Oxidants and Antioxidants in Medical Science, 2022
VOL 11, NO. 6, PAGE 01-02

COMMENTARY

Open Access

Lipid Peroxidation: Types and its Determination

Xiei Su*
Department of Biochemistry, University of Milan, Milan, Italy

ARTICLE HISTORY
Received: 26-May-2022, Manuscript No. EJMOAMS- 22-64820;
Editor assigned: 28-May-2022, PreQC No. EJMOAMS- 22-64820 (PQ);
Reviewed:11-Jun-2022, QC No. EJMOAMS- 22-64820;
Revised: 16-Jun-2022, Manuscript No. EJMOAMS- 22-64820 (R);
Published: 27-Jun-2022

Description

Lipid peroxidation is considered to be the major cellular mechanism involved in oxidative damage to cell structures and the toxic process that leads to cell death. Initially, lipid peroxidation was studied by nutritionists as a mechanism of fat and fat alimentary damage, yet some researchers considered that lipid peroxidation was the result of toxic metabolites producing more active forms, disruption of intracellular membranes and cell damage.

Lipid peroxidation is a series of reactions to the oxidative degradation of lipids. It is a process by which free radicals "steal" electrons from lipids in cell membranes, leading to cell damage. This process continues with the free radical chain reaction mechanism. It usually contributes to polyunsaturated fatty acids, as it contains double bonds in which there are methylene bridges containing active hydrogen atoms. As with any powerful reaction, the reaction consists of three main stages: initiation, distribution, and termination. The chemical products of these oxidation compounds are known as lipid peroxides or lipid oxidation products. Antioxidants such as vitamin C and vitamin E may prevent lipid peroxidation [1]. Alternatively, the pharmaceutical method uses the isotope effect on lipid peroxidation of deuterated polyunsaturated fatty acids in methylene bridges between double bonds, leading to inhibition of chain reactions. Such D-PUFAs, for example, 11-D2-ethyl linoleate, suppress lipid peroxidation even at low levels of membranes [2]. There will be damage to the cell membrane, which contains mainly lipids. Phototherapy can cause haemolysis by breaking down the red blood cell membranes in this way [3]. In addition, the final products of lipid peroxidation can be mutagenic and carcinogenic [4]. Active aldehydes can also form Michael adducts or Schiff bases containing thiol or amine groups in separate amino acid chains [5]. The toxicity of lipid hydroperoxides in animals is well demonstrated by the lethal phenotype of glutathione peroxidase 4 knockout mice [6].

Lipid peroxidation is a complex process known to occur in both plants and animals. It involves the formation and distribution of lipid radicals, the acquisition of oxygen, the rearrangement of double bonds in unmodified lipids and the ultimate destruction of membrane lipids, through the production of various degradation products, including alcohols, ketones, alkanes, aldehydes and ethers.

Determination of lipid peroxidation

Lipid peroxidation can be determined by quantity or quality in a variety of ways. It can be measured by the loss of fatty acids; amounts for key peroxidation products; amounts for secondary products such as carbon and hydrocarbon gases; and reducing antioxidant activity. Some of the most commonly used methods are described below. Analysis of fatty acids by gas liquid chromatography or high-performance liquid chromatography is used to measure the loss of unsaturated fatty acids, resulting in lipid peroxidation. Lipid hydroperoxides, the main product of peroxidation, can be measured directly with HPLC by chemiluminescence detectors. Iodine release mechanisms and glutathione peroxidase methods are often used to measure lipid peroxides.

The most popular tests for lipid peroxidation measurements are thiobarbituric acid tests and diene conjugation determination. In the TBA test, lipid-containing samples were burned with TBA and LP product, malondialdehyde at low pH to allow for the formation of a pinkish complex. Colour density is related to the level of lipid peroxidation.

Types of lipid peroxidation

Lipid peroxidation proceeds in three different ways: (1) free radical-mediated oxidation; (2) free radical independent non-enzymatic oxidation; and (3) enzymatic oxidation. Lipids such as Poly Unsaturated Fatty Acids (PUFAs) and cholesterol are oxidized by enzymatic pathways and non-enzymatic.

Contact: Su X, E-mail: xiesoui@gmail.com

Free radical-mediated oxidation: Free radicals of oxygen-containing molecules have an unequal number of electrons. An unequal number allows them to react more easily with other molecules. Free radicals can trigger chemical reactions in a large chain in your body because they react easily with other molecules. This reaction is called oxidation.

Free radical independent non-enzymatic oxidation: The two main types of non-enzymatic browning are caramelization and Millard reaction. Both vary in reaction rate as water activity (in food chemistry, the general state of water activity is often defined as the pressure of a vapour component of pure water at the same temperature).

Enzymatic oxidation: Enzymes can only oxidize substrates that have lower redox potentials than their own and few peroxidases have higher redox potential than that of lignin peroxidase those of the plant peroxidases HRP and soybean peroxidases are lower.

References

[1] Huang HY, Appel LJ, Croft KD, Miller III ER, Mori TA, Puddey IB. Effects of vitamin C and vitamin E on in vivo lipid peroxidation: results of a randomized controlled trial. Am J Clin Nutr 2002; 76: 549-55.

[2] Hill S, Lamberson CR, Xu L, To R, Tsui HS, Shmanai VV et al. Small amounts of isotope-reinforced polyunsaturated fatty acids suppress lipid autoxidation. Free Radic Biol Med 2012; 53:893-906.

[3] OSTREA JR EM, Cepeda EE, Fleury CA, Balun JE. Red cell membrane lipid peroxidation and hemolysis secondary to phototherapy. Acta Paediatr Scand 1985; 74: 378-81.

[4] Marnett LJ. Lipid peroxidation—DNA damage by malondialdehyde. Mutat Res 1999; 424: 83-95.

[5] Bochkov VN, Oskolkova OV, Birukov KG, Levonen AL, Binder CJ, Stöckl J. Generation and biological activities of oxidized phospholipids. Antioxid Redox Signal 2010; 12:1009-59.

[6] Muller FL, Lustgarten MS, Jang Y, Richardson A, van Remmen H. Trends in oxidative aging theories. Free Radic Biol Med 2007; 43:477-503.