000), benefits for neurological diseases (Cc=0.722, p=0.005) and cholesterol levels in blood (Cc=0.671, p=0.021).

The feeling of pressure of every days life, were most elaborated by the group MC that estimated most frequently the positive effects of wine providing rest after work (Cc=0.706, p=0.032), diminishing the feelings of pressure-stress. Groups MF and TPHTB estimated that wine consumption provides a rise of mood, diminishing their stress (Cc=0.696, p=0.016; Cc=0.692; p=0.016). The group M7B estimated most frequently the positive health benefits of wine through positive benefit for hart health (Cc=0.733, p=0.050), blood vessels health (Cc=0.739, p=0.042), psychological health and memory (Cc=0.711, p=0.042), body weight (Cc=0.757, p=0.019) and psychical condition-energy (Cc=0.768, p=0.011). The second most frequently correlated group TAN stated positive effects for hart health (Cc=0.722, p=0.005), neurological diseases (Cc=0.678, p=0.025), cholesterol levels in blood (Cc=0.669, p=0.033).

From the findings of correlations between the negative feelings, such as anxiety, feeling nervous and under pressure-stress and wine, the results had shown that wine provides rest after work, rise of mood and was taken as a remedy to battle the negative effects of everyday life.

Correlations of positive feelings of happiness were more scattered so there was no particular group that stood out in the terms of frequency of statistically significant correlations. Just one group referred that wine is taken to enhance their mood (group TM21, Cc=0.677, p=0.047) and two groups used wine as remedy for rest after work (group MPB and MP, Cc=0.644, p=0.000; Cc=0.729; p=0.048). Health benefits were equally dispersed among all groups so each of them highlighted one health benefit.

Our starting hypothesis about the possible differences among groups was partly supported for the different groups consuming experimental wines. Since there were no consisted relations for all groups of wine consumers for all health benefits of wine, we proceeded with the data processing by comprising all groups and all wine consumers in one group, proceeding to factor analysis to estimate which particular wine items might show their importance for all wine consumers.

We have tried to evaluate our last hypothesis if all participants would share some similar opinions and attitudes, regardless the two referent time points (before/after) and regardless the type of wine consumed. We tested their opinions and attitudes about wine and health benefits, wine quality, labelling, positive and negative effects of wine and psychological well-being.

The exploratory factor analysis which was performed in data processing that measured wine quality, perceived positive and negative benefits of wine, motives of wine consumption, general and actual personal well-being. The final factor matrix model fit indices were acceptable, explaining 69.5% of variance and all items significantly loaded onto their respective latent construct and were higher than 0.40. Correlations were all positive and none of them were excessive.

The final factor matrix included a total of four factors (Table 3), which were named as follows; factor 1 positive health benefits of wine; factor 2 perceived wine quality; factor 3 perceived health risks of wine, factor 4 psychological affects/subjective well-being.

Table 3. Factor analyis of wine health benefits, risks, quality and percieved well-being

Factor	Item	Mean	SD	Standard load
F1 Wine health benefits perception	Heart health	3.6	1.03	0.870
	Blood vessels health	3.7	0.92	0.869
	Cholesterol levels in blood	3.4	1.10	0.822
	Psychological health and memory	3.4	1.10	0.808
	Blood sugar levels	3.2	1.14	0.806
	Neurological diseases	3.2	1.16	0.796
	Body weight	2.9	1.18	0.748
	Physical condition (energy)	3.0	1.20	0.733
	Metabolism	3.2	1.11	0.715
	I consume wine as part of healthy lifestyle	3.5	1.03	0.666
	Positive general effect on human health	3.9	0.92	0.663
	Good-happy personal feeling	3.7	1.01	0.504
	Wine is a natural beverage	4.0	1.06	0.475
	Rest after work	3.4	0.95	0.464
	Rise of mood	3.7	1.16	0.447
	Wine complexity - bouquet	4.1	1.03	0.434
	Wine anti-oxidative compounds	3.9	0.91	0.411
F2 Perceived wine quality	Micro region - vineyard	3.3	1.11	0.736
	Terroir	3.3	1.08	0.727
	Ageing	3.5	1.03	0.633
	Harvest/vintage	3.5	1.07	0.605
	Sugar content	3.3	1.08	0.537
	Quality (PGI/PDO)	3.6	1.03	0.427
F3 Perceived health risks of wine	Consumption with medicine	4.2	1.00	0.608
	Drinking and driving	4.4	0.99	0.565
	Pregnancy	3.9	1.20	0.556

