EDITORIAL

# Organoselenium Compounds in Cancer: A Review

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Oxidative stress is described as the formation of toxic effect due to the deficiency of cellular antioxidative level toward the level of reactive oxygen species. This phenomenon is either described as the deficiency of antioxidative defense system, or the excess production of oxygen species enhances the stress, or else both are responsible for this. The excess production of reactive oxygen species (ROS) or the decrease in the antioxidative defense system could be the cause for oxidative stress. ROS cause DNA chain breaking and lipid peroxidation and carcinogenesis. The antioxidant formed either physiologically or taken as an hexogen is responsible for the detoxification of reactive oxygen species that might be formed as a result of environmental and cellular factors (Ozdemir et al. 2006).

Antioxidant defense molecules are divided into two categories: enzymatic and nonenzymatic. Selenium is an essential element with nonenzymatic antioxidant effects by the absolute requirement of selenium for glutathione peroxidase (GSH-Px). Biological importance of selenium is due to its being cofactor for GSH-Px which plays a key role in the primary antioxidant defence system of the cell (Selamoglu et al. 2007).

As a fundamental trace elements, selenium as a part of antioxidative defense system is responsible for the immune system as part of enzymes in defense system. Organoselenium compounds present in the laboratories that were prepared synthetically that show the anti-carcinogenesis effect in the animal studies, thus these compounds show the similar trend for the preventing illness, preservative effect, and the extension of life period. Due to the fact that organoselenium compounds show better antioxidative effect than classical selenium made a new era of preparing novel synthetic selenium compounds (Selamoglu Talas 2015).

This approach to cancer prevention is based on the recognition that human cancer has multifactorial etiology and evolves through several molecular and cellular events occurring over many years following exposure to carcinogens. The use of the micronutrient selenium in human clinical trials is limited, but the outcome of these investigations indicates that selenium is one of the most promising agents. The selenium is called a chemo preventive and antioxidant trace element because of the inhibiting of oxidative stress. Selenium is thought to prevent damage carried out by lipid peroxidation because of the presence of free radicals in the unsaturated fatty acids of subcellular membranes (Selamoglu Talas 2009).

Selenium counteracts cancer and chromosome damage as well as increases our resistance to viral and bacterial infections. Selenium has antioxidant properties and is scavengers of free radicals, thus preventing damage to tissues. Selenium is a structural component of some enzymes with antioxidant properties, including glutathione peroxidase and thioredoxine that catalyze chemistry major to preserve of biomolecules against oxidative stress and free radical attract. The biochemistry and pharmacology of selenium is of intense current interest. The selenoprotein glutathione peroxidase may protect the thyroid gland from oxidative damage due to any excess hydrogen peroxide produced during thyroid hormone synthesis. Hypothyroidism is associated with dyslipidemia, hypertension, and cardiovascular diseases. Selenium plays a major role in thyroxine (T4) conversion to triiodothyronine (T3). Selenium acts as an antioxidant by incorporation to selenocysteine in selenoproteins. The human genome contains 25 genes that are predicted to encode over 30 selenoproteins due to the alternative splicing. It is, however toxic above little concentration which is required for health. Selenium is incorporated into proteins as selenocysteine, the 21st amino acid. Selenium containing heterocycles are of increasing interest because of their chemical structures and biological effects (Selamoglu Z 2005).

The first attempt to research the effectiveness of aromatic selenium compounds in cancer chemo-prevention was carried out by Karam El-Bayyoumy in the 1980s. After that time, clinical trials in humans revealed beneficial effects of organoselenium compounds such as ebselen in pathological situations. It was found that the forms were able to inhibit or delay the process of carcinogenesis induced by chemical carcinogens. Cancer chemoprevention efforts have currently been focusing on and investigating means of cancer control and prevention by inhibition to suppression or reversal of the process of carcinogenesis by administration of naturally occurring or synthetic agents (El-Bayoumy 2003).

Some epidemiological works have showed the preventive actions of organoselenium compounds against a wide variety of cancers and their ability to reduce oxidative damage, enhance exert anticancer activities. Selenium is neccessary for the development of the acquired immune system. Nowadays, there has been a great deal of investigations carried out on selenium metabolism. In recent years several inorganic or organic forms of selenium have been studied as possible cancer chemo preventive agents. In some investigations, the external selenium was applied to experimental animals as selenite form. Selenium could prevent damage to the unsaturated fatty acid of sub cellular membranes by lipid peroxidation induced by free radicals. They have been found to inhibit or delay the process of carcinogenesis induced by chemical carcinogens. The concept that selenium containing molecules may be better nucleophilic (and, therefore, antioxidants) than classical antioxidants have led to the design of synthetic organoselenium compounds (El Bayoumy 2001; El Demerdash 2004; Sieja and Talerczyk 2004).

New approaches for the synthesis of selenium heterocycles by using more stable, less toxic, and easily accessible selenium reagents have a great interest. Selenium containing heterocycles are of increasing interest because of their biological activities and chemical properties. Many selenium compounds, organic derivatives of selenium have been synthesized as anticancer, and for other medicinal applications, as well as biologically active agents showing antiviral, antibacterial, antihypertensive and fungicidal effects. Nowadays, there has been a great deal of studies made on selenium metabolism. Benzimidazole and benzylpyrimidine derivatives are interest widely because of their diverse biological effects and clinical applications. Recently a large number of synthetic organocompounds have been prepared in our laboratory for their antibacterial and antioxidant properties. In connection with these studies, it was planned to modify the position of the methyl and methoxy structure on the benzimidazole and benzylpyrimidine moiety in order to develop new antimicrobial and antioxidant agents (Selamoglu Talas 2015).

As many carcinogens produce free radicals in vivo, selenium compounds can act as a trap for free oxygen radicals and exert their effect by scavenging free radicals and converting them into stable compounds. Sufficient antioxidant defense systems including micronutrient intake may protect oxidative cell damage. Selenium has antioxidant activities and scavenges free radicals, thus it can prevent cell and tissue injuries.

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