The Composition of Bioactive Compounds in Wine and Their Possible Influence on Osteoporosis and on Bone Consolidation

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Given that bone consolidation (callus formation) has two important phases in terms of vascular factors, the inflammatory phase and the vascular invasion phase, on the one hand, and, the existence of biologically active compounds in the composition of wine (compounds that influence inflammation and vascular development), on the other hand, we can conclude that there is definitely a link between wine consumption and bone consolidation or bone structure. Considering the idea stated above, in conducting our research we have pursued the following objectives: to set thresholds for defining occasional and chronic alcohol consumption, according to literature; to investigate how chronic or occasional wine consumption and non-consumption influence bone quality; to investigate how chronic or occasional wine consumption and non-consumption influence the conformation of trajectories of distal radius fractures (DFRs); to investigate the secondary displacement of DFRs in chronic or occasional wine consumers and nonconsumers; to determine the phenolic composition for a number of five wines of designated origin. There is certainly a positive influence in the bone consolidation process in people who chronically or occasionally consume wine compared to the other population groups. The substantial accumulation of phenolic compounds in red wines recommends their consumption for curative purposes.

Key words: alcohol consumption, bone consolidation, influence of phenolic compounds, osteoporosis, biologically active compounds in wine

The research was conducted in compliance with the legislation in force. The studies were carried out considering all ethical aspects (issues that confer legitimacy) and in compliance with law 677/2001 on the protection of individuals with regard to the processing of personal data and the free movement of such data.

Given that bone consolidation (callus formation) has two important phases in terms of vascular factors, the inflammatory phase and the vascular invasion phase ([1],on the one hand, and, the existence of biologically active compounds in the composition of wine (compounds that influence inflammation and vascular development) [2], on the other hand, we can conclude that there is definitely a connection between wine consumption and bone consolidation or bone structure [3]. Considering the idea stated above, in conducting our research we have pursued the following objectives:

-to set certain thresholds for defining occasional and chronic alcohol consumption, according to literature;

-to investigate how chronic or occasional wine consumption and non-consumption influence bone quality;

-to investigate how chronic or occasional wine consumption and non-consumption influence the conformation of trajectories of DFRs;

-to investigate the secondary displacement of DFRs in chronic or occasional wine consumers and nonconsumers;

-to investigate how chronic or occasional wine consumption and non-consumption influence the functional recovery of the wrist after a DFR;

-to introduce the results obtained in a statistical analysis program;

-to determine the phenolic composition for a number of five wines of designated origin.

Experimental part

Materials and methods

Phenolic compounds play an important role in the formation of wine aromas but also in strengthening the health of consumers [4]. The most commonly found in grapes are hydroxybenzoic and hydroxycinnamic phenolic acids, which by esterification with wine alcohols form specific flavor compounds, such as methyl and ethyl vanillates, ethyl cinnamate (Methyl trans-3-phenyl-propionate) [5].A precursor of ethyl cinnamate is ferulic acid which intensifies the fruity attribute of the final wine, together with thiol compounds such as mercapto-pentanone, which reacts with the oxidized phenolic compounds (tinons) [6]. The aromatic profile of wines is closely linked to the area of origin of the grapes, but also depends on soil structure and soil and climatic factors [7]. This study proposes an evaluation of phenolic compounds in wines from Iasi area, a prestigious wine region, well known both nationally and internationally.

The following have been analysed:

Feteasca Regala wines (FR), Feteasca Alba (FA), Italian Riesling (RI), white varieties from the 2010 production, Iasi vineyard;

Feteasca Neagra wines (FN) and Babeasca Neagra (BN), red varieties from the 2010 production, Iasi vineyard.

The method of identifying and quantifying the phenolic compounds consisted in directly injecting in the chromatographic column of the HPLC Agilent 1200

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cromatograph equipped with autosampler and UV-Vis detector set at 220 nm.

