

**ANTIOXIDANTS FROM NATURAL SOURCES: REVIEW**

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Article Received on  
04 Feb. 2021,

Revised on 24 Feb. 2021,  
Accepted on 16 March 2021

DOI: 10.20959/wjpr20214-20079

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**ABSTRACT**

A variety of plant materials are known to be natural sources of antioxidants, such as herbs, spices, seeds, fruits and vegetables. The richest sources of polyphenols are various spices and dried herbs, cocoa products, some darkly colored berries, some seeds (flaxseed) and nuts (chestnut, hazelnut, walnut), and some vegetables, including olive and globe artichoke heads. This chapter describes the antioxidant properties of these sources in great detail. Antioxidants are common transient intermediaries in chemical reactions with cell components, causing permanent damage. They are believed to be the

source of aging and the cause of a number of degenerative diseases. In the human body, white blood cells interact with the free radicals, protecting body cells from harm. This paper provides knowledge on natural antioxidants and their sources, health benefits and Process of Extraction for natural Antioxidants.

**KEYWORDS:** Natural Antioxidants, Food Products, Health benefits of Antioxidants.

**INTRODUCTION**

Antioxidants are compounds that inhibit oxidation. Oxidation is a chemical reaction that can produce free radicals, thereby leading to chain reactions that may damage the cells of organisms. The body can cope with some free radicals and needs them to function effectively. However, the damage caused by an overload of free radicals over time may become irreversible and lead to certain diseases (including heart and liver disease) and some cancers (such as oral, oesophageal, stomach and bowel cancers). Oxidation can be accelerated by stress, cigarette smoking, alcohol, sunlight, pollution and other factors. Antioxidants are

found in certain foods and may prevent some of the damage caused by free radicals by neutralising them. These include the nutrient antioxidants, vitamins A, C and E, and the minerals copper, zinc and selenium.<sup>[1]</sup> Antioxidants may protect cells by a variety of mechanisms, including the conversion of ROS to non-radical species (which are dependent on the antioxidant involved), breaking the auto-oxidative chain reaction initiated by ROS and decreasing localized oxygen concentrations. The intake of exogenous antioxidants, such as ascorbic acid (Vitamin C),  $\alpha$ -tocopherol (Vitamin E), carotenoids and polyphenols, that can be found in commonly consumed fruits, vegetables, beverages, cereals and others food products, may support the antioxidative defence. Oxidation reactions are also present in many food products when exposed to air (oxygen) and/or to heat or light. In fact, food products' deterioration processes are highly related to oxidation reactions and the decompositions of oxidation products. As such, antioxidants also play an important role in the maintenance of the products' overall quality. One of the common deterioration processes is lipid peroxidation (e.g., in margarine, mayonnaise and frying oils).<sup>[2,3,4]</sup> Natural antioxidants are primarily phenolics that may occur in all parts of plants, such as fruits, vegetables, nuts, seeds, leaves, roots, and barks. In the recent past, some toxicological studies regarding the use of synthetic antioxidants have shown their unwanted or adverse effects. These reports have urged the researchers to focus their study on exploring the natural sources with reasonable antioxidant potential. Moreover, the availability and economy are significant concerns too in the context of using these natural antioxidants. The antioxidants from the nature can be categorized into the various sub classifications. However, two major categories are like antioxidants from commonly consumed or routine natural diets (e.g., vegetables, fruits, cereals, and beans) and secondly from plant or herb source those have fair antioxidant potential but are not the routine dietary source (e.g., medicinal plants and wild herbs). Among these, the routine dietary sources are very important as these can be easily available and more suitable for the dietary interventions. The need is to identify and generate awareness about these sources, which can be rated from top to down regarding antioxidant potential. The people who are habitual of consuming these vegetables and fruits in their routine meal are reported to be less affected by various chronic diseases and studies have also endorsed the long-term healthy impact of consuming these nature-origin diets. Most common dietary supplements are comprised of vitamins C and E from synthetic as well as natural sources. Vitamin C is rich in the citrus fruits, which is a renowned fact, so fruits such as orange, lemon, blueberries, strawberries, grapes, prunes, and plums; red beans; spinach; kale; broccoli lowers; and alfalfa sprouts have good amount of antioxidants. Fortunately, these are the part of our routine diet;

