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THE IMPORTANCE OF ANTIOXIDANT FOODS AND FREE RADICALS FOR HEALTH

Antioksidan Besinler ve Serbest Radikallerin Sağlık Açısından Önemi

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ÖZET

Besinlerimiz, çevremiz, duygularımız ve düşüncelerimizin yönetimi ve içinde yaşadığımız ortam yaşlanma ve sağlıklı bir hayat sürme ile doğrudan ilişkilidir. Bu faktörlerden beslenmenin insan ömrü ve hastalıklarla ilişkisi oldukça fazladır. Günümüzde fast food ağırlıklı beslenme, yoğun şeker tüketimi ve hazır gıdalar sağlıksız bir hayata yol açmaktadır. Bunun nedenlerinden birisi, çok hızlı kana karışan ve mitokondriyal oksidasyonda serbest oksijen türleri oluşturan besinlerdir. Bu tip bir beslenmenin antioksidan içeren besinlerle dengelenmesi gerekmektedir. Bu besinler genel olarak bitkisel ağırlıklıdır. Bu çalışmada, serbest veya reaktif oksijen türlerinin nasıl meydana geldiği, bu moleküllerin antioksidan mekanizması ile nasıl nötralize edildiği ve antioksidan özelliği yüksek olan gıdalara değinilmiştir.

Anahtar kelimeler: ROS, ORAC, Antioksidan besinler

ABSTRACT

Our food, our environment, the management of our emotions and our thoughts, as well as the environment in which we develop are factors that can undoubtedly establish our balance and accelerate aging. These factors are determinants in the health of the human being and this is already admitted by a wide sector of society Nutrition has a relationship with human life and diseases. Today, fast food-based nutrition, intense sugar consumption and ready-made foods lead to an unhealthy life. One of the reasons for this is the foods that mix very rapidly into the blood and form free oxygen types in mitochondrial oxidation. This type of diet needs to be balanced with foods containing antioxidants. These foods are generally vegetable-based. In this study, how free or reactive oxygen types are formed, how these molecules are neutralized by the antioxidant mechanism and foods with high antioxidant properties are mentioned.

Keywords: ROS, ORAC, Antioxydant foods

1. INTRODUCTION

What is a free radical? "In chemistry, a radical is a chemical species (organic or inorganic), characterized by having one or more missing electrons. Free radicals are highly reactive molecules, and the consequence of these reactions causes a disorganization in the cell membranes of our body. Such disorder is lethal to the cell." (Jansson, 1990)

That is, a free radical is a reaction that takes place inside our body and destroys cells such as skin cells (Hatefi, 1990). In adequate quantities, the radicals bring benefits such as the fight against bacteria and viruses, among others. But the problem appears when the concentration of these free radicals is very high. To focus the issue, we would like to talk about Free Radicals what they are, how they are produced and their possible consequences in our body if oxidative stress is not combated (Capaldi,1990)

Among the destructive effects caused by RL, is the peroxidation of the polyunsaturated lipids of the biological membranes. This process is similar in its mechanism to the self-oxidation that fats undergo in their storage if they are exposed to ambient oxygen, but is accelerated intracellularly by the presence of the reactive oxygen species mentioned above or by other RLs. The propagation chain of this process develops from the action of an RL on the polysaturated lipid. The hydroperoxide (ROOH) and endoperoxide (ROO) radicals can react with other polyunsaturated fatty acids of the membranes causing massive damage (Halliwell, 1991)

Malonaldehyde (MAD) is formed only by fatty acids with three or more double bonds and is used as a measure of lipid peroxidation together with the ethane of the two terminal carbons of gamma 3 fatty acids and gamma6 fatty pentane acids. The lipid peroxidation process is also a consequence of the action of the RL, a source that generates new radicals such as ROOH and ROO. (Giri et al, 1988). An antioxidant is a molecule capable of inhibiting oxidation caused by free radicals, giving up electrons without losing their balance.

2. BIOCHEMICAL MECHANISM

The oxygen in the atmosphere, and especially the sun, originate free radicals attacking the cells, precipitating cellular aging (White, 1980). A paradox of metabolism is that while the vast majority of complex life requires oxygen for its existence, oxygen is a highly reactive molecule that can harm living beings by producing reactive oxygen species. Therefore, organisms have a complex network of metabolites and antioxidant enzymes that work together to prevent oxidative damage of cellular components such as DNA, proteins and lipids.

SOD is an enzyme present in all aerobic organisms and is found in the vast majority of cells, both in the cytoplasm and in the mitochondria, cytoplasmic SOD has an atom of Cu and another of Zn in its active center, while Mitochondrial contains Mn, regardless of this difference both forms catalyze the conversion of superoxide to peroxide.