Column equilibration takes about 10 minutes, and then the injection can be achieved. The chemical compounds and the solvents used were analytical pure grade and ultrapure water was used for dilutions obtained by purification with the Milli-Q system (Millipore, Bedford, MA), with a maximum resistivity of 18.2 MΩ/cm.

The standards for phenolic compounds (gallic acid, syringic acid, p-coumaric acid, (+)- catechin, quercitin, rutin and vanillin (-)-epicatechin, resveratrol) were purchased from Sigma-Aldrich (Steinheim, Germany).

Standard base solutions were made by accurately weighing about 10 mg of each phenol in a 25 mLvolumetric flask, and then dissolving it in 10 mL of methanol. The working standards were obtained by dilution of standard base solutions in the same solvent. Both the standard base solutions and the working standards were kept at 4°C.

Separation of the phenolic compounds was performed using a method previously optimized (80), on an Aquasil C18 column (5μm, 250 x 4.6 mm), while maintaining a flow rate of the mobile phase of 1 mL / min, at a temperature of 30 °C.

The mobile phase consists of two solvents, solvent A water/acetic acid (98:2 v/v) and solvent B methanol/ solvent A (60:40 v/v) under a gradient elution program, as follows: initial condition 0% solvent B, after 5 min from 0 to 10% solvent B, followed after 15 min by 10-20% solvent B, 20-30% solvent B for 15 min and 30-40% solvent B for another 15 min, then return to initial conditions.

Identification of phenolic compounds was made by comparing retention times with those of the standard.

Individual quantification of phenols was performed using the calibration curves obtained for each standard.

In this work, a series of 3773 cases of DFRs were analyzed out of a total of 21 512 cases diagnosed with fractured limbs. As can be seen, the percentage of DFRs from the total number of fractures is 17.53%, slightly above the average of 15% reported in the literature. All patients expressed their informed consent for treatment and for inclusion in the present study. All consent forms are kept in the hospital archives, as required by law.

The cases were recorded between November 2009 and June 2013. Out of this series of cases, 366 were hospitalized and underwent surgical intervention. The remaining 3407 cases received conservative treatment.

In this study, two classifications of fractures of the distal radius were used. The first classification used was the AO Foundation classification (Arbeitsgemeinschaft für Osteosynthesefragen), an alphanumeric classification which characterizes all bone fractures of the body. We used this classification, although it is only of didactic interest for our study because it is a global classification, accepted worldwide and enabling a better quantification in statistical terms of the cases observed.

The second classification we used in the present study was Kapandji's classification, which, although older and having some disadvantages in terms of establishing very clear therapeutic protocols, is more appropriate for several considerations for the objectives of this research. This classification divides DFRs in 12 types depending on the trajectory of the fracture and its degree of stability. As shown in other studies, in the case of fractures, the trajectory depends on the energy of the trauma and the fragility of bone [8]. Therefore, if the energy of the trauma is invariable, the complexity of fracture trajectories is inversely proportional to the toughness of the bone and directly proportional to its fragility, which is fully in line with the objectives of this study.

The cases included in this study were functionally evaluated periodically after the removal of immobilization. The assessments were performed weekly during the first month, and at 2, 3, 6 and 12 months afterwards. The parameters quantified were: pain perception, amplitude of the flexion-extension movement, amplitude of the adduction-abduction movement. The functional evaluation was necessary to assess the clinical evolution during the period of functional enabling.

Additionally, for case evaluations, the MAYO score (Mayo Wrist Performance Score) [9] was also used to assess the functionality of the wrist. This score assesses four aspects in the evaluation of the wrist: pain perception, functional status, movement amplitude compared to that of the normal contralateral limb, or, if that is not possible, movement amplitude by measurement of the amplitude of the angles described, gripping ability. The functional status is very important to assess the dominant limb.