however, their availability pertaining to the geographical distribution as well as cultivation is an important factor. Though international trading made them available throughout the world and even in the off season as well, the consumption of seasonal and fresh fruits is always encouraged. Vitamin E is a fat-soluble vitamin and exerts its antioxidant effect by reducing fat oxidation in the body. Synthetic form of this vitamin is comprised of  $\alpha$ -tocopherol, which is widely used as food supplement. The natural form of this vitamin contains mixed tocopherols almost having eight isomeric forms of  $\alpha$ -tocopherol. The availability of these mixed tocopherols enhances the per cent absorption of vitamin E from the natural sources in the human body.<sup>[5,7]</sup>

This review is specially focused on the use of plant-source antioxidants and health benefits.

### **Natural antioxidants**

Natural antioxidants can be found in fruits and vegetables and are divided into three groups: vitamins, carotenoids and phenolic compounds. Glutathione is the most powerful and important among the antioxidants our body produces. The nature is always a significant and rich source of countless ingredients that can be served as health-promoting agents. Many of these natural sources include routinely used fruits, vegetables, Antioxidants from Natural Sources herbs, spices, and edible mushrooms that can be the part of routine diet. In addition to that, there is a huge list of medicinal plants reported to have extensive health-boosting potentials. One of the most beneficial effects from these natural sources is due to their potential antioxidant properties. Regarding the antioxidant capability, the researchers have focused their studies to explore the most potential sources along with their active ingredients. The researchers have added some marine sources such as algae and sea grass as well in the list of these natural sources.<sup>[7,8, 9]</sup>

### **Types of antioxidants from fruits, vegetables, nuts**

Polyphenols, present in fruits and vegetables, is a group of several low- and high-molecular weight compounds having antioxidant properties that prevent lipid oxidation. Most of them are conjugates of mono and polysaccharides connected with one or more groups of phenol rings or may also present as functional derivatives such as esters and methyl esters. This major class of natural antioxidants can be obtained from teas, particularly green and red teas, as well as fruits such as grapes. However, polyphenols from teas have more significant than in fruits because of their bioavailability in blood. Approximately 15–20% polyphenols are absorbed in human blood from their consumed amount. This absorption is enhanced when

there are no sugar molecules attached with them. So, teas have more absorption of polyphenols than in fruits because of high sugar content in fruits. Flavonoids, another important antioxidant content, is a subclass of polyphenols present abundantly in most of the foods, such as potatoes, wheat, tomatoes, red berries, peaches, and almonds. Polyphenols show their antioxidant properties by preventing the oxidation of low-density lipoproteins (LDL), thus preventing plaque formation some types of polyphenols have also been found to inhibit the oxidation of some important enzymes and thus preserve their proper functioning. Carotenoids are another major class of phytochemicals antioxidants from fruits and vegetables after polyphenols. They mostly found in vegetables, such as potatoes, carrots, papayas, and apricots. Among the vitamins obtained from fruits and vegetables, acting as antioxidants, vitamin C, also known as ascorbic acid, is a very potent water-soluble antioxidant commonly found in citrus fruits and vegetables such as oranges, lemons and tomatoes. It is recommended that the fruits and vegetables containing vitamin C should be taken in small divided doses instead of having a large dose simultaneously because vitamin C shows less absorption when given in large quantities. Another vitamin with antioxidant properties is vitamin E, which is related to tocopherol family of antioxidant. It is a fat-soluble, nonpolar vitamin found naturally in lipid-rich fruits and vegetables, such as olives, sunflower, and nuts Vitamin E shows higher bioavailability than vitamin C, which is perhaps due to its fat solubility and can be further enhanced when taken with fatty foods. <sup>[10,11,12]</sup>