Factor	Item	Mean	SD	Standard load
F4 Psychological well-being perception	Feeling nervous	4.5	0.74	0.552
	Anxious	4.7	0.66	0.496
	Under pressure/stressed	4.1	0.95	0.483
χ^2 = 720.98; dF = 465; p-value = 0.000; αF1=0.92; αF2=0.90, αF3=0.86, αF4= 0.80; KMO= 0.873				

Source: Authors survey

The first factor named "Positive health benefits" showed the most of importance, containing 17 items. The strongest factor loadings (above 0.8) were connected to the positive effects of wine on cardiovascular health (namely, heart, blood vessels health and levels of blood cholesterol) showing that respondents were highly aware of these health benefits. Further strong positive health benefits (above 0.7) were evident for the physical benefits, such as body weight, physical condition (energy) and metabolism. Wine was also perceived as a hedonic remedy providing a rest after work and a rise of mood. The actual psychological state of respondents during the survey showed that wine consumption enhances the current good-happy personal feeling. The utilitarian side of wine consumption was recognized through its positive general effects on human health, wine complexity – bouquet and wine anti-oxidative compounds.

In the factor 2 "Perceived wine quality", respondents showed awareness of wines quality attributes, whereas the micro region-vineyards and terroir were most important (above 0.7). These two quality attributes indicate that respondents were highly aware of the importance that wine is produced at a certain territory and to be distinguished among other wines (from other territories and countries). Ageing of wine and harvest as indicators of quality were also very highly ranked (above 0.6) revealing that respondents recognize the quality of wines changes with ageing (and enhances, especially for red aged wines) and that each harvest provides a different quality differing from year to year (depending on climatic circumstances, time of harvest).

Expressed preferences for dry wines indicated the awareness of this compound and forwarded their preferences toward dry wines (with low content of sugars) establishing healthy choices in wine consumption (less sugar - better for ones' health).

Wine quality was described by geographical indications (PGI/PDO, protected geographic origin/protected designation of origin), ageing/vintage, terroir, micro region/vineyards, which are according to the Croatian wine laws textually indicted on the wine bottle label. These indications were state controlled labels, pointing out the exact wine region where wine is produced and assuring procedures which producers should follow in order to obtain such a label. The factor loading of geographical indications showed that surveyed wine consumers estimated these features of high importance.

Factor 3 explained the possible negative effects of wine, named as "Perceived health risks of wine" and considered the need for the health warnings that will make consumers aware of these negative effects on human health. The respondents showed that the most important risks were related to wine consumption with medicine and driving vehicles

(do not drive and drink) and risks in pregnancy. In the future these statements may be used to recommend new proposals on wine labelling and may be used as an example of the Croatian population.

The last factor, factor 4 "Psychological affects/subjective well-being" described the current state of participants psychological well-being. Their perception of subjective well-being included negative stress affects during the survey, displaying participants expressed affects of being nervous, anxious and under pressure during the last month. These feelings of stress were explained by everyday pressures of work and family obligations. It should be noted that the construct of negative affects was separate from the positive affects expressed in factor 1. Although the participants expressed negative affects, due to external circumstances, they had no negative effects on the perception of positive health benefits of wine and wine quality perception (factor 1 and 2). The stress feelings were at least important in the factor matrix showing that moderate wine consumption diminishes profoundly the stress symptoms.

Discussion

Wine consumption in the case of Croatian participants' has indicated the rationality in taking choices how to consume wine and in which quantities. As a group, they have shown their similar behaviour confirming our main research goal in a positive sense. Their awareness about the importance of moderate wine consumption guided them to consume one or two decilitres a day in about ninety percent of cases. This respond with the suggestions of Goldberg et al. (2001) to the intake of one or two drinks a day with up to 60 mL of alcohol as health beneficial. Croatian participants had high levels of awareness about the "bad" influence of sugar and prevention of diabetes, therefore they most likely choose dry wines for consumption.

The study shown in this paper provides evidence that health benefits of wine were perceived mainly in a positive sense and with positive effects on primarily cardiac health and physical health. Wine consumers believed that wine consumption is beneficial and positive for their health, similar to findings of Vecchio et al. (2017).

The whole group of participants perceived that wine was a healthy product that may enhance a persons' health. The image of wine as a natural product, its smell and taste were highly validated. The familiarity with the healthy compounds of wine (antioxidants) was a prerequisite to the perception of healthy behaviour. Wine was perceived as a healthy indulgence in a way that it provided a rise of mood and after work remedy, within the frames of moderate wine consumption, supporting the results of Fiore et al., 2019. For a minor number of participants wine consumption was connected to social occasions such as festivities or special events indicating that wine may connect to certain life moments, similar to findings of Yang & Li (2019).

Appreciation of wine quality implies that Croats were highly aware of the characteristics of the local wines, emphasizing the micro region and terroir as important or very important. Moreover, the vintage and ageing of wines showed the inclination of

wine consumers to choose particular wines with features particular for a certain year of harvest or a result of ageing in the bottle or wooden barrel. These findings relate to wine quality dimensions expressed by Verdu Jover et al. (2004) and consumption habits findings of Hristov & Kuhar (2015) indicating preferences for certain wines in connection to healthy lifestyles.

Our findings confirm other surveys that point out importance of antioxidants in wine (Guilford & Pezzuto, 2011). Because of the large range of questions asked in the questionnaire and possible misunderstanding about certain antioxidants we did not refer in detail to antioxidants (in the ways Guilford & Pezzuto 2011 described particularly to flavonoids and non-flavonoids in wine such as melatonin, cathechins, ellagic acid, lutein, quercetin as potent antioxidants affecting LDL levels, cholesterol oxidation, platelet aggregation).

Evidence in our study about the awareness of positive effects of wine on body weight supported the thesis of Flechteur & Moss (2004) from a 3 month trial of white wine/ grape juice consumption.

The impact of wine on neurological disorders and cognitive diseases (dementia, stroke, Alzheimer) was also perceived in a positive way, similar to the survey of Anekonda (2006). Wine had not increased the negative feelings of psychological well-being of participants, but on the opposite it was consumed in order to battle the pressures of everyday life. Moderate wine consumption had relaxing effects on some groups and provided rise of mood and rest after work.

Awareness about side effects or possible negative effects of wine consumption were related to driving and to taking medicines, similarly to findings of Annunziata et al. 2016. The participants expressed their concern of taking wine during pregnancy, with medicines and about drinking and driving. Moreover, participants stated that in the future they expect some kind of tags, pictures or written explanations on the wine labels.

Considering these findings, we may suggest to producers and state authorities to add some written information on the wine labels similar to the ones in other European countries, such as Italy, France or Spain stated by Annunziata et al., (2016). Since consumers clearly recognized the health benefits and perceived them as important, this fact may be used for future health claims legislations and regulations that will provide positive statements on the wine labels indicating healthiness of moderate wine consumption. Therefore this study might be used as scientific evidence for developing further health claims for wine and for producers to create health enhancing properties of wines (wines with enhanced resveratrol). Possible use of this survey may be found additionally in creations of packages and/or labels which may boost the positive perception of wine and boost its perceived health benefits. Implicit visual images may attract more consumers to buy wine and use it more often as part of healthy behaviour.

Conclusions

The survey on moderate wine consumption in Croatia has indicated that in general wine is perceived in a positive sense as a natural and healthy beverage. The positive effects were expressed through positive wine health benefits and positive wine quality perceptions, while risks were perceived by certain health risks.

Our survey was country specific and may be diverse in other countries due to differences in cultural and societal background, consuming patterns which originate from cultural influences of wine consumption, traditional diets that contain wine, societal influence of wine connected to social occasions (festivities, family gatherings). This survey, although specific may be useful for future wine surveys in the Mediterranean area, where wine is considered as part of balanced diet and healthy life style.

Due to the fact that Croatian consumers appreciated health benefits of wine to improve their health status, and/or reduce health risks/diseases in the future, a correct communication of these effects should be addressed in public, trust and credibility of expected benefits should be highlighted and existing product safety remained.

For the ongoing discussions at the legal authorities on the European and Croatian state level about the safety of agricultural products, this survey might be used as one of the guidelines. The existing regulations that define wine in Croatia as a food item should remain and may be improved by regulations that state both positive and negative effects of wine on human health expressed on wine labels and packages.

Acknowledgements

This work has been supported by the Croatian Science Foundation under the project „Influence of different vinification technologies on the qualitative characteristics of wines from Croatian autochthonous varieties: the role of wine in human diet “ VINUM SANUM (IP-2018-01-5049).

Authors contributions

CRediT roles: Anita Silvana Ilak Peršurić: Conceptualization, Investigation, Methodology, Formal analysis, Data curation, Writing – original draft; Sara Rossi: Writing – review & editing. Ena Bestulić: Writing – review & editing. Sanja Radeka: Resources, Writing – review & editing, Supervision, Project administration.

Conflict of interests

The authors declare no conflict of interest. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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APPENDIX

Table 1. Market wines consumers groups - grades for wine items

Wine type* / **Item**	**MF**	**MA**	**TF**	**TA**	**PF**	**PA**	**PMF**	**PMA**	**S**
Rest after work	-0,57 ± 0,79**ab**	0,29 ± 0,95**a**	-0,29 ± 0,95**ab**	-1,43 ± 2,44**b**	0,14 ± 0,38**a**	0,14 ± 1,95a	0 ± 0,58**a**	0 ± 0**a**	
Natural beverage	-0,57 ± 1,4**b**	0,14 ± 0,69**ab**	0,71 ± 1,38**a**	-1 ± 1,73**b**	0,14 ± 0,38**ab**	0,57 ± 1,27**ab**	0 ± 0,58**ab**	0,13 ± 0,83**ab**	
General positive benefits	0,43 ± 2,44**a**	0,43 ± 0,79 **a**	0,43 ± 0,53 **a**	-1,14 ± 1,68**b**	0,29 ± 0,49 **a**	0,71 ± 1,6 **a**	0,29 ± 0,76 **a**	0,25 ± 0,71 **a**	
Rise of mood	-0,14 ± 1,46**ab**	0,86 ± 1,07**a**	0,14 ± 1,35 **ab**	-1 ± 1,41**b**	-0,14 ± 1,07 **ab**	0,29 ± 1,89 **ab**	0,57 ± 1,27**a**	0 ± 1,41 **ab**	
Body weight	-0,43 ± 0,98	0,14 ± 1,57	-0,57 ± 0,98	-0,57 ± 1,27	0,57 ± 0,98	0,57 ± 1,13	0,14 ± 0,9	0,38 ± 0,74	ns
Psychical condition (energy)	0,29 ± 1,25 **ab**	-0,29 ± 1,25 **ab**	0,14 ± 1,07 **ab**	-0,86 ± 1,57**b**	0,29 ± 0,95 **ab**	0,29 ± 1,89 **ab**	-0,14 ± 1,35 **ab**	0,75 ± 0,89**a**	

Wine type* / Item	MF	MA	TF	TA	PF	PA	PMF	PMA	S
Pregnancy	0,14 ± 1,46**a**	-0,14 ± 1,95 **ab**	0,71 ± 0,49 **a**	-1,57 ± 2,15 **b**	0,57 ± 0,79 **a**	1,43 ± 1,72 **a**	0,14 ± 1,21 **a**	0,38 ± 1,6 **a**	
Micro region	-1,14 ± 1,95**c**	-0,14 ± 0,69**abc**	0,57 ± 0,98**a**	-1 ± 2,16**bc**	0,43 ± 1,72**ab**	1 ± 1,41**a**	-0,14 ± 1,35**abc**	0 ± 0,76**abc**	
Quality (PGI/PDO)	-0,71 ± 1,38**bc**	0,57 ± 0,98**ab**	0,29 ± 1,11**ab**	-1,43 ± 1,9**c**	0,14 ± 1,07**ab**	0,71 ± 1,5**a**	0 ± 0,58**ab**	0,25 ± 0,71**ab**	

Differences for items on start/end of moderate wine consumption: differences low case letter represent statistical significant differences (S) between groups at $p<0.05$ level obtained by one way Anova. *Source:* Authors' calculations

Table 2. Correlations of feeling anxious and health benefits of wine

Feeling anxious and health benefits of wine	Wine type*	χ^2	dF	Cc	p
General positive benefits	MF	18.4	8	0.644	0.018
	MC	9.7	3	0.604	0.021
Rise of mood	MF	17.9	8	0.639	0.022
	M7B	12.1	6	0.634	0.050
	MF	8.5	3	0.579	0.036
	TM7	13.4	6	0.654	0.037
Positive for hart health	MC	10.5	4	0.619	0.032
	TM7	12.4	6	0.640	0.050
Positive for memory	MC	10.5	4	0.619	0.032
Positive for neurovegetative diseases	MF	25.2	8	0.702	0.001
	MC	10.5	3	0.619	0.014
Blood sugar levels	MF	18.1	8	0.641	0.020
	M7B	15.6	8	0.682	0.047
Body weight	M21	15.3	8	0.711	0.050
	M7B	16.5	8	0.692	0.036
	TM10B	15.8	8	0.665	0.044
Psychical condition (energy)	M21	16.7	8	0.726	0.033
Metabolism	M7B	19.8	8	0.724	0.011

Source: Authors' calculations

Table 3. Correlations of feeling nervous v.s health benefits of wine

Feeling nervous and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Rest after work	MF	31.0	12	0.738	0.002
	M21	18.1	9	0.740	0.033
	M1	21.8	12	0.750	0.039
I consume wine as part of healthy lifestyle	M21	16.3	9	0.722	0.050
	M1	25.7	12	0.776	0.012
General positive benefits	MF	35.9	12	0.762	0.000
	M21	17.0	9	0.729	0.048
Hart health	M21	19.6	9	0.753	0.020
	TM10B	22.2	12	0.726	0.035

Feeling nervous and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Blood vessels health	M21	19.8	9	0.755	0.019
	TM10B	22.2	12	0.726	0.035
Psychological health and memory	M21	25.0	12	0.791	0.015
	TM10B	27.0	12	0.758	0.008
Neurological diseases	MF	28.2	12	0.722	0.005
Blood sugar levels	M1	21.9	12	0.750	0.039
Cholesterol levels in blood	MF	21.3	9	0.671	0.021
	M21	22.0	4	0.771	0.035
	M7	9.9	4	0.618	0.042
	M7	9.1	8	0.603	0.003
	TM10B	22.8	12	0.730	0.030
Body weight	M21	30.3	12	0.818	0.003
	MP	9.4	4	0.622	0.050
Psychical condition (energy)	M21	31.7	12	0.824	0.002
	MM7B	20.7	12	0.732	0.055

Source: Authors' calculations

Table 4. Correlations of feeling under pressure v.s health benefits of wine

Feeling under pressure/stressed and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Rest after work	MC	16.8	8	0.706	0.032
Rise of mood	MF	24.4	12	0.696	0.018
	TPHTB	15.6	6	0.692	0.016
Wine is a natural beverage	M7B	21.0	12	0.734	0.050
	MC	20.6	9	0.741	0.014
I consume wine as part of healthy life style	PF	22.4	12	0.785	0.033
	TM21	16.7	9	0.727	0.050
General positive benefits	TM10	8.0	2	0.707	0.018
	MC	19.7	9	0.733	0.019
Hart health	TAN	18.5	6	0.722	0.005
	M7B	20.9	12	0.733	0.050
Blood vessels health	MC	18.1	6	0.719	0.006
	M7B	1.6	12	0.739	0.042
Psychological health and memory	M7B	21.6	12	0.711	0.042
Neurological diseases	MC	14.4	6	0.678	0.025
Cholesterol levels in blood	MC	13.7	6	0.669	0.033
	M1	18.6	9	0.723	0.028
	PA	21.3	12	0.788	0.045
Body weight	M7B	24.2	12	0.757	0.019
Psychical condition (energy)	M1	22.2	12	0.753	0.035
	M7B	25.8	12	0.768	0.011

Source: Authors' calculations

Table 5. Correlations of feeling good – happy v.s health benefits of wine

Feeling good-happy and health benefits of wine	**Wine type***	χ^2	**dF**	**Cc**	**p**
Rest after work	TAN	12.0	16	0.644	0.000
	MC	17.0	9	0.729	0.048
Rise of mood	TM21	5.4	6	0.677	0.047
General positive benefits	M21B	25.7	12	0.776	0.012
	M7	9.9	4	0.619	0.042
	TAN	25.7	16	0.776	0.050
Blood vessels health	TPHTB	19.2	9	0.729	0.023
Psychological health and memory	TM21	14.9	8	0.643	0.050
Neurological diseases	MC	16.4	9	0.701	0.050
Blood sugar levels	TA	18.6	9	0.509	0.029
Neurological diseases	MC	16.4	9	0.701	0.050
Body weight	LH	21.0	12	0.764	0.050

Source: Authors' calculations

*The Malvazija istarska wines were produced in vinification treatments: (MC) control treatment without maceration, (TAN) treatment without maceration with the addition of tannin, (M1) pre-fermentatitive cold 1-day maceration, (M7) 7 days maceration, (M21) 21 day maceration and (LH) late harvest grape vinification. Three of these wines were aged in barrique barrels and named M7B, M21B, LHB.

The Teran wines were produced in vinification treatments: TPHT 48h prefermenative heating at 45 degrees, followed by 8 day clasical maceration, (TM7) control treatment with 7 days of maceration, (TM10) prolonged 10 day maceration, (TM21) prolonged post-fermentative 21 day maceration. These wines were aged in barrique barrels and named TPHTB, TM7B, TM10B, TM21B.

The wines bought from the open market were MF (Malvazija fresh), MA (Malvazija aged), TF (Teran fresh), TA (Teran aged), PF (Pošip fresh), PA (Pošip aged), PMF (Plavac fresh), PMA (Plavac aged).