Selection criteria

Depending on the objective, the cases were selected by age, in order to exclude influences due to the onset of osteoporosis [10]. Cases which received medication that favors the onset of osteoporosis were excluded from the study [11]. The functional assessment excluded cases in which conservative treatment was converted to surgery. Also excluded from the study groups were cases of initial high energy trauma. Furthermore, in cases when the cast was removed to eliminate compression phenomena, functional evaluation and evaluation of secondary movements were not considered. When no satisfactory radiological results were obtained after orthopedic reduction in patients who presented late to the orthopedic trauma service, the cases were not quantified in the following evaluations. Cases presenting psychiatric disorders or mental retardation as associated pathology, which prevented an appropriate functional rehabilitation, were also excluded from the study groups. Deaths during the assessment period and iterative fractures were excluded from the groups under functional assessment. Cases in which a moderate or a chronic consumption of other alcoholic beverages was identified were eliminated from the study groups. Patients who were occasional consumers of other alcoholic beverages were classified as nonconsumers.

Assessment of alcohol consumption

To achieve the objectives set for this research, it is necessary to clearly define the categories of wine consumers. The best method of assessment is to assess the amount of alcohol ingested by subjects [12,13]. This assessment was based on studies conducted by the research teams regarding the thresholds of alcohol ingestion relating to its harmfulness [14,15], mainly due to the effect that ethanol has on human liver [16,17].

All this considered, we defined four study groups observing the following definitions [18,19]:

- the chronic alcohol consumer is the subject who ingests an amount of at least 60 grams of pure alcohol every day. Since wine has an average concentration of 11% ABV and the density of pure alcohol is 0.8, to exceed that threshold the consumer would need to drink over 750 mL of wine daily;

- moderate wine consumption is defined as the ingestion of 30 to 60 g of pure alcohol every day. Transforming this amount in ml of wine, we obtained a value of 400 to 750

mL, which defines moderate consumption of this beverage;

- the occasional alcohol consumer is defined as the subject who ingests less than 30 g of pure alcohol [20]. If this consumption is converted in ml of wine, it means an amount of not more than 400 ml. It should be noted that, in this category of subjects, the alcohol needs to be ingested at least four days per week;

- the occasional consumer or the nonconsumer belongs to the category of subjects who consume alcohol only occasionally, without excesses, and their daily alcohol consumption does not exceed 3 days a week [21].

Observations:

- the quantities of alcohol as defined above refer to an average daily consumption of alcohol but do not presume it;

- the amounts of alcohol as defined above are halved for females, in accordance with international conventions regarding the assessment of alcoholism and its effects.

Some authors also accept the definition of the occasional consumer as the consumer who does not exceed the amount 10 g of pure alcohol every day, daily intake accepted [22]. As far as we are concerned, we considered this last category as occasional consumers, since the purpose of the study is to assess the effects of metabolically active compounds, not to determine the effect of alcohol on the subjects. From this point of view, we believe that a glass of wine daily brings a sufficient intake of resveratrol, estrogen or quercetin to be considered a constant consumption of substances that may influence bone metabolism [23,24]. The effects of alcohol on the modification of gastric pH change and on the favoring of *Helicobacter Pylori* infection should also be considered [25,26].

To get a first idea about the relationship between the complexity of fracture and the different types of wine consumers, we will use a descriptive exploratory technique, the correspondence analysis. The results offered by this technique are similar in nature to those provided by factor analysis. The correspondence analysis is a technique that applies only to categorical variables, allowing us to explore the structure of variables and the relationships between them [27].

For result interpretation, we will consider several significations of some values based on which the interpretation of results is achieved:

Mass = total number of rows or columns for the table of relative frequencies;

Quality = quality of representation of a point – the higher the value, the better the representation of that point;

Relative inertia = proportion of total inertia explained by that point;

Relative inertia for each size = relative contribution of that point to the inertia explained by that size;

Cosine^2 = correlation point- size. The higher this value, the more important the definition of that size by that point.

Results and discussions

Evaluation of ecoclimatic parameters of Iasi Vineyard

The mean temperature value in the region of Ia^{o}i was 9.7 °C in 2010, 9.2 °C in 2011, and 9.3 °C in 2012. It can be said that the average value for the three years under study was 9.4 °C.

