



COMMENTARY



Role of Reactive Oxygen Species (ROS) in Liver Diseases

Pault Mour*

Department of Chemical Engineering, University of Tehran, Tehran, Iran

Description

Free radicals are atoms or molecules that have unpaired electrons, are usually unstable, and are highly reactive. In a biological system, oxygen-based radicals and nitrogen-based radicals are two types of free radicals. Free oxygen radicals such as superoxide, hydroxyl radicals, and peroxy radicals, with the addition of non-radicals such as hydrogen peroxide, per chloric acid, and ozone, are known as Reactive Oxygen Species (ROS), which are produced during oxygen metabolism. Reactive Nitrogen Species (RNS), including nitrogen-based radicals and non-radicals such as nitrogen dioxide, nitric oxide radicals, and peroxy nitrite, are generated from nitric oxide and superoxide via Inducible Nitric Oxide Synthase (iNOS) and Nicotinamide Adenine Dinucleotide Phosphate (NADPH) oxidase, respectively. Due to their special chemical characteristics, ROS/RNS can initiate lipid peroxidation, induce DNA strand breaks, and indiscriminately oxidize virtually all molecules in biological membranes and tissues, leading to damage. The liver is the main organ under attack by ROS. Parenchymal cells are the primary cells exposed to oxidative stress. Mitochondria, microsomes, and peroxisomes in parenchymal cells can produce ROS by regulating PPAR α , which is mainly associated with hepatic fatty acid oxidation gene expression. In addition, Kupffer cells, hepatic stellate cells, and endothelial cells are potentially more susceptible or sensitive to molecules associated with oxidative stress. A variety of cytokines, such as TNF- α , can be produced in Kupffer cells under oxidative stress, which can increase inflammation and apoptosis. As for hepatic stellate cells, the proliferation and collagen synthesis of hepatic stellate cells is triggered by lipid peroxidation induced by oxidative stress.

Regarding the vital role of oxidative stress in the liver disease chain, various antioxidant therapies and antioxidants are proposed for the prevention and treatment of liver disease. A series of studies tested the effectiveness of certain antioxidants in the treatment of patients with various liver diseases, such as chronic hepatitis C virus infection, alcoholic hepatitis or liver cirrhosis, and

ARTICLE HISTORY

Received: 03-Oct-2022, Manuscript No. EJMOAMS- 22-77357;
Editor assigned: 07-Oct -2022, PreQC No. EJMOAMS- 22-77357 (PQ);
Reviewed: 21-Oct-2022, QC No. EJMOAMS- 22-77357;
Revised: 27-Oct-2022, Manuscript No. EJMOAMS- 22-77357 (R);
Published: 03-Nov-2022

Non-Alcoholic Fatty Liver Disease (NAFLD). The clinical effects of adjuvant antioxidants, including vitamin E/C, mitoquinone, N-acetyl cysteine, poloprezinc silymarin, silibinin, and some antioxidant cocktails, in patients with chronic hepatitis C have been reviewed and have shown a clear benefit of antioxidants for HCV interferon therapy.

Natural antioxidants have been found in many food (such as fruits, vegetables, grains and tea) and medicinal plants, which often have strong antioxidant and free radical scavenging and anti-inflammatory effects.

Oxidative stress in liver diseases

Oxidative stress caused by drugs: The liver is the most common target organ in terms of drug toxicity. The production of radical species, particularly ROS and RNS, has been proposed as an early event of drug hepatotoxicity and as an indicator of hepatotoxic potential. Many medications have been found to cause oxidative stress, including increases in cellular oxidants and lipid peroxidation, depletion of antioxidants in the liver, such as anti-inflammatory drugs, pain medications, anticancer drugs, and antidepressants.

Oxidative stress caused by alcohol: Alcoholic beverages are widely consumed throughout the world; however, excessive alcohol consumption can cause a number of health problems. It has been reported that alcohol consumption accounts for approximately 3.8% of global deaths. Alcoholic Liver Disease (ALD) is one of the most important causes of liver-related death, which is associated with increasing dose and duration of alcohol consumption. In 2003, the age- and sex-adjusted death rate for ALP was reported to be 4.4/100,000. Although a decrease in overall ALP mortality has been observed in several national reports, it is likely is due to progress in the treatment of the disease, rather than a decrease in the prevalence of ABP, which may be supported by the increase in hospitalizations for alcoholic liver failure and alcoholic hepatitis.

Oxidative stress caused by other factors: Other factors such as radiation and temperature can also cause oxidative stress to the liver. Oxidative stress induced by cell phone-like radiation was investigated in the liver of guinea pigs.

Contact: Pault Mour, E-mail: pautmour@gmail.com

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