

LETTER TO THE EDITOR

Comments on "Potential Explanation for the French Paradox"

With great attention I read a very interesting review of Leasa L. Stanley and M.J. Patricia Mazier entitled "Potential explanations for the French paradox" (Nutrition Research, Vol 1, pp 3-15, 1999). The authors of this review tried to find potential explanation for the French paradox. But from our point of view without following comments the explanation can not be comprehensive.

Now it is an established fact that moderate consumption of alcoholic beverages leads to positive biochemical changes in the blood of the consuming persons, which are regarded as indicators of improved prevention of atherosclerosis (1,2). These positive changes are: 1. improved lipid metabolism; 2. increased antioxidant activity; 3. improved anticoagulant status.

It is widely believed that these positive changes lead to a decrease in morbidity of coronary artery disease (CAD) and to a decreased mortality from CAD (3). At present there are different opinions about biologically active compounds of alcoholic beverages, which determine these changes. Some authors suggest that alcohol per se is responsible for this beneficial effect (3,4). But our experiments on laboratory animals did not confirm this thesis (5,6)

In the first experiment we examined the influence of diets supplemented with different lyophilized wines and beer on lipid metabolism and antioxidant activity in serum of rats. The investigation was conducted on 60 male Wistar rats, divided into three experimental (EG) and one control (CG) group, each of 15 animals. The rats of the 3 EGs were fed basic diet (BD) supplemented with South African (SA) dry red wine (EG1), SA dry white wine (EG2) and Israeli Macabee beer (EG3). The rats of the CG were fed BD only. During 4 weeks of our experiment the animals of EG3 were fed BD supplemented with lyophilized beer at a concentration corresponding to an intake of 6.0 ml of original beer. The rats of EG1 and EG2 were fed BD supplemented with lyophilized wine at a concentration 2.0 ml of original wine daily.

Before and after completion of the trial we performed a wide range of laboratory tests. The results of our investigation reveal that diets supplemented with the dry matter of red wine and beer led to a marked improvement in lipid metabolism by reducing total cholesterol (TC), triglycerides and elevating high density lipoprotein (HDL-C)/ TC ratio. These diets also increased the antioxidant activity of the serum of laboratory animals.

Other authors also find that lyophilized alcoholic beverages are biologically very active (7,8).

The second experiment was conducted on 60 male Wistar rats with standard weight of 120 g each. All rats were divided into 5 equal in number groups: four experimental (EG1, EG2, EG3 and EG4) and one control (CG), each of 12 animals. The rats were fed the same basal diet. All groups of rats during 4 weeks of the experiment were fed basal diet (BD), supplemented with dry red wine (EG1), beer (EG2), lyophilized dry red wine (EG3) and lyophilized beer (EG4). The rats of the CG were fed BD only. The diet of the rats of EG1 and EG2 was supplemented daily

with 2.0 ml of wine and 6.0 ml of beer respectively. The diet of the rats of EG3 and EG4 - with lyophilized wine and lyophilized beer at a concentration corresponding to an intake of 2.0 ml of original wine and 6.0 ml of original beer respectively.

Like in the first experiment we found in all EGs a marked improvement in lipid metabolism and a rise in the antioxidant activity of the serum of rats. There were no significant differences in the results of laboratory tests after the trial between EGs fed diets supplemented with alcohol containing and alcohol free beverages. The conclusion of these studies: the main biologically active component of wine and beer is their dry matter, which contains phenolic substances.

It is known that polyphenols are a large family of natural compounds, which are from chemical point of view characterized by presence of one or more benzene-type ring (9). A couple of years ago it was suggested that they were directly related to some characteristics of foods such as taste, palatability and nutritional value (9). Recent studies *in vitro* and *in vivo* show that polyphenols possess antioxidant properties (10-13).

A unique group of phenolic metabolites are tannins and epicatechin is one of these compounds (9). They have relatively high molecular weight and possess antioxidant ability, which is 20 times stronger than vitamin E - a classical antioxidant (14).

It is generally assumed that the higher the total polyphenolic content of a beverage, the greater is its antioxidant activity (15).

Our experiments on laboratory animals show that the content of total polyphenols is higher in white wine than in beer, but beer possesses a higher antioxidant activity (5,6). In order to find the sources, which determine the degree of the antioxidant activity the comparative content of some important phenolics in beer, red and white wines was examined.

Among the phenolic acids found in beer the most significant is the ferulic acid (16). But also proanthocyanidins, epicatechin, quercetin, *p*-coumaric and gallic acids are important constituents of total polyphenols.

High-performance liquid chromatography (HPLC) to determine the content of total polyphenols and above-mentioned phenolics was used.