During the growing season, the sum of temperatures reached 3187 °C in 2010, 3129 °C in 2011, and 3160 °C in 2012, so that the average for the three years monitored was 3159 °C. Regarding the number of hours of insolation, this was 1462 in 2010, 1434 in 2011 and 1452 in 2012. This was beneficial for the grape production and very good quality wines were obtained.

Rainfall proved to be moderate, with lower averages in 2010 of 545 mm, 573 mm in 2011, while in 2012 it reached an optimum average of 565 mm. This led to an annual average of 562 mm over the three years taken into account.

Rainfall during insolation showed average values around 354 mm in 2010, 378 mm in 2011 and 366 mm in 2012, the latter year being considered one of the best harvest years.

The average value for this indicator over the three years under study was 366 mm.

The oenoclimatic aptitude index recorded values of 4407 in 2010, 4402 in 2011 and 4401 in 2012, the average value for the three years being 4433.

The wines produced in the Ia^{o}i vineyard are generally subtle, less extractive, not very acidic, with a lower concentration of alcohol, but full of flavor and taste.

In this vineyard, the grapevine culture is beneficial and productive in the sunny plateaus and the basins in secondary valleys.

Overall, the vineyards have a northern orientation, but benefit from shelter from the air masses from the north or the north east, placed under the foehn effect of the southern and western air masses blowing from the high plateau towards the corridor of Bahlui and Prut rivers.

Identification and quantification of phenolic compounds in white and red wines from the Iasi vineyard

The table below presents the phenolic compounds identified in white wines, such as Feteasca Regala, Feteasca Alba, Italian Riesling, and red wines, such as Feteasca Neagra and Babeasca Neagra, all of them production 2010.

Table 1 Identification and quantification of phenolic compounds in red and white wines production 2010 under study (Feteasca Regala, Feteasca Alba, Italian Riesling, Feteasca Neagra and Babeasca Neagra).

It can be noted that the amount of anthocyanins in the wines under study shows very different values depending on the variety of grape, the lowest values being recorded in white wines.

This way, the variety Feteasca Regala records a value of 177.002 mg/L, Feteasca Alba 189.089 mg/L, and the variety Riesling Italian, 185.451 mg/L. It is noted that the lower value is recorded for white wines (Feteasca Regala), and the highest value for Feteasca Alba.

As regards the amount of anthocyanins in red varieties, it can be said that it is between generous values of 646.045mg/L for Feteasca Regala and 678.033 mg/L for Babeasca Neagra.

Analyzing the content of anthocyanins in terms of anthocyanin fractions, it can be noted that *malvidol* ranges for white wines between 112.334 mg/L for Feteasca Regala and 128.783 mg/L for the Italian Riesling variety.

Values found for red varieties range between 429.887 mg/L for Fetasca Neagra and 442.732 mg/L for Babeasca Neagra.

The values define both the variety of grapes from which the wine was produced and their area of origin.

Petudinol has been identified in close amounts in white wines, these values ranging between 22.578 mg/L for Italian Riesling and 23.443 mg/L for Feteasca Alba. Red wines had values of about four times higher than the white ones, petudinol being present in the amount of 82.131 mg/L in Feteasca Neagra and 89.412 mg/L in Babeasca Neagra. Regarding *delfinidol*, the values obtained were 45% lower than petunidol for white wines, and approx. 53% for the red ones. This way, it is noted that this anthocyanin

