

Chapter 13

Food in Health Preservation and Promotion: A Special Focus on the Interplay between Oxidative Stress and Pro–Oxidant/Antioxidant

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ABSTRACT

Association between food and health is complex. Healthy food can promote and maintain good human health. Healthy food and nutrition is a key regulating factor for boosting the immunity and therapeutic effectiveness of a treatment strategy. Oxidative stress is well involved in the pathogenesis of diverse diseases and aging. Food always considered as good source of nutrients, protein, fat, carbohydrates, vitamins, minerals and antioxidants. Consumed as part of a normal diet, phytochemicals present in food like vitamins (vitamin C & E), minerals (like, zinc, selenium), phytoconstituents (phenolic compounds, flavonoids, carotenoids) confer additional health benefits, by virtue of their antioxidant property. A diet rich that rich in antioxidant molecule reduces the risk of several oxidative stress related diseases. Numerous antioxidant molecules isolated from food showed the curative and health promotion effect. This chapter majorly deals with the role antioxidant/pro-oxidant substances present in different foods on human body.

INTRODUCTION

Good health is elemental to living a productive life, meeting basic needs and contributing to healthy society. The components of health are numerous and their interactions with food are complex. Healthy diet is essential for the success of physical and mental potential for all individuals. Good food, physical activity and healthy lifestyle are the basic requirement for preservation and promotion of health. A good

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diet is about receiving the correct amount of nutrients, bioactive molecules to maintain good health. Foods not only contain protein, fat, carbohydrates, vitamins and minerals but also supply essential biomolecules like antioxidants which are boosting our health. A good food can support human health and improve health potential, and yet can also be an important factor influencing ill health.

In 1980s the name antioxidants came into spotlight when it identified as miracle substances for good health. Food contains numerous biomolecule (antioxidant), which prevent free radical induce diseases, increase immunity and also act as anti-aging molecule. Regular intake of fruits and vegetables has also been shown to protect human from number of diseases, and concurrent scientific investigations have confirmed that antioxidant substances present in those fruits and vegetables are playing a central role for their beneficial effect (Wahlqvist, 2013; Sen & Chakraborty, 2015). Fruits, vegetables and other food can boost the antioxidant capacity of body and thus helpful for human.

REDOX HOMEOSTASIS AND OXIDATIVE STRESS

ROS/RNS and Redox Homeostasis

Cellular redox homeostasis can be described as a normal physiological situation specifically the maintenance of normal level of free radical/reactive species in *in vivo* condition through the genetic control and array of enzymatic systems. In normal physiologic conditions, cells regulate the redox balance through production and elimination of reactive oxygen species (ROS) and reactive nitrogen species (RNS). Cells are well equipped with different enzymatic and non-enzymatic antioxidant systems to maintain the normal level of ROS/RNS in body by scavenging ROS/RNS, so that redox homeostasis sustains (Sen & Chakraborty, 2011; Trachootham, Lu, Ogasawara, Valle & Huang, 2008; Valko et al., 2007).

ROS and RNS consist of free radicals and different reactive species. Free radicals can be generated in both endogenous and exogenous environment. Production of free radicals in *in vivo* condition is continuous process as a part of normal physiology. Several process or system of our body like immune system, metabolic process (lipid peroxidation, metabolism of arachidonic acid, platelets, and macrophages), inflammation, and stress generates reactive species continuously. Drugs (adriamycin, bleomycin, mitomycin C, nitrofurantoin), chemicals (carbon tetrachloride, chloroform, paraquat, benzo pyrene, cleaning products, glue, paints, paint thinners, perfumes, and pesticides), smoking of tobacco products, radiation, pollution and some food are responsible for generation of free radicals (Sen, Chakraborty, Sridhar, Reddy, & De, 2010; Sen & Chakraborty, 2011). Generation of free radical also increased in pathological condition. ROS and RNS are essential for body in low/moderate concentration. It acts as intercellular signal molecules and also participate in immune mechanism. But at high concentration they induce molecular damage (Valko et al., 2007; Zorov et al., 2005). Table 1 describes different ROS and RNS along with their properties.

Oxidative Stress and Diseases

Normal physiological and biochemical function of cell maintain by the steady state concentration of reactive species, which determined by the balance between the generation and removal of reactive species by various antioxidants. Redox state cannot explain only as the state of redox pair, but it also demonstrates the redox environment of a cell. Usually in normal conditions, redox state of a biological system

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