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Antioxidant Role of Saliva

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ABSTRACT

In physiological conditions in the body there is a balance between prooxidanas and antioxidants. Oxidative stress is a state in which the balance between proxydanases and antioxidants shifted towards prooxydanes, with consequent oxidative damage essential cell biomolecules. Oxidative stress can lead to cell damage through micro-damage to the cell membrane, protein deactivation, DNA damage, and stimulation of cell signaling molecule-induced tissue damage. Some molecules are more vulnerable to oxidation than others. In particular, some of the molecules in cell walls, containing unsaturated lipids, are particularly susceptible to the attack of free radicals. Other vulnerable molecules include RNA, DNA, and protein enzymes. Salivary antioxidants can be classified in three groups, according to their function. The first group is formed by preventive antioxidants, which are those which inhibit the production of free radicals, such as antioxidants Superoxide Dismutase (SOD), carotenoids, catalase, glutathione, peroxidase, transferrin, albumin and haptoglobin. Secondly there are 'sweeping' antioxidants, such as vitamin A and E, Uric Acid (UA), albumin and bilirubin, which eliminate free radicals in order to inhibit the starting and spreading of cell damage. The last groups are enzymes such as proteases, transferase, lipases, etc, which repair the damage caused in the tissues. Whole saliva may contain simply measured indicators of oxidative processes. This may provide a tool for the development and monitoring of new treatment strategies.

INTRODUCTION

In physiological conditions in the body there is a balance between prooxidanas and antioxidants. Oxidative stress is a state in which the balance between proxydanases and antioxidants shifted towards prooxydants, with consequent oxidative damage essential cell biomolecules [1]. According to the new definition, oxidative stress represents disturbance of redox dependent signaling pathways and the processes they control. Free radicals they have an unpaired electron in an external orbit, making them highly reactive electrophilic species that can be associated with almost all atoms. The most important are reactive oxygen species (oxygen free radicals, OFR) [2].

For oxidative stress, it can be said that it is a normal phenomenon, or that it is present in healthy people because it is closely related to aging. The oxidation process is part of the regulatory biochemical functioning of our bodies in the process of creating the energy that we need for life. During these processes, free radicals are created that have their physiological positive functions [3,4]. The problem arises when a finite equilibrium is broken and when natural defense mechanisms fail, the level of free radicals begins to exceed the capacity of the organism to neutralize them, which changes the oxidative status and the body enters the zone of increased oxidative stress, or a state of high risk for the generation of various disorders and diseases [5].

The harmful effect of free radicals in oxidative stress, according to the understanding of modern medicine, is reflected in the emergence of many acute and chronic diseases that are clinically manifested as acute and chronic inflammatory processes (rheumatoid arthritis, vasculitis) [6], neurological disorders (Alzheimer's disease, Parkinson's disease, cerebrovascular damage , muscular dystrophy), cardiovascular disorders (hypertension and hypertensive heart disease, atherosclerosis), lung fibrosis, cataract, malignant disease, and many other conditions called early aging [7].

Most free radicals are highly reactive species and have a very short half-life (just a few seconds). In contrast, half-life of lipids, proteins, carbohydrates and nucleic acid, after the action of free radicals, lasts from several hours to several days, making them more stable markers of oxidative stress. Indirect measurement of oxidative stress involves the measurement of more stable molecular products produced by the oxidation reaction between free radicals and certain biologically important macromolecules - lipids, proteins and DNA [8,9].

During the evolution, aerobic organisms developed an antioxidant protective system for preventing the creation and capture of free radicals, as well as repairing the damage caused free radicals. Antioxidant protection consists of cytoprotective enzymes and non-enzymatic antioxidants, which prevent potential free radicals toxicity [10]. Protective mechanisms include the prevention of the occurrence and elimination of the resulting, as well as the repair of the resulting damage, and removing damaged molecules before their accumulation causes new damage. Non-enzyme antioxidants are low molecular weight compounds that are synthesized in the body or are fed through food. To provide effective protection, these antioxidants are strategic arranged in the intra and extracellular space. The effectiveness of the antioxidant system depends on the intake of vitamins and micronutrients through food and the synthesis of antioxidant enzymes, which can be change under the influence of physical activity, nutrition or aging [11,12].

THE ROLE OF OXIDATIVE STRESS IN THE PATHOGENESIS OF THE ORAL DISEASES

Oxidative stress can lead to cell damage through micro-damage to the cell membrane, protein deactivation, DNA damage, and stimulation of cell signaling molecule-induced tissue damage. Some molecules are more vulnerable to oxidation (i.e., "electron theft") than others. In particular, some of the molecules in cell walls, containing unsaturated lipids, are particularly susceptible to the attack of free radicals. Other vulnerable molecules include RNA, DNA, and protein enzymes [13]. Oral cells are uniquely susceptible to free radical damage because the mucus membranes allow rapid absorption of substances across their surfaces. In oral tissues, infection from gum disease can generate oxidative stress as can alcohol, nicotine, hydrogen peroxide, and other dental procedures and substances such as hydrogen peroxide, dental cements and composite fillings. The increase in free radicals from oxidative stress leads to further breakdown of cell walls and oral tissue [14,15]. Not only does oxidative stress exacerbate inflammation in the oral tissues, recent scientific studies have shown it is a contributing factor to systemic inflammatory diseases, including rheumatoid arthritis and cardiovascular disease. Because of the association between gum disease, inflammation and oxidative stress, it is critical to control gum disease and to maintain the balance between oxidants and antioxidants in oral tissues [16].

