

SYSTEMATIC REVIEW: ROLE OF ANTIOXIDANTS IN HEALTH CARE**Dr. V. R. Ravikkumar¹, C. Meena.², K. Mohamed Kaif², K. Jaisurya,² K. Sudhagar², Dr. M. Senthil Kumar***¹HOD Department of Pharmacognosy, ²UG Students,
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ABSTRACT

Background: Oxidative stress happens when there is an imbalance between reactive oxygen species (ROS) and the antioxidant defense systems. This kind of stress seems to play a role in several long-term illnesses. Medicinal plants that are rich in phenolic compounds and flavonoids are getting a lot of interest, mainly because they appear to have antioxidant potential. **Methodology:** In this systematic review we looked at published, peer-reviewed research articles plus review papers focused on antioxidants, medicinal plants, oxidative stress, and the way these may be used therapeutically. Studies related to diabetes mellitus, cancer, aging, autoimmune disorders, gallbladder diseases, and irritable bowel syndrome (IBS) were carefully checked, then synthesized. **Results:** the evidence suggests that medicinal plants like *Momordica charantia*, *Catharanthus roseus*, *Curcuma longa*, *Boswellia serrata*, *Phyllanthus niruri*, and *Plantago ovata* have notable antioxidant effects. Their bioactive phytochemicals can scavenge free radicals, lower oxidative stress, and also show antidiabetic, anticancer, anti-inflammatory, immunomodulatory, hepatoprotective, and gastrointestinal protective actions. **Conclusion:** Antioxidants found in medicinal plants may work as promising complementary therapeutic tools to help prevent and manage diseases that are linked with oxidative stress. Still, more standardized phytochemical work is needed, plus better planned clinical studies, so the real efficacy and safety can be confirmed.

KEYWORDS: Antioxidants; Oxidative stress; Reactive oxygen species; Medicinal plants; Phenolic compounds; Flavonoids; Phytochemicals.

INTRODUCTION

Free radicals are harmful molecules created through normal processes and exposure to pollutants, etc. The presence of excessