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The role of antioxidants and pro-oxidants in the prevention and treatment of cancers

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Core tip

According the dual properties of reactive oxygen species in determining cell destiny, both pro-oxidants and antioxidants treatments have been proposed in cancer treatment. Based on either side, a number of drugs, agents and approaches are expanding or in the growth of development, some of which have shown clinical promise.

Introduction

Antioxidants are category of molecules that are capable of preventing the oxidation of other molecules. They are important and have basic role in control of free radicals in body and prevention of cell damage caused by free radicals. Free radicals are negated by antioxidants. They include non-enzymatic and enzymatic antioxidants which both exclusively scavenge different kinds of free radicals (1).

The lack of balance in production of free radicals and the ability of the body to negate their dangerous effects through neutralization by antioxidants produce oxidative stress. Oxidative stress causes tissue damage by different mechanisms including lipid per-oxidation, DNA damage, and protein modification. Oxidative stress has a key role in the pathophysiology of many cancers (2,3). Environmental factors, including radiation and smoke, can cause free radical formation and induce oxidative stress in body cell. In humans, the abundant form of free radicals is oxygen. When oxygen molecules (O_2) loose an electron or "radicalized" it tries to take the electron from other molecules, and lead to damage to the DNA and other molecules. Over time, such damage may become unalterable and causing disease including cancer. Actually any deviance in redox equilibrium may lead to diseases including cancers. Since, reactive oxygen species (ROS) levels are high in cancer cells due to oncogene activation, relative lack of blood or other variances. ROS do involve in initiation, regression and metastasis of cancers and are considered oncogene. There are many reports suggesting that the use of antioxidants might be beneficial in disease prevention, including cancers (4-7). Antioxidants are plentiful in vegetables and fruits, as well as in other foods including grains, nuts and some meats, fish and poultry. The use of combined antioxidants distributed in foods seems to be effective methods for cancer prevention. Various antioxidants in foods, for example phenolic compounds and carotenoids were demonstrated to have anti-carcinogenic activity. Also, the mixture of carotenoids was found to be very effective. In fact, hepatoma was significantly repressed by the treatment with natural carotenoids mixture (8).

As mentioned previously ROS level in cancer cells are higher than normal cells that this different lead to recognize them from normal cells. Such increase in free radicals in the body cellules lead to damage them. Recently this tactic was used to kill cancer cells as selective method, decreasing their antioxidant capacity of cancer cell that this work lead to increase in ROS intra of cellular and cancer cell death. Many chemotherapeutic methods have been designed to increase cellular ROS levels with the aim of inducing damages, consequently resulting in tumor cell apoptosis. ROS generation is a mechanism used by all non-surgical therapeutic strategies for cancers, including photodynamic, radiotherapy and therapy chemotherapy, causing their significance in triggering the death of cell. Therefore, ROS are also used to destruct cancer cells. The advantage of this method is that normal cells are not affected because they have lower basal ROS levels and so are less dependent on antioxidants (9).

Conclusion

According the dual properties of ROS in determining cell destiny, both pro-oxidants

and antioxidants treatments have been proposed in cancer treatment. Based on either side, a number of drugs, agents and approaches are expanding or in the growth of development, some of which have shown clinical promise.

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KH was the single author of the manuscript.

Conflicts of interest
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Ethical considerations
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