TOTAL mg/L ppm		FR	FA	RI	FN	BN
		177.002	**189.089**	**185.451**	**646.045**	**678.033**
Anthocyanins	Malvidol	112.334	121.325	128.783	429.887	442.732
	Petunidol	22.675	23.443	22.578	82.131	89.412
	Delfinidol	13.771	14.774	10.931	49.812	48.391
	Cianidol	7.213	7.998	5.834	18.778	19.721
	Peonidol	21.009	21.549	17.325	65.437	77.777
Flavans	**TOTAL**	**0.178**	**0.273**	**0.287**	**2.652**	**2.983**
	Epicatechin	0.122	0.197	0.123	1.389	1.667
	Catechin	0.031	0.056	0.097	1.117	1.121
	Gallocatechin	0.009	0.011	0.56	0.025	0.056
	Epigallocatechin	0.016	0.009	0.011	0.121	0.139
Flavones and Flavonols	**TOTAL**	**0.368**	**0.428**	**0.513**	**18.400**	**18.768**
	Quercetin	0.019	0.023	0.056	5.872	5.114
	Kaempferol	0.011	0.013	0.023	1.334	1.211
	Myricetin	0.034	0.029	0.037	0.995	0.892
	Isorhamnetin	0.011	0.021	0.009	0.763	0.552
	Rutin	0.293	0.342	0.388	9.436	10.999
Phenolic acids	**TOTAL**	**31.721**	**33.825**	**46.667**	**49.979**	**63.471**
	Caftaric acid	0.111	0.123	0.152	0.994	0.781
	Gallic acid	0.324	0.297	0.444	4.456	5.721
	Caffeic acid	0.229	0.528	0.429	2.997	3.323
	Vanillic acid	10.923	11.452	11.449	12.093	13.756
	Syringic acid	20.134	21.425	34.193	29.439	39.89
Microphenolic compounds	**TOTAL**	**30.189**	**28.976**	**26.476**	**85.145**	**100.907**
	Shikimic acid	29.078	27.983	25.561	41.223	51.892
	Resveratrol	1.111	0.993	0.915	43.922	49.015

Table 1
CONCENTRATION OF PHENOLIC COMPOUNDS

component ranges between 10.931mg/L and 14.774 mg/L for white wines, and between 48.391 mg/L and 49.812 mg/L for red wines. *Cianidol* is a compound that is characterized by low values, as follows: 5.834 mg/L for Italian Riesling, 7.213 mg/L for Feteasca Regala and 7.998 mg/L for Feteasca Alba. It is noted that the values for Feteasca Regala and Feteasca Alba are fairly close, while those for Italian Riesling are lower by 20%. Red wines accumulate concentrations ranging from 18.778 mg/L for Feteasca Neagra to 19.721 mg/L for Babeasca Neagra. The values of *peonidol* approach those of petunidol, the differences being of the order of 9-10%. These values are in the range of 17.325 mg/L and 21.549 mg/L for white wines and between 65.437 mg L and 77.777 mg/L for red wines.

Flavans are an important segment in terms of the potential taste of wines, even if the values identified range between 0.178 mg/L and 0.287 mg/L for white wines, and 2.652 mg/L and 2.983 mg/L for red wines. The flavan composition of wines under study shows that the most significant values are found for *epicatechin*, which ranges for white wines between 0.122 mg/L for Feteascã Royal and 0.197mg/L for Feteasca Alba. Red wines are 10-12 times richer in epicatechin than white ones, so that the values determined are between 1.389 mg/L for Feteasca Neagra and 1.667 mg/L for Babeasca Neagra. *Catechin*, *gallocatechin* and *epigallocatechin* have subunitary values for all white wines. For red wines only catechin records values over 1, between 1.117 mg/L and 1.121 mg/L.

Flavones and flavonols are present in subunitary amounts in white wines, with values between 0.368 mg/L and a maximum of 0.513 mg/L. On the other hand, red wines reach values of up to 18.400 mg/L for Feteasca Neagra and 18.768 mg/L for the Babeasca Neagra variety. In this case, *quercetin* and *rutin* show the highest values (5.114 mg/L, 5.872 mg/L, respectively 9.436 mg/L-10.999 mg/L).

