ANTIOXIDANT CAPACITY OF SOME RED WINES SOLD IN CAMEROON

Damaris Enyegue Mandob[1], Gabriel Agbor[1, 2], Gilles Inès Dongmo Fomekong[1], Judith Laure Ngondi[1], Julius Enyong Oben*[1]

[1] Laboratory of Nutrition and Nutritional Biochemistry, Department of Biochemistry, Faculty of Sciences, University of Yaoundé 1, PO Box 812 Yaoundé, Cameroon
[2] CRPMT, Institute of Medical Research and Medicinal Plants Studies, P.O. Box 6163, Yaoundé, Cameroon

Summary

Chronic administration of moderate amounts of red wine has been associated with a protective effect on the cardiovascular system. The antioxidant properties of the red wines could be allotted to their contents in polyphenolic compounds which differ according to the wine. In this study we evaluated the antioxidant capacity of 12 red wines sold in Cameroon by using three different analytical methods: 1-1 diphenyl-2picrylhydrazyl (DPPH) radical scavenging assay, ferric reducing antioxidant power (FRAP) for the evaluation of the reducing power and the total phenolic compounds using the Folin-Ciocalteu's reagent. The total polyphenol concentration was found to vary between 1348.44 to 5895.06 mg/l equivalent catechin. For the reduction power, we obtained 31.78 to 123.86 mg/l equivalent catechin. The antioxidant capacity varies from 2675.16 to 5358.03 mg/l equivalent catechin. No significant difference for antioxidant capacity was observed between wine for prize, level of alcohol and the name of the wine.

Key words: Red wine, Antioxidant, Ferric reducing antioxidant power (FRAP), 1, 1-Diphenyl-2-Picrilhydrazyl (DPPH), Folin.

*** Corresponding Author's Contact Details:**
Pr. Julius ENYONG OBEN
Associate Professor
Laboratory of Nutrition and Nutritional Biochemistry
Department of Biochemistry, Faculty of Science
University of Yaoundé 1, Cameroon
P.O. Box 8418, Phone: +237 77 74 50 87
E-mail: juliusoben@hotmail.com

Introduction

Oxidative stress involving enhanced generation of reactive oxygen species (ROS) has been implicated in the etiology of over one hundred human diseases such as inflammation, HIV aids metabolic disorder, cellular aging and atherosclerosis (1,2,3). Antioxidants are molecules that are capable of neutralizing ROS and their actions are considered beneficial (4). Epidemiological study reveals that the regular intake of moderate amount of red wine is associated with a reduced risk of mortality (5,6).

It has been well documented that, in addition to endogenous antioxidant defense system, external supply of both synthetic as well as plant derived natural antioxidants appear to play significant role in oxidative stress imbalances (7). There is high demand for natural antioxidants in the food, cosmetic and therapeutic industries, due to their low cost, high stability, high compatibility with dietary intake and no harmful effects to the human body, like some synthetic antioxidants BHA (Butylated Hydroxyl Anisole) and BHT (Butylated Hydroxy Toluene) are carcinogenic in nature. On the basis of above facts, natural antioxidants are potentially promising alternatives for synthetic antioxidants (8,9).

The protective effects of the wine could be allotted, at least partly, with their capacity to improve the lipidic profile, to inhibit activation plate (6-8), and to prevent the expression of molecules pro-atherosclerotic like *the monocyte chemoattractant protein-1*, it *vascular cell adhesion molecule-1 and* the *vascular endothelial growth Factor* (9-11). Many work within the laboratory allowed to study the direct effects of polyphenols red wine on the vascular vessels and cells (12). Polyphenols of the red wine have antiangiogenic properties, anti-atherosclerotic (13) and vasorelaxantes capacities. The antioxydant properties of the red wines could be allotted to their contents in compounds polyphenolic which differ according to the wine. Taking into account the variation of the polyphenol content of the wines, during this study we determine the polyphenolic concentration of the wines but also their aptitude to trap the free radicals.

Materials and Methods

Red wines material

Wines were bought on April 2007 in supermarkets Yaoundé (Cameroon).

Phenol content:

The phenolic content of each wine was measured at 750 using Folin-ciocalteu reagent diluted 10 times before use with catechin as standard. Optical density was read after 20 min of incubation (14). All determinations were performed in triplicate.

