Oxidative Stress Biomarker and Its Application to Health Maintenance
Guest Editor: Yasukazu Yoshida

Introduction to serial reviews: Oxidative stress biomarker and its application to health maintenance

Yasukazu Yoshida*

Health Research Institute (HRI), National Institute of Advanced Industrial Science and Technology (AIST),
2217-14 Hayashi-cho, Takamatsu, Kagawa 761-0395, Japan

It is now widely accepted that "oxidative stress" is involved in various disorders and diseases. Oxidative stress has been defined as an imbalance between oxidants and antioxidants in favor of the former, potentially leading to the damage.[1] Oxidative stress may be induced not only by oxidants, but also by non-oxidant mechanisms, such as gastric stress ulcer. It is noteworthy that even if the level of stress is smaller than the antioxidant capacity, the stress acts as signal to which the body responds. Furthermore, when the stress level exceeds the defense capacity, it may induce oxidative damage ("destress"), whereas low level stress may stimulate the defence network and induce an adaptive response ("eustress").[2,3]

Recently, the biological roles of molecules induced by oxidative stress have received a great deal of attention, not only for elucidating pathological mechanisms but also for practical clinical applications as biomarkers. For example, lipid peroxidation has been the subject of extensive studies from the viewpoints of mechanisms, dynamics, product analysis, involvement in diseases, inhibition, and biological signaling in the past 50 years.[4,5] The term "biomarker" was defined by the National Institutes of Health

Biomarkers Definitions Working Group in 1998 as a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention.[6]

Oxidative stress yields complex products such as low molecular chemicals and polymeric materials. These products exert cytotoxic and genotoxic effects.[7] Their applications as biomarkers for diagnosing disease progression and evaluating therapies, and in health examinations have been the focus of intensive study. Some markers have been proposed, together with the method for assessing them, as described in this serial review. It should be noted that there is no sole marker and that inclusive assessments of oxidation products are needed. Additionally, the physiological significance of biological effects *in vivo* has to be established.

In this serial review, several types of biomarker, including lipids, proteins, and their compounds, will be introduced, and their comprehensive assessments and practical application will be discussed.

References

1 Sies H. Oxidative stress: Introductory remarks. In: Sies H, ed. *Oxidative Stress*, Academic Press, London, 1985; 1–18.
2 Chen ZH, Yoshida Y, Saito Y, Sekine A, Noguchi N, Niki E. Induction of adaptive response and enhancement of PC12 cell tolerance by 7-hydroxycholesterol and 15-deoxy-delta(12,14)-prostaglandin J2 through up-regulation of cellular glutathione via different mechanisms. *J Biol Chem* 2006; **281**: 14440–14445.
3 Ogawa Y, Saito Y, Nishio K, Yoshida Y, Ashida H, Niki E. γ-Tocopheryl quinone, not α-tocopheryl quinone, induces adaptive response through up-regulation of cellular glutathione and cysteine availability via activation of ATF4. *Free Rad Res* 2008; **42**: 674–687.
4 Niki E, Yoshida Y, Saito Y, Noguchi N. Lipid peroxidation: mechanisms, inhibition, and biological effects. *Biochem Biophys Res Commun* 2005; **338**: 668–676.
5 Yoshida Y, Umeno A, Shichiri M. Lipid peroxidation biomarkers for evaluating oxidative stress and assessing antioxidant capacity *in vivo*. *J Clin Biochem Nutr* 2013; **52**: 9–16.
6 Biomarkers Definitions Working Group. Biomarkers and surrogate endpoints: preferred definitions and conceptual framework. *Clin Pharmacol Ther* 2001; **69**: 89–95.
7 Brown HA, Marnett LJ. Introduction to lipid biochemistry, metabolism, and signaling. *Chem Rev* 2011; **111**: 5817–5820.

*To whom correspondence should be addressed.
E-mail: yoshida-ya@aist.go.jp

doi: 10.3164/jcbn.53-3-intro
©2014 JCBN

J. Clin. Biochem. Nutr. | **May 2014** | vol. 54 | no. 3 | 137