TOXICOLOGY AND FORENSIC MEDICINE

Openventio PUBLISHERS

ISSN 2474-8978 Open Journal http://dx.doi.org/10.17140/TFMOJ-1-e002

Editorial

Corresponding author
Bashir M. Rezk, PhD
Assistant Professor of Biology
Department of Natural Sciences
Southern University at New Orleans
6400 Press Drive
New Orleans, LA 70126, USA
Tel. 504-284-5405; +1(504)957-8806
E-mail: batteia@suno.edu

Volume 1 : Issue 1
Article Ref. #: 1000TFMOJ1e002

Article History
Received: November 16th, 2015
Accepted: November 17th, 2015
Published: November 18th, 2015

Citation
Rezk BM, van der Vijgh WJF, Bast A, Haenen GRMM. Toxicity of the antioxidants. *Toxicol Forensic Med Open J*. 2015; 1(1): e3-e4. doi: 10.17140/TFMOJ-1-e002

Toxicity of Antioxidants

Bashir M. Rezk[1*], Wim J. F. van der Vijgh[2], Aalt Bast[2] and Guido R. M. M. Haenen[2]

[1]Department of Natural Sciences, Southern University at New Orleans, New Orleans, LA 70126, USA

[2]Department of Toxicology, Maastricht University, P. O. Box 616, MD Maastricht 6200, The Netherlands

The fundament of toxicology is the risk-benefit analysis. This means that the positive as well as the negative health effects of all compounds, including antioxidants, have to be assessed and related to each other. Only in this way the rational for the use of a compound can be evaluated.

The beneficial effects of antioxidants are due to their ability to protect against free radical damage. In the diseases and other pathological conditions where free radicals are implicated, the biochemistry may greatly vary, i.e. the radicals involved, their flux, the site where they are generated and the target they attack can differ.[1] Thus for each type of radical damage specific criteria need to be fulfilled by an antioxidant in order to be active. Free radicals of biological interest are often divided into oxygen centred and nitrogen centred radicals. Reactive Oxygen Species (ROS) is a collective term that includes both oxygen centred radicals and certain oxygen containing non-radicals that are oxidizing agents or easily converted into radicals. In the Reactive Nitrogen Species (RNS) the reactivity of the species is located on or near a nitrogen atom. The adjective "reactive" is not always appropriate; H_2O_2, O_2•- and NO• quickly react only with very few molecules. OH• reacts instantaneously with almost everything. RO_2•, RO•, HOCl, NO_2•, ONOOH, and O_3 have a reactivity that lies in between these extremes.

Regarding safety, in the 16th century Paracelsus already stated that all compounds are toxic, provided the dose is high enough. There is no reason to assume that antioxidants should be an exception to this rule. On the contrary, the mega-dosages sometimes recommended make safety a very relevant issue for antioxidants. The biological origin of most antioxidants helps to increase the acceptance of antioxidant supplementation by the general public. The perception is that the biological origin guarantees that antioxidants are not harmful; biological and natural is incorrectly thought to be synonymous to safe.[2]

The adage on the use of antioxidant supplementation seems to be: The more, the better. Indeed, antioxidant supplements are taken frequently by a great part of the public at a relatively high dose despite our limited knowledge on their beneficial health effect and safety. From a toxicological point of view, the free radical processes as well as the profiles of antioxidants have to be elucidated to a greater extend to be able to further rationalize and optimize antioxidant therapy.[3]

An important issue in the use of antioxidants is metabolism.[4] Like other bioactive compounds, metabolites formed by phase 1 and phase 2 enzymes can contribute to the beneficial and toxic effect of an antioxidant. More importantly, during the actual antioxidant activity of a free radical scavenging antioxidant, it is converted into a metabolite.[1] The effect of such a metabolite on a biological system is relevant since the metabolite usually contains some residual reactivity of the radical that has been scavenged.

According to 2013, Annual Report of the American Association of Poison Control Centers (AAPCC): National Poison Data System (NPDS), more than 65,000 instances of vitamin toxicity are reported annually to US poison control centers.[5] Unintentional and intentional exposures continue to be a significant cause of morbidity and mortality in the United States.[4] It

ISSN 2474-8978 Open Journal http://dx.doi.org/10.17140/TFMOJ-1-e002

is of importance to identify groups that are at risk. In spite of the focus on the adverse effects of antioxidants and vitamins, priority should be given to identify groups that are likely to benefit.[6]

The bottom line is that in the appraisal of antioxidants, their benefits must first be identified and substantiated by elucidating the molecular mechanism. The risks must then be identified the molecular mechanism. The optimal benefit-risk ratio has to be determined for each antioxidant and each individual separately, also taking into account, the dose.[7]

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interests.

REFERENCES

1. Lemmens KJ, Vrolijk MF, Bouwman FG, van der Vijgh WJ, Bast A, Haenen GR. The minor structural difference between the antioxidants quercetin and 4'O-methylquercetin has a major impact on their selective thiol toxicity. *International journal of molecular sciences.* 2014; 15(5): 7475-7484. doi: 10.3390/ijms15057475

2. Bast A, Haenen GR. Ten misconceptions about antioxidants. *Trends in pharmacological sciences.* 2013; 34(8): 430-436. doi: 10.1016/j.tips.2013.05.010

3. Haenen GRMM, Bast A. The use of vitamin supplements in self-medication. *Therapie.* 2002; 57: 119-122.

4. Bast A, Haenen GRMM. The toxicity of the antioxidants and their metabolites. environ. *Toxicol Pharmacol.* 2002; 11: 251-258. doi: 10.1016/S1382-6689(01)00118-1

5. Mowry JB, Spyker DA, Cantilena LR Jr, McMillan N, Ford M. 2013 Annual report of the American association of poison control centers' national poison data system (NPDS): 31st annual report. *Clin Toxicol (Phila).* 2014; 52(10): 1032-1283. doi: 10.3109/15563650.2014.987397

6. Assmann KE, Andreeva VA, Jeandel C, Hercberg S, Galan P, Kesse-Guyot E. Healthy aging 5 years after a period of daily supplementation with antioxidant nutrients: a post hoc analysis of the French randomized trial SU.VI.MAX. *American journal of epidemiology.* 2015; 182(8): 694-704. doi: 10.1093/aje/kwv105

7. Vrolijk MF, Opperhuizen A, Jansen EH, et al. The shifting perception on antioxidants: the case of vitamin E and β-carotene. *Redox boil.* 2015; 4: 272. doi: 10.1016/j.redox.2014.12.017