$O^{-}_{2} + O^{-}_{2} + 2H$ ---------- $H_2O_2 + O_2$

In this way SOD acts by eliminating superoxide ions in the aqueous phase of the cell. The importance of this enzyme has been potentiated in recent years by the discovery that a mutation of it is a cause of amyotrophic lateral sclerosis. How to fight free radicals? To neutralize, that is, combat, free radicals the body uses the famous antioxidants (An antioxidant is a molecule capable of retarding or preventing the oxidation of other molecules). These antioxidants can be found in natural foods and ingredients, and also in cosmetics and synthetic products (Babior, 1985).

ROS, natural antioxidants and antitumor response. In addition to their harmful effects, free radicals and other reactive species have defense functions against foreign substances that invade our body, and also function as messengers in cellular signaling processes. Due to this signaling function, our cells can adapt to external stress stimuli, so that, for example, we can withstand exposure to a toxic agent for longer, or a higher concentration of the toxic. In this context, free radicals can also cause activation of signaling cascades that lead to programmed cell death (apoptosis) (Jamieson, 1989).

3. MECHANISMS OF WAR AGAINST FREE RADICALS

1. Glutathione and Glutathione Peroxidase (GSHPx)

Thiol groups are cellular antioxidants which act by enzymatic reactions and by capturing free radicals. Glutathione, a tripeptide bearing thiol groups, serves as substrates of many enzymes, such as transferases, peroxidases, which inhibit or reduce the destructive effects of free radicals. Water soluble glutathione, which is a thiol and is present in very high concentrations in many cells, protects biological membranes against lipid peroxidation. This protection occurs enzymatically (Baly, 1982).

2. Catalase and Peroxidase

The catalase enzyme known as a metalloenzyme is one of the most effective protein catalysts that promote redox reaction (Larson 1988). The toxic hydrogen peroxide produced by SOD enzyme activity is converted to water and oxygen. Although it does not react specifically with most of the biologically important molecules, it plays a role in the formation of more reactive oxidants such as radicals (Richardson, 1988).

3. Superoxide dismutase enzyme (SOD)

This enzyme catalyzes the conversion of superoxide anion to hydrogen peroxide and oxygen, reducing the effect of these radicals (Drost, 2010). In this case, the active region of the enzyme SOD Zn is an important mineral. This reaction is carried out at a pH of 11 and below superoxide anion. Although very stable, enzyme catalysis, even without normal physiological pH values are running very quickly. However, in reality all aerobic organisms were found to contain SOD (Farber, 1990). The enzyme SOD is a strong enough catalyst to increase the reaction rate (Benzi et al 1988), (Koca,2003).

4. MATERIAL AND METHODS

The ORAC experiment is dependent on free radical damage in a fluorescent probe, such as a fluorescent probe, leading to a change in fluorescence intensity, and the degree of change is an indication of the amount of radical damage. The presence of antioxidants leads to the prevention of free radical damage in the fluorescent compound. This inhibition is observed as the protection of the fluorescent signal. It is possible to measure the protection by calculating the area under the curve (AUC) from the test sample. Once the AUC is removed for space, the resulting difference will be the protection provided by the antioxidant compound. The water-soluble vitamin E analog, Trolox®(6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid) is used as the calibration standard, and the ORAC results are expressed as the Trolox® equivalent. The ORAC assay is unique because the AUC calculation combines both the inhibition time and the percent inhibition of free radical damage by the antioxidant, as it is directed towards completion of the assay (G-Biosciences, 2020).

5. RESULTS

Because as the antioxidant power of a food increases, its health benefits increase. Antioxidant power can be measured and defined by a particular system. The most commonly used method is to measure the oxygen radical absorption capacity (ORAC) of that food. Specialists are recommended to create a nutritional list of at least 3000 ORACs antioxidant per day to keep an adult body healthy. It is stated that it will be very beneficial to take daily foods up to 20000 orac. As it is known, the foods with the highest antioxidant capacity are vegetables and fruits. Considering the ORAC value, the top 10 foods with high antioxidant power can be listed as follows; Prunes 5500, Raisins 2500 (5-6 black raisins each morning), Blueberry 2400, Blackberry 2000, Strawberry 1500, Spinach 1250, Cabbage 900 (Also a strong prebiotic, an excellent source of calcium.), Red pepper 700 (An excellent vegetable, a great store of vitamin C.), Cauliflower 600, Onion 450.

4. CONCLUSION

Antioxidants are natural substances (lycopene, quartset, catechin), vitamins (vitamins C and E) and minerals (zinc and selenium), which are found in vegetables and fruits, protect cells from aging and rust, and prevent cancer, weakening of immunity. ORAC values can also show minor fluctuations in different sources, but these differences have no serious effect. Therefore, these foods should be consumed daily in certain proportions.

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