DPPH scavenging activity:

Scavenging activity against the DPPH (1.1-Diphenyl-2-Picrilhydrazyl) free radical was studied as follows: 20 µL of wines were introduced into 2mL of a methanolic solution of DPPH (0.3mM) and kept in the dark for 30 min. The wine was replaced by methanol for the control and catechin for the standard. The absorbance was then spectrophotometrically read at 517 nm and the antioxidant content were calculated as earlier described (15). All determinations were performed in triplicate.

Ferric Reducing Antioxidant Power:

The Ferric Reducing antioxidant Power (FRAP) of each wine was determined using the method of Benzie and Strain (16). The FRAP reagent consisted of ten part acetate buffer (300mM, pH3.6), one part of TPTZ (10 mM in 400 mM of HCl, Sigma) and one part of ferric chloride (10mM). All determinations were performed in triplicate.

Statistical analysis:

Measurements of absorbance were made in triplicate and the results presented as mean ± standard deviation. The homogeneity of data was analysed by ANOVA and the Student-test for comparison between mean (P<0.05). We used SPSS for windows software for this analysis.

Results

The results of the antioxidant capacity of each sample as analysed by the various methods are presented in figures 1, 2 and 3. The free polyphenolic content were measured using folin-ciocalteu (Folin) reagent while DPPH and FRAP were used to determine free radical scavenging and free antioxidant capacity respectively.

Figure 1 below shows the results of the polyphenolic assay.

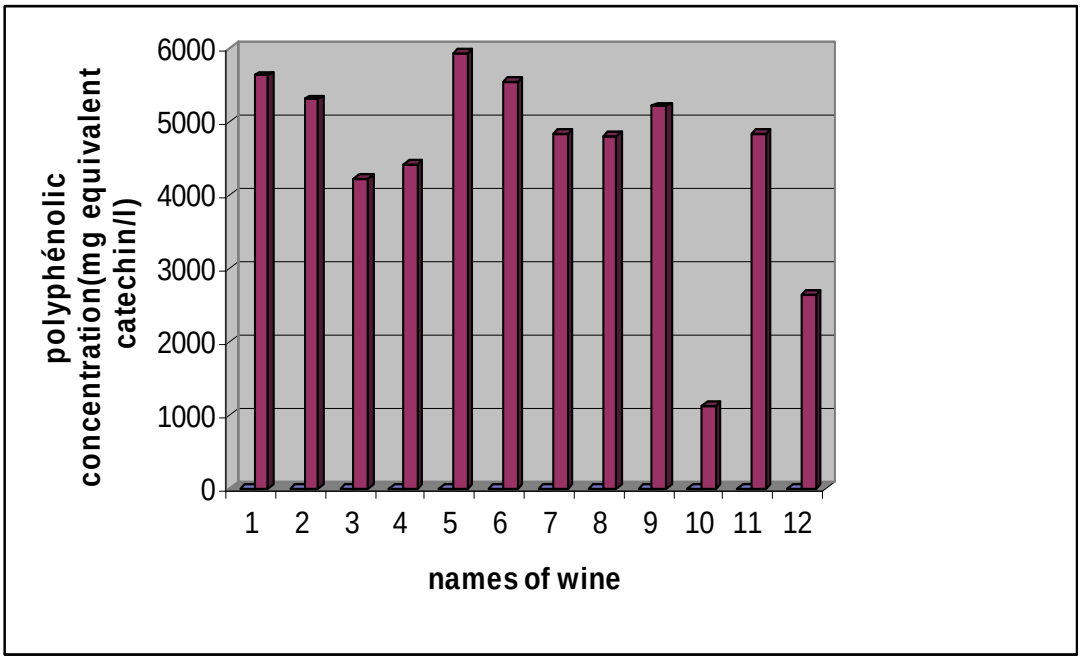

Figure 1. Free polyphenolic concentration of red wines as determined using Folin reagent

We observed that all the wines studied showed a polyphenolic potential. However, among these wines, the 10 and 12 species are those who showed a very low polyphenolic potential while the 1, 5 and 6 species are those who presented the best polyphenolic potential (P<0.05).

Figure 2 below shows the results of free radical (DPPH) scavenging activity of each wine.