The content of total polyphenols was significantly higher in red wine than in white wine and beer ($p < 0.0025$ in both cases). Similar relationship was found for proanthocyanidins, epicatechin, quercetin, ferulic, *p*-coumaric and gallic acids ($p < 0.0005$ in all cases). The contents of total polyphenols and quercetin were significantly higher in white wine than in beer ($P < 0.0125$ and 0.01 , respectively). But the contents of proanthocyanidins, epicatechin and ferulic acid were statistically significant higher in beer than white wine ($p < 0.005$, $p < 0.05$ and $p < 0.0025$ respectively).

The higher contents of proanthocyanidins, epicatechin and ferulic acid in beer is a possible explanation of the marked antioxidant activity of diets supplemented with this beverage rather than with white wine.

CONCLUSION

There is evidence to support one of the possible explanations of the French paradox:

- a) the polyphenol content of alcoholic beverages rather than alcohol per se is responsible for the beneficial biochemical changes in moderate consumers.
- b) the antioxidant effect of the alcoholic beverages is mostly connected to the contents of proanthocyanidins, epicatechin and ferulic acid rather than to the level of total polyphenols.

Sheila Gorinstein
The Hebrew University of Jerusalem
The Adolph Weinberger (Building 12065)
Jerusalem, Israel

REFERENCES

1. Gorinstein S, Zemser M, Lichman I, Berebi A, Kleipfish A, Libman I, Trakhtenberg S, Caspi A. Moderate beer consumption and the blood coagulation in patients with coronary atherosclerosis. *J Intern Med* 1997;241:47-51.
2. Gorinstein S, Zemser M, Berliner M, Goldstein R, Libman I, Trakhtenberg S, Caspi A. Moderate beer consumption and some positive biochemical changes in patients with coronary atherosclerosis. *J Intern Med* 1997;242:219-24.
3. Friedman LA, Kimball AW. Coronary artery disease and alcohol consumption in Framingham. *Am J Epidemiol* 1986;124:481-89.
4. Thun MJ, Peto, R, Lopez AD, Monaco JH, Henley SJ, Heath CW, Jr., Doll R. Alcohol consumption and mortality among middle-aged elderly U.S. adults. *New Engl J Med* 1997;337:1763-64.
5. Gorinstein S, Zemser M, Weisz M, Haruenkit R, Trakhtenberg S. The influence of dry matter of different alcoholic beverages on lipids, proteins, and antioxidant activity in serum of rats. *J Nutr Biochem* 1998;9:131-35.
6. Gorinstein S, Zemser M, Weisz M, Halevy SH, Martin-Belloso O, Trakhtenberg S. The influence of alcohol-containing and alcohol-free beverages on lipid levels and lipid peroxides in serum of rats. *J Nutr Biochem* 1998;12:1-8.

7. Mosinger B. Polyphenolics but not alcohol in beer and wine protect serum low-density lipoprotein against atherogenic modification. *Cor Vasa* 1994;4:171-74.
8. Serafini M, Maiani G, Ferro-Luzzi A. Alcohol free red wine enhances plasma antioxidant capacity in humans. *J Nutr* 1998;128:1003-7.
9. Harbone J. In *Methods in plant biochemistry*, Harborne, JB, ed. Academic Press, Harcourt Brace Jovanovich, Publishers. London, San Diego, New York, Berkeley, Boston, Sydney, Tokyo, Toronto, 1989;1:3-4, 389.
10. Frankel EN, Kannar J, German JB, Parks E, Kinsella JE. Inhibition of oxidation of human low density lipoproteins by phenolic substances in red wine. *Lancet* 1993;341:454-57.
11. Frankel EN, Waterhouse AL, Kinsella JE. Inhibition of human LDL-C oxidation by resveratrol. *Lancet* 1993;341:1103-4.
12. Rankin SM, Whalley CV, Houtt JR, Jessup W, Wilkins G, Collard J, Leake S. The modification of LDL by the flavonoids myricetin and gossypatin. *Biochem Pharmacol* 1993;45:67-75.
13. Morel I, Lescoat G, Cillard P, Cillard J. Role of flavonoids and iron chelation in antioxidant action. *Methods Enzymol* 1994;234:437-43.
14. Uchida S, Ohta H, Edamatsu R, Hiromatsu M, Mori A, Nomaka GI, Nishioka I, Akashi T, Niwa M, Ozaki N. Persimmon tannin prolongs life span of stroke-prone spontaneously hypertensive rats (SHRSP) by acting as a free-radicals scavenger. *New horizons in preventing cardiovascular diseases*. Yamori Y, Strasser T, Eds. Elsevier, 1989, 15-17.
15. Abu-Amsha R, Croft KD, Puddey IB, Proudfoot JM, Beilin LJ. Phenolic content of various beverages determines the extent of inhibition of human serum and low-density lipoprotein oxidation *in vitro*: identification and mechanism of action of some cinnamic acid derivatives from red wine. *Clinical Science* 1999;91:449-58.
16. McMurrough I, Madigan D, Donnelly D, Hurley J, Doyly AM, Hennigan G, McNulty N. Control of ferulic acid and 4-vinyl guaiacol in brewing. *J inst Brew* 1996;102:327-32.