THE ANTIOXIDANT CAPACITY OF SALIVA

Saliva is the clear, viscous fluid secreted by the three pairs of major salivary glands. It is 98 percent water, and the remaining two percent includes proteins, electrolytes, enzymes, hormones, and other substances [17]. One of the major functions of saliva is digestion. The liquid and the enzymes soften food and begin the process of breaking it down [18]. Human saliva is rich in antioxidant compounds. The primary antioxidants include uric acid, albumin, ascorbic acid, glutathione and antioxidant enzymes. In addition, because saliva reflects the body’s levels of various hormonal, immunological, toxicological and infectious disease markers, it is an excellent tool for monitoring oral and systemic health [19,20]. Salivary antioxidants can be classified in three groups, according to their function [21]. The first group is formed by preventive antioxidants, which are those which inhibit the production of free radicals, such as antioxidants Superoxide Dismutase (SOD), carotenoids, catalase, glutathione, peroxidase, transferrin, albumin and haptoglobin. Secondly there are 'sweeping' antioxidants, such as vitamin A and E, Uric Acid (UA), albumin and bilirubin, which eliminate free radicals in order to inhibit the starting and spreading of cell damage. The last groups are enzymes such as proteases, transferase, lipases, etc, which repair the damage caused in the tissues [22]. Antioxidants are critical to the body's defense system. They neutralize free radicals, including Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) that can cause oxidative stress leading to cell breakdown, tissue damage and DNA mutations. Antioxidants have also been shown to promote the wound-healing process and to limit the body's release of certain inflammation-causing proteins [23]. Antioxidant salivary protection has been in the last few decades, the subject of many biomedical research. Many studies have confirmed that oxidative stress plays an important role in the pathogenesis of chronic inflammatory diseases [24]. As chronic periodontal disease is the most commonly inflammatory disease of the oral cavity, this role of oxidative atres and antioxidant protection in the pathogenesis of this disease is increasingly illuminated. Of special importance is the antioxidative role of saliva in the aim of neutralizing free radicals and reducing the oxidative damage of the periodontal tissue cells, which this secretion accomplishes by the presence of enzymatic and non-enzymatic antioxidants. Among them are dominant: salivary peroxidase, superoxide dizmutase, glutathione peroxidase, catalase, uric acid, albumin. Analyzing saliva antioxidants, as well as its overall antioxidant capacity, is important for a better understanding of pathogenesis of periodontal disease and the introduction of new preventive measures [25].

Oral Peroxidase (OP) is a salivary enzyme that consists of from two peroxidase enzymes: salivary peroxidase (80%) and myeloperoxidase (20%). She is more significant enzymatic antioxidant salivary [26]. Salivary peroxidase secretes the main salivary glands, mostly parotid glands. It is an enzyme that is in its active one the center contains selenium. The role of salivary peroxidase is reduction Hydrogen Peroxide (H_2O_2), the product of metabolism oral bacteria, in the presence of ions thiocyanate (SCN-) [27]. Thiocyanates, saline ingredients (0.3-1.5mM), are donors electrons, similarly reduced glutathione in other biological systems [28]. They come from Hydrogen Cyanide (HCN) of tobacco smoke during detoxification in the liver, and then by the way blood is transported to the salivary glands, where ultrafiltration they get into saliva. The reaction of salivary peroxidase catalyses the reaction H_2O_2 and ions thiocyanates [29]. Saliva is also rich in non-enzymatic antioxidants such as ascorbic acid, albumin, glutathione, lactoferrin, vitamins and uric acid, which is the main representative agent of this group [30]. Correlation between the level of uric acid in the saliva and plasma suggests that uric acid is plasma born. It was reported that uric acid accounts for more than 85% of the total antioxidant capacity of the human unstimulated and stimulated saliva . Uric acid can act as a prooxidant, especially when it occurs in higher concentration. It can also act as an antioxidant [24]. Uric acid (acidum uricum) is the ultimate product metabolism of purine nucleotides. However, her presence in saliva has not been fully clarified [31]. There is also the possibility of her presence in the gingival fluid as a result of oxidative damage to the local protein tissue. Regardless of its origin, it is considered to be the main one antioxidant saliva, because it participates in about 70% total salivary antioxidant capacity. Uric acid reduces and neutralizes free radicals and they themselves oxidize themselves to allantoin [26]. Glutathione is a tripeptide consisting of glutamic acid, cysteine and glycine. The cells are present in two forms: as reduced (GSH) and oxidized (GSSG). For normal the functioning of a cell is especially important in it always has a sufficiently reduced form of this biomolecule which is necessary for the action of the antioxidant enzyme glutathione peroxidase. This enzyme exerts glutathione oxidation, neutralizing hydrogen peroxide and other peroxides [32].

CONCLUSION

Whole saliva may contain simply measured indicators of oxidative processes. This may provide a tool for the development and monitoring of new treatment strategies. A noninvasive determination of the salivary concentrations of antioxidants allows the evaluation of the defensive capacity of the oral mucosa, and in this way we can prevent many pathological conditions in the oral cavity and act preventively.

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