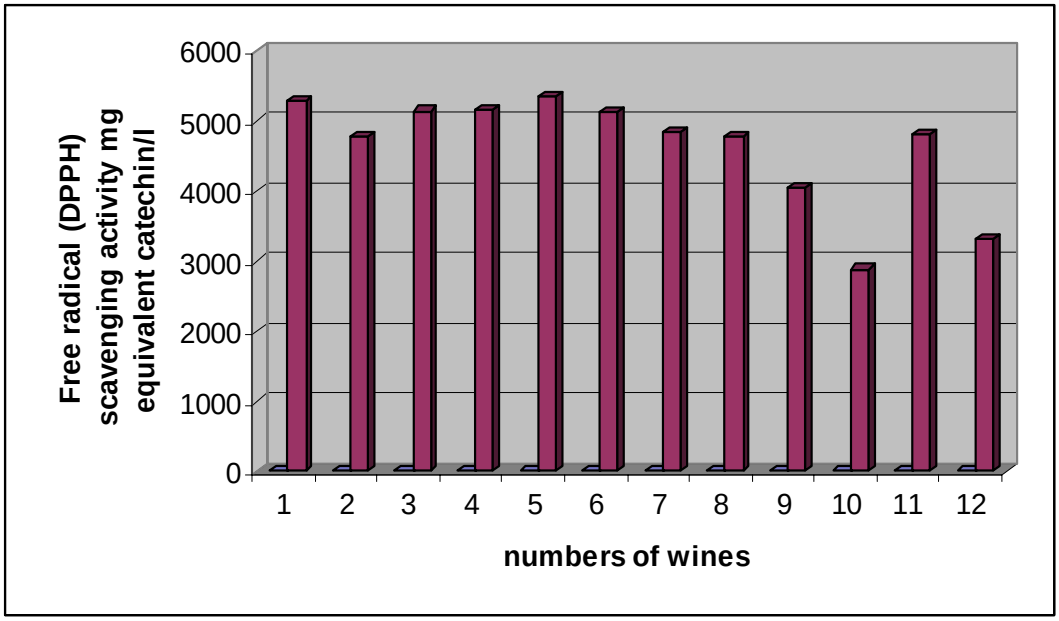

Figure 2. Free radical (DPPH) scavenging activity of wines

From these result, we observed that all the studied wines present a very interesting scanvenging activity. However, the 10 and 12 species are those who showed a lower scavenging activity compared to others. This difference was significant (P<0.05).