**Table no. 1.**

| Sr. no. | Source       | Name of Antioxidants | Health benefits                                                          | Image                                                                                |
|---------|--------------|----------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1       | Strawberries | Anthocyanins         | Reduce the Risk of Heart Disease                                         |  |
| 2       | Artichokes   | Chlorogenic acid     | Reduce the risk of certain Cancers, Type 2 Diabetes and Heart Disease    |  |
| 3       | Goji Berries | Lycium barbarum      | Reduced risk of Heart Disease and Cancer, and may help Combat skin aging |  |

|    |                              |                                  |                                                                                           |                                                                                       |
|----|------------------------------|----------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 4  | Raspberries                  | Anthocyanins                     | Reduce inflammation and oxidative stress.                                                 |     |
| 5  | Kale                         | Anthocyanin                      | Maintain bone health and plays roles in other cellular functions                          |    |
| 6  | Red Cabbage                  | Anthocyanins                     | Reduce inflammation, protect against heart disease and reduce the risk of certain cancers |    |
| 7  | Beans                        | Kaempferol                       | reduced chronic inflammation and suppressed cancer growth                                 |     |
| 8  | Beets                        | Betalains                        | Reduce risk of cancers in the colon and digestive tract                                   |  |
| 9  | Spinach                      | Lutein and Zeaxanthin            | Help protect your eyes from damaging UV light and other harmful light wavelengths         |  |
| 10 | Purple, Red, and Blue Grapes | Anthocyanin and Proanthocyanidin | Protect against cancer and heart diseases                                                 |   |

|    |              |                                                                  |                                                                                                                                                  |                                                                                      |
|----|--------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 11 | Nuts         | Polyphenols                                                      | Lower cholesterol level                                                                                                                          |    |
| 12 | Tea          | Anthocyanin and Pro Anthocyanin                                  | Fight Inflammation                                                                                                                               |    |
| 13 | Sweet potato | Beta-Carotene,                                                   | Reduced risk of cancer,                                                                                                                          |   |
| 14 | Acorn squash | Beta-carotene, Lutein and Zeaxanthin                             | Reduce Inflammation                                                                                                                              |  |
| 15 | Carrots      | Flavonoids, Flavones, Catechins, Polyphenols, and Phytoestrogens | Improved Immune function and reduced risk of many illnesses, including heart disease, various degenerative ailments, and certain types of cancer |  |
| 16 | Papaya       | Carotenoids                                                      | Reduce oxidative stress in older adults and people with prediabetes, mild hypothyroidism and liver diseases                                      |  |

|    |         |            |                                          |                                                                                    |
|----|---------|------------|------------------------------------------|------------------------------------------------------------------------------------|
| 17 | Oranges | Hesperidin | Protective effects against heart disease |  |
|----|---------|------------|------------------------------------------|------------------------------------------------------------------------------------|

### Extraction methods for antioxidants from plants

Extraction is the first and crucial step for studying the natural antioxidants from plants. Many extraction factors play important roles in the extraction efficiency, such as type and concentration of extraction solvent, extraction temperature, extraction time, and extraction pH. Among them, the solvent is one of the most influential factors. Numerous solvents have been used for the extraction of antioxidants from food and medicinal plants. The selection of solvents is based on the chemical nature and polarity of antioxidant compounds to be extracted. Most of the phenolics, flavanoids and anthocyanins are hydrosoluble antioxidants. The polar and medium polar solvents, such as water, ethanol, methanol, propanol, acetone and their aqueous mixtures, are widely used for extraction. Carotenoids are lipid-soluble antioxidants, and common organic solvents, such as the mixtures of hexane with acetone, ethanol, methanol, or mixtures of ethyl acetate with acetone, ethanol, methanol, have been used for extraction. Various extraction procedures, including conventional extraction methods and non-conventional extraction methods, can be chosen to extract antioxidants from food and medicinal plants. The conventional extraction methods are mainly hot water bath, maceration and Soxhlet extraction, which are very time-consuming and require relatively large amounts of organic solvents with low extraction yields. Furthermore, the long heating process such as hot water bath and Soxhlet extraction may lead to the degradation of the thermolabile compounds. To obtain antioxidants from plants in an energy-efficient and economically sustainable way, ultrasound, microwave, pressurized liquid, enzyme hydrolysis, supercritical fluids, high hydrostatic pressure, pulsed electric field, and high voltage electrical discharges have been studied as non-conventional methods.<sup>[13,14,15]</sup>

### CONCLUSION

This paper provides knowledge on natural antioxidants and their sources and health benefits. Studies show that natural anti-oxidants are safer, easily consumable and healthier as compared to synthetic chemical-based anti-oxidants. In this Paper, we point up some significant natural anti-oxidant sources including fruits, vegetables, legumes, nuts, oilseeds along with health benefits and extraction of the same.

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