

# **R**OLE OF ANTIOXIDANTS ON IMMUNE SYSTEM: A REVIEW

**SABINA KHANAM**

*Department of Biological Sciences, Yobe State University, Nigeria.*

## **ABSTRACT**

**A**ntioxidants are first line of defense against damage which is caused by free radicals and play an important role in immune function. Exposure to pollutants, drugs, cigarette smoke, stress, illness can increase the production of free radicals in the body. Several antioxidants like Vitamin E, Vitamin C and  $\beta$ -Carotene play an important role in immune responsiveness, health and can affect immune responses. These antioxidants increase the activity of cells which are involved in immunity. This review article focus on the effects of antioxidants on immunity and how immune system depends on antioxidants.

**Keyword:** *antioxidants, immunity, free radical, vitamin c*

## **Introduction:**

Antioxidants are essential for health and it occur naturally in many foods. Antioxidants are found in both natural and synthetic forms which are used by many food industries as food additives. Antioxidants are those substances which delays or prevents oxidation of lipids, carbohydrates, proteins, and DNA at low concentrations (Halliwell, 1990) or it is a substance which neutralize the action of free radicals. (Sies, 1996).

**A**ntioxidants are capable of deactivating free radicals before they attack the cells. Antioxidants are of two types: enzymatic and non-enzymatic. Enzymatic antioxidants are: glutathione reductase, glutathione peroxidase, superoxide dismutase (SOD) etc. and Non-Enzymatic antioxidants are flavonoids, carotenoids, glutathione and polyphenols etc. There are several antioxidants such as Vitamin E and  $\beta$ -Carotene which play an important role in immune responsiveness and health of animals and humans and also can affect the immune responses (Weiss and Spears, 2006; Chew and Park, 2004).

Many edible natural products such as vegetables and fruits are very important for human health. It is well known that cancer is prevented by dietary consumption of fruits, vegetables, herbs (Ames, 1998; Liu, 2004). Most of the natural products contain antioxidant properties such as flavonoids, phenolic acids, carotenoids, vitamins (Klimczak *et al.*, 2007; Rupasinghe and Clegg, 2007). Some antioxidants such as flavonoids show protective effects against various diseases like cancer, Alzheimer's disease, epilepsy, cardiovascular diseases (Farzaei *et al.*, 2016; Fantini *et al.*, 2015; Spinello *et al.*, 2016; El Haouari and Rosado, 2016; Grassi *et al.*, 2015; Sucher and Carles, 2015; Diniz *et al.*, 2015)

**Table 1: Natural Antioxidants and their Sources**

Antioxidants	Dietary sources
$\beta$ -Carotene	Mango, Melon, Papaya, Peach, Pineapple, Strawberries, Grapes, Watermelon, Orange. Cauliflower, Carrots, Potatoes, Tomatoes, Cabbage, Broccoli, Brinjal, Spinach. Peas, Chillies, Saffron, Beans.

	Cheese, Butter, Yogurt, Milk.
<b>Flavonoids</b>	Grapes, Pears, Pomegranate, Apples, Strawberries, Citrus fruits. Tomatoes, Brinjal, Onion, Beetroot, Pepper, Spinach. Cardmom, Cumin seeds, White and Black beans, Soy beans, Olive oil.
<b>Vitamin C and Vitamin E</b>	Oranges, Lemon, Amla. Olive oil, Soybean oil, Groundnut oil, Cashew, Rasins, Corn, Sunflower seed, Germinated pulses.

Activity of immune system decreases with age. As the age increases immune system activity decreases. Due to these pronounced alterations being found in cell-mediated immunity, decrease proliferative capacity of T-lymphocytes and decreased production of IL-2. Immune cells contain high levels of antioxidants vitamins, which provide protection against lipid per oxidation and immunosuppression which are the risks posed by high content of polyunsaturated fatty acids (Bendich, 1988).

This paper will review the role of antioxidants on immune system and how immune system depends on antioxidants.

### **Carotenoids**

It boosts the immune system by increasing the production of helper T-cells and natural killer cells cytotoxicity. It modulates the host defense systems. Supplementation of  $\beta$ -Carotene increases total number of circulating mononuclear cells and tumor necrosis factor alpha and IL-1.

## Vitamin C

Vitamin C boost the immune system more than another nutrient. It increases the production of antibodies and WBC (White blood cells) in the body. It increases the production of interferon which coats the cell surfaces and prevent the entry of foreign elements such as viruses. It is important for the normal functioning of neutrophil in the body. When Reactive Oxygen Species (ROS) released extracellularly in the body then it is mutagenic, auto toxic and immunosuppressive to phagocytes then Vitamin C neutralized phagocyte derived extracellular oxidants.

**Table 2: Endogenous Antioxidant their source and Applications**

Antioxidants	Source	Application
<b>Superoxide Dismutase (SOD)</b>	Skin, Brussels Sprouts, Broccoli, Cabbage, Barley grass.	<ul style="list-style-type: none"> <li>• It generates skin building cells fibroblasts.</li> <li>• It prevents the development of Amyotrophic Lateral Sclerosis (ALS).</li> <li>• It is used in Arthritis, Prostrate problems, Inflammatory diseases.</li> <li>• It prevents the formation of wrinkles.</li> <li>• It also heal wounds.</li> </ul>

<b>Catalase (CAT)</b>	All animal cells	<ul style="list-style-type: none"> <li>• It degrades the hydrogen peroxide to protect the cells.</li> <li>• Used in food industry for removing H<sub>2</sub>O<sub>2</sub> from milk prior to cheese formation.</li> <li>• It is used in textile industry for removing H<sub>2</sub>O<sub>2</sub> from fabrics.</li> </ul>
<b>Glutathione peroxidase (GPx)</b>	Most of the tissues, cytosol, mitochondria, kidney, liver, erythrocytes.	<ul style="list-style-type: none"> <li>• It acts as body's immune system boosters.</li> <li>• It protect the white blood cells which is responsible for immunity.</li> </ul>

### Glutathione

If the lymphoid cells have properly balanced glutathione, then immune system works properly. White blood cells present in sufficient quantities when glutathione present in sufficient quantity. Glutathione regulate degradation, binding and T-cell proliferation by increasing the number of binding cellular receptors. It increases the humoral immune function. This is an immune response which involves transformation of B cells into plasma cells which produce antibodies for specific antigen.

### Vitamin E

Vitamin E decreases with age. It is deficient in the elder peoples. If the level of Vitamin E is low then it leads to unstable immune cell membranes, which enhanced the production of immunosuppressors

such as prostaglandins. It increases the cell mediated immunity. It is also needed for better survival and fertilising potency of sperm cells. It is important for normal functioning of male reproductive system that is why this vitamin is called anti-sterility.

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