Figure 3 below presents the antioxidant power of red wines as determined by FRAP

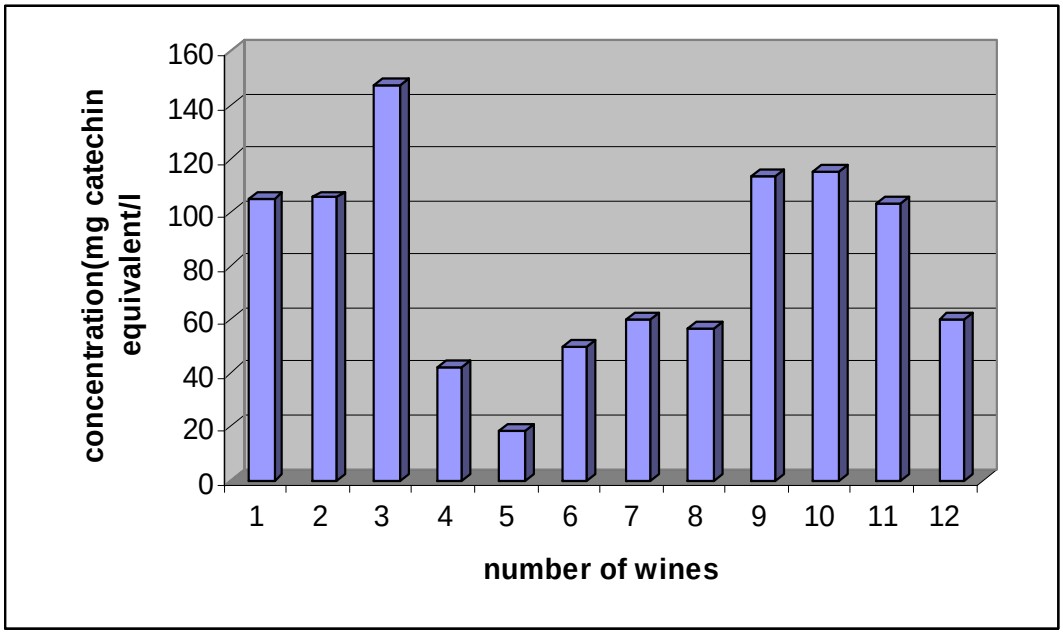

Figure 3. Antioxidant power of red wines as determined by FRAP

From the result obtained, we can classify all the wines studied in two major classes. Thus, we observed that the species 4, 5, 6, 7, 8 and 12 are those who had not showed a better antioxidant power while the other species showed a very greater and significant ($P<0.05$) antioxidant power compared to the first group. Also, the 3rd species is the alone who showed the very high antioxidant power compared to the other wines.

Discussion

Phenols, flavonoïds and tannins are good antioxidant substances which have been reported to have anti-diarrhoeal and anti diabetic activities (1,17) and prevent or control oxidative stress related disorders (12,13,18,19).

DPPH is a free radical that forms a stable molecule on accepting an electron or a hydrogen atom. Free radicals induce oxidative stress *in vivo* that may lead to oxidative modification or damage of some biological structures such as lipids, proteins, DNA and may give rise to degenerative diseases (1). There is need for antioxidant intervention which one of the wines studied may be of importance. The *in vitro* study sounds encouraging as all wines studied have some radical scavenging effect. Also, increased consumption of fruits, wines (20) and vegetables is associated with a lower risk of degenerative diseases that come with aging such as cancer, cardiovascular diseases, cataracts and brain and immune dysfunction (13,21). These positive influences have been attributed to natural antioxidant phytochemicals. It has been shown that phenols such as flavonoïds, anthocyanins and phenylpropanoïds might act as antioxidants or as agents of other mechanisms contributing to cardioprotective action (22,23,24,25).

Folin measures the polyphenolic concentration of the tested material. The principal antioxidant constituents of natural products are phenolic compounds that are comprised of phenolic acids and flavonoïds (26). They are potent free radical terminators (27). They donate hydrogen to free radicals, and hence, break the reaction of lipid oxidation at the initiation step (1,28). Thus, high polyphenolic content will mean a strong antioxidant power and a strong scavenging activity. However, this is not always the case since plant tissues or wines are often made up of different matrix that may react differently with change of chemicals/reagent or reaction mechanism.

Conclusion

The present study has demonstrated that these 12 red wines could be a good source of antioxidant substances as determined by three methods. All the red wines studied show some antioxidant activity irrespective of the method used for the analysis, of the cost, and the alcohol level and therefore could be good source of antioxidants. These red wines may play an important role in preventing cell damage and other diseases mediated by oxidative stress. However they might be consumed moderately together with food.

References

1. Favier A. Le stress oxydant : intérêt conceptuel et expérimental dans la compréhension des mécanismes des maladies et potentiel thérapeutique. *L'actu. chimique* Novembre-Décembre 2003.
2. Hill AF. Economic Botany. A textbook of useful plants and plant products. 2nd edn. McGarw-Hill Book Company Inc, New York, 1952.

