

## Antioxidants and Oral Health

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### ABSTRACT

The oral cavity is ubiquitous of various bacteria due to steady assaults of various food substances, soft drinks, alcohol, tobacco products etc. Antioxidants are substances that inhibit oxidation and prevent the formation of free radicals, which are responsible for cellular damage. Since the oral tissues are vulnerable to cellular damage caused by free radicals and oxidation process hence maintenance, a good level of antioxidants is very essential to achieve optimal oral health. This review highlights the role of antioxidants in the prevention of oral diseases.

**Keywords:** Antioxidants, Free Radicals, Oral Health

Oral health is the essence of general health and equally important to pursue a quality life. In a developing country like India, regardless of the advancement of treatment modalities, dental diseases are still a leading problem. Dental diseases including dental caries, periodontitis, gingivitis, and periapical pathology, oral cancers affect the normal day-to-day activities of a person and may be life-threatening. Antioxidants are the substances that inhibit oxidation of other molecules, which produces free radicals. These free radicals are responsible for harmful chain reactions for cell damage or cell death that is responsible for carcinogenesis or low-density lipoprotein (LDL) oxidations in various diseases [1].

Free radical is defined as any molecular species that contains an unpaired electron capable of independent existence. The most important oxygen-containing free radicals are hydroxyl radical, superoxide anion radical, hydrogen peroxide, oxygen singlet, hypochlorite, nitric oxide radical, and peroxynitrite radical. These are highly reactive species capable in damaging of biologically relevant molecules such as DNA, proteins, carbohydrates, and lipids and leading to cellular damage and homeostatic

disruption [2, 3]. Antioxidants neutralize these radicals by donating their electrons and ending the electron taking reaction [1]. Antioxidants present in all biological species, body fluids including saliva and foods like carrots, berries, spinach, pumpkin, mangoes, and apricots are the cheapest and readily available source of antioxidants [4]. Human beings have extremely multifaceted antioxidant systems which act synergistically to prevent cells and organs with free radical [5]. Oral tissues are extremely delicate and vulnerable for cellular damage by oxidative stress and salivary composition plays an enormous role in controlling and maintaining oxidative stress because of its antioxidant activity [6].

Hence, antioxidants are an important role in the protection of oral tissues against cellular damage; therefore, the aim of this review is too high lighten the facts of antioxidants against good oral health.

### CLASSIFICATIONS OF ANTIOXIDANTS

1. Based on their dietary supplements [5]  
Endogenous and Exogenous

## 2. Based on their Properties [7]

Enzymatic	Non- Enzymatic
<b>Primary enzymes:</b> SOD, Catalase, Glutathione Peroxidase <b>Secondary Enzymes:</b> Glutathione reductase, glucose 6-phosphate dehydrogenase	<b>Minerals:</b> Zinc, Selenium <b>Vitamins:</b> Vit A, E, C, K <b>Carotenoids:</b> beta carotene, lycopene <b>Low molecular weight antioxidants:</b> Glutathione, Uric acid <b>Antioxidant cofactor:</b> Coenzyme Q10 <b>Polyphenols:</b> Flavonoids, Phenolic acid

## 3. Based on their mode of action as [8]

Preventive	Scavenging (Chain Breaking)
Enzymes Superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), DNA repair enzymes	Ascorbate (vitamin C), carotenoids (including retinol – vitamin A), uric acid, $\alpha$ - tocopherol (vitamin E), polyphenols (flavonoids).

## ROLE OF ANTIOXIDANTS IN DIFFERENT DENTAL PROBLEMS

### Dental caries

Dental caries is an infectious microbiologic disease of teeth that results in localized dissolution and destruction of calcified structures. Oxidative stress is an important factor in the initiation and progression of dental caries and saliva provides the first line of defense against oxidative stress [4]. Various physio-chemical properties of saliva like pH, buffering capacity, salivary flow rate, the concentration of various components like proteins, calcium, and antioxidant defense system play a major role in the development of caries [9]. A study conducted by Hegde et al found that total antioxidant capacity of saliva positively correlated with the incidence of early childhood and rampant caries [10]. According to Motamayel AF et al oxidative stress marker, which has an important role in caries progression was higher in the caries prone individual than the healthy control group [11]. All these studies showed that antioxidant is a crucial role in dental caries progression.

### Antioxidants and Periodontal disease

Periodontitis is an inflammatory disease of the oral cavity, which has multi-factorial etiology. However, according to various researches loss of balance between reactive oxygen species and antioxidant defense mechanism results in periodontal diseases and according to Chapple IL et al, oxidative stress involves in the pathogenesis of

periodontitis [12]. *Superoxide dismutase* (SOD) enzyme, which is a potent antioxidant present in periodontal ligaments, reduced in activity with increasing age. Sometimes impulsive production of superoxide (free radicals) in gingival crevicular fluid demonstrated in periodontitis patients in early nineties [13, 14]. Uric acid, which is a strong antioxidant of saliva, contributes approximately 70% of the total salivary antioxidant capacity and fight against various oral diseases. According to Moore et al, uric acid levels vary according to the severity of disease and low in a patient with periodontal disease [15]. Similarly, a study by Diab-Ladki *et al* found that decrease concentration of three main antioxidants (uric acid, ascorbic acid, and albumin) in saliva increases the severity of periodontal disease [16]. According to an in vitro study, SOD and catalase activity promote ROS production, which in turn causes tissue destruction. GCF and plasma total antioxidant capacity significantly reduced in patients with periodontal disease in comparison to periodontally healthy controls [17, 18]. All these studies showed that antioxidant level has potent inhibitor in periodontal diseases and according to Mathur A et al and Chandra RV et al, antioxidants could use as a promising treatment modality in periodontal diseases [19, 20].

### Oral cancer

Oral cancer is the biggest public health problem worldwide and ranks as the eighth most common cancer in developing countries. In Indian sub-continent, high incidence of oral cancer observed which accounts one-third burden of oral cancer worldwide. According to various studies, alteration in antioxidant levels due to the presence of carcinogens in the blood plays a key role in the development of malignant states. A study conducted by Madhulatha G et al showed that antioxidant protection mechanism comprises an imperative defense system against the free radical injury, therefore, the antioxidants play the essential role and valuable markers in diagnosing oral cancer [21]. Various antioxidants use as adjunctive treatment modalities of oral precancerous lesions e.g. Vitamin-E can use as an antioxidant in oral lesions because it inhibits the reactions of the tobacco-specific nitrosamine (carcinogens). Other antioxidants like  $\beta$  carotene, provitamin A, vitamin-C, vitamin-E, zinc, selenium and spirulina also have a potent role in the prevention of oral cancer [22]. Balwant Rai et al proved that Vitamin-C and Vitamin-E could utilize in the treatment of oral Lichen planus [23] and antioxidant combinations as Vitamin A, E, and C proved to be most effective with maximum clinical resolution and regression of dysplasia recorded [24].

## CONCLUSION

This review concludes that antioxidants protect the body against the harmful effects of free radicals and prevent cellular damage. Considerable evidence present that

indicates optimal antioxidants level in the body provides a barrier against various oral diseases. Therefore, antioxidant enzymes act as a useful biomarker for various oral diseases, therefore, supplementation of antioxidants provides may reduce the prevalence of oral problems.

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