The values for phenolic acids are in the shape of an ascending line, starting from 31.721 mg/L for white wines (Feteasca Regala) and reaching a double in red wines (Babeasca Neagra). This distinguishes the *caftaric acid*, which ranges between 0.111 mg/L for Feteasca Regala and 0.152 mg/L in the case of Italian Riesling. Red wines show accumulations of caftaric acid ranging from 0.781 mg/L for Babeasca Neagra to 0.994 mg/L for Feteasca Neagra. *Gallic acid* is subunitary for white wines, reaching values of 4.456 mg/L and 5721 mg/L, respectively, for red wines.

Vanillic acid maintains at similar values for all the varieties under study, being quantified between 10.923 mg/L and 13.756 mg/L. Feteasca Alba and Italian Riesling show a very close quantification, with values around 11.450 mg/L. Another important phenolic compound with significant relevance for the characterization of a variety of wine is *syringic acid*. The values determined in this case range between 20.134 mg/L and 21.425 mg/L for Feteasca Regala and Feteasca Alba, with a 70% higher value for Italian Riesling. Red wines show interesting values, namely: Feteasca Neagra shows an amount of 29.439 mg/L, lower

than Italian Riesling. The value for Babeasca Neagra doubles at 39.890 mg/L compared to the white wine Feteasca Regala. Actually, all of these determined components (caftaric acid, gallic acid, caffeic acid, vanillic acid, syringic acid) lead to the formation of a particular aromatic palette for each variety of wine. The ratios in which these compounds are found lead to the personality of each wine variety, to the creation of a typical flavor that also results in a wide variety in this area.

Microfenolic compounds largely participate in the harmonious completion of a wine's flavor, and has significant implications for the health of the human body. It is found that these compounds accumulate at values of 26.476 mg/L (Italian Riesling), the lowest value, up to 30.189 mg/L (Feteasca Regala), the highest value for the white wines under study. In contrast, red wines show accumulations of microfenolic compounds of 85.145 mg/L (Feteasca Neagra), up to values of 100.907 mg/L (Babeasca Neagra), about 3-4 times higher than in the case of white wines.

Shikimic acid values are within the range of 25.561 mg/L for Italian Riesling and 29.078 mg/L for Feteasca Regala. These values are 40%-50% lower than those detected in red wines. They show an accumulation of 41.223 mg/L up to 51.892 mg/L of shikimic acid in Feteasca Neagra and Babeasca Neagra. *Resveratrol* is one of the compounds with well defined relevance for human health, its characteristics being well known and appreciated. Resveratrol is very low in white wines, around 1 (0.915 mg/L, and 1.111mg/L). On the other hand, red wines show a accumulation of up to 43.922 mg/L for Feteasca Neagra and 49.015 mg/L for Babeasca Neagra, which is particularly beneficial for the quality of red wines. All of these components, and also others, help producing particularly fine wines, of a pleasant color, ruby-red, with a characteristic taste and frutty flavor: cherries, cranberries, raspberries, vanilla and hazelnuts.

Study on the trajectory of fractures

As shown above, *there is an increased rate of wine consumption in rural areas [28,29]. People consume mainly wine produced in their own household.*

In this paper we recorded a total of 3773 cases of fractures of the lower end of the radius. Of these, 2111 (55.95%) were females and 1662 (44.05%) were men, a normal distribution in the general population. According to the distribution by age groups, a distribution of this type of fracture in Age Group III can be noted.

Fractures were divided into study groups, as classified by Kapandji, and depending on the category of wine consumption (table 2).

The analysis of the data obtained shows that the incidence of complex fractures is lower in wine consuming population. The data was introduced into a statistical analysis program.

Functional outcomes

Functional outcomes were assessed only for 3 of the types of the Kapandji classification of DFRs, types 0, 1 and 2. The other types of fracture, although the functional outcomes were quantified, will not be subject to these discussions because we believe that the groups are not representative for a correct assessment.