3. Okwu DE. Flavouring properties of spices on cassava Fufu. *African Journal of Roots Tuber Crops* 1999; 3: 19-21.
4. Okwu DE. Evaluation of the chemical composition of indigenous spices and flavouring Agents. *Global J. Pure Appl. Sci.* 2001; 7(3): 455-459.
5. Chenu J. Plantes Medicinales tropicales et camerounaises. Ed. Berrebi Rene-Rouche Veronique. Tome 1. 1992: 214p.
6. Hayek T, Fuhrman B, Vaya J. Reduced progression of atherosclerosis in apolipoprotein E-deficient mice following consumption of red wine, or its polyphenols quercetin or catechin, is associated with reduced susceptibility of LDL to oxidation and aggregation. *Arterioscler Thromb Vasc Biol* 1997; 17: 2744-2752.
7. Da Luz PL, Serrano Junior CV, Chacra AP. The effect of red wine on experimental atherosclerosis: lipid-independent protection. *Exp Mol Pathol* 1999; 65: 150-159.
8. Bentzon JF, Skovenborg E, Hansen C, *et al.* Red wine does not reduce mature atherosclerosis in apolipoprotein E-deficient mice. *Circulation* 2001; 103: 1681-1687.
9. Fitzpatrick DF, Hirschfield SL, Coffey RG. Endothelium-dependent vasorelaxing activity of wine and other grape products. *Am J Physiol* 1993; 265: H774-778.
10. Andriambeloson E, Kleschyov AL, Muller B, Beretz A, Stoclet JC, Andriantsitohaina R. Nitric oxide production and endothelium-dependent vasorelaxation induced by wine polyphenols in rat aorta. *Br J Pharmacol* 1997; 120: 1053-1058.
11. Flesch M, Schwarz A, Bohm M. Effects of red and white wine on endothelium-dependent vasorelaxation of rat aorta and human coronary arteries. *Am J Physiol* 1998; 275: H1183-1190.
12. Ndiaye M, Chataigneau T, Stoclet J-C, Andriantsitohaina R, Schini-Kerth VB. Involvement of reactive oxygen species in EDHF-mediated relaxations induced by red wine polyphenols in the porcine coronary artery. *Circulation* 2001; 104: II-32.
13. Liu F, Ooi VE, Chang ST. Free radical scavenging activities of mushroom polysaccharide extract. *Life Sci.* 1997; 60: 763-771.
14. Singleton VL, Rossi JA. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-ciocalteu reagent. *Methods in Enzymology* 1999; 299: 152-178.
15. Yen GC, Duh PD. Scavenging effect of methanolic extracts of peanut hulls on free-radical and active oxygen species. *J.Agric.Food Chem.* 1994; 42: 629-632.
16. Benzie IFF, Strain JJ. The ferric Reducing Ability of Plasma (FRAP) as measure of antioxidant power: The FRAP assay. *Anal.Biochem.* 1996; 239: 70-76.
17. Agbor GA, Talla L, Ngogang JY. The antidiarrhoeal activity of *Alchornea cordifolia* leaf extract. *Phytother.Res.* 2004; 18: 873-876.
18. Vinson JA, Jang J, Dabbagh YA, Serry MM, Cai S. Plant phenols exhibit lipoprotein-bound antioxidant activity using an *in vitro* model for heart disease. *Journal of Agriculture and Food Chemistry* 1995a; 43: 2798-2799.
19. Vinson JA, Dabbagh YA, Serry MM, Jang J. Plant flavonoïds, especially tea flavonoïds, are powerful antioxidants using an *in vitro* oxidation model for heart disease. *Journal of Agriculture and Food Chemistry* 1995b; 43: 2800-2802.
20. Katalinié V. Antioxidant effectiveness of selected wines in comparison with (+)-catechin. *Food Chemi.* 2004; 86: 593-600.
21. Ames A.N, Shinega M.K, Hagen TM. Oxidants, antioxidants and the degenerative diseases of aging. *Proc.Natl.Acad.Sci.* 1993; 90: 7915-7922.
22. Okwu DE. Phytochemicals, vitamins and mineral contents of two Nigerian medicinal plants. *Intl. J. Mo. Med. Adv. Sci.* 2005; 1(4): 375-381.

23. Rice-Evans CA. Structure-antioxidant activity relationships of flavonoids and phenolic acids. *Free Radical. Biol. Med.* 1996; 20: 933-956.
24. Wang H., Cao G, Prier RL. Oxygen radical absorbing capacity of anthocyanins. *J.Agric.Food Chem.* 1997; 45: 304-309.
25. Gorinstein S, Zachwieja Z, Katrich E, Pawelzik E, Haruekit RR, Trahtenaerg S, Belloso OM. Comparison of the contents of the main antioxidant compounds and the antioxidant activity of white grapefruit and his new hybrid. *Lebensm.-Wiss. U.-Technol.* 2004; 37: 337-343.
26. Kähkönen MP, Hopia AI, Vuorela HJ, Rauha JP, Pihlaja K, Kujala TS, Heininen M. Antioxidant activity of plant extracts containing phenolic compounds. *J.Agric.Food Chem.* 1999; 47: 3954-3962.
27. Shahidi F, Janitha PK, Wanasundara PKJPD. Phenolic antioxidants. *Crit. Rev. Food.Sci.Nutr.* 1992; 32: 67-103.
28. Gülçin I, Beydemir S, Alici HA, Elmastas M, Büyükokuroglu ME. *In vitro* antioxidant properties of morphine. *Pharmacol.Res.* 2004; 49:59-66.