In the group for which the functional outcomes of Kapandji type 0 fractures were quantified, after eliminating patients who abandoned the programme of functional rehabilitation, a total of 412 cases were recorded, of which 184 patients were sporadic wine consumers or nonconsumers, or consumers of other alcoholic beverages, 108 declared themselves occasional wine consumers, 59 moderate consumers and 61 reported exceeding the threshold for chronic alcohol (wine) ingestion. Mention must be made that, for these cases, the cast immobilisation period was 30 days. The functional rehabilitation for all four study groups worked well and very well. All groups registered similar values, with no significant differences between the parameters quantified. However, it should be

Kapandji classification	Nonconsumers	Occasional wine consumption	Moderate wine consumption	Chronic wine consumption	Total number of cases
Type 0	226	132	73	76	507
Type 1	148	99	66	73	386
Type 2	343	123	51	50	567
Type 3	346	51	41	38	476
Type 4	341	66	48	46	501
Type 5	25	10	21	40	96
Type 6	14	13	11	13	51
Type 7	17	20	19	12	68
Type 8	7	8	7	7	29
Type 9	810	68	79	94	1051
Type 10	39	0	1	1	41

Table 2
DISTRIBUTION OF FRACTURES OF THE LOWER END OF THE RADIUS DEPENDING ON THE KAPANDJI CLASSIFICATION AND WINE CONSUMPTION

noted that, for moderate wine consumers, the results were closer to *restitutio ad integrum*. The obtained data was processed with a statistical analysis program.

The group with fractures of Kapandji type 1 of the lower end of the radius, after the elimination of cases that have dropped out of the functional rehabilitation program and of those in which the reduction was not acceptable or could not be achieved after secondary displacements, included a total of 313 cases of which 120 cases were sporadic wine consumers or nonconsumers or consumers of other alcoholic beverages, 80 cases declared themselves occasional wine consumers, 54 moderate consumers and 59 reported exceeding the threshold for chronic alcohol (wine) ingestion. As can be seen, functional rehabilitation for all four study groups worked well and very well. All groups registered similar values, with no significant differences between the parameters quantified. However, fractures in the moderate wine consumer group have apparently evolved much better, almost similarly to the fractures without displacement. The obtained data was processed with a statistical analysis program to highlight their significance.

In the group with fractures of Kapandji type 2 of the lower end of the radius, after the elimination of cases that have dropped out of the rehabilitation program function and of those in which the reduction was not acceptable or could not be achieved after the secondary displacements, the remaining number of 460 cases, of which 278 cases were occasional wine consumers or nonconsumers or consumers of other alcoholic beverages, 101 declared themselves occasional wine consumers, 41 moderate consumers and 40 reported exceeding the threshold for chronic alcohol (wine) ingestion.

Conclusions

The phenolic compounds identified in white varieties had values that lead to flavors typical to these species. For red wines, these compounds lead to their varietal discrimination so that it can be said that the gallic acid, catechin, epicatechin, rutin, quercetin and resveratrol are key elements in their aromatic characterization. The quantification of phenolic compounds in white wines is much lower than in the red varieties, concentrations of antioxidants being even ten times lower. The analysis of the two categories of wine, red and white, showed that, in terms of phenolic compounds, moderate amounts of red wine are beneficial for health. The substantial accumulation of microphenolic compounds in red wines recommends them for curative purposes.

There is certainly a difference between the rates of secondary displacements in the four categories of consumers. Thus, in nonconsumers and occasional wine consumers the rate of this complication rises to 21-22%, while, in moderate and chronic wine drinkers, the secondary displacement rate is 13-14%. Nonconsumers and occasional consumers of wine are associated with a greater likelihood to suffer a fracture of greater complexity. Each of them is about two times more likely to suffer complex fractures than chronic consumers. The complexity of fractures in moderate wine consumers and chronic consumers are similar.

There is certainly a positive influence in the bone consolidation process in chronic and moderate wine consumers compared with other population groups.

The values obtained and the research, which sometimes show conflicting results in terms of wine consumption, require the creation and implementation of standard research associated with the corresponding technological line.

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Manuscript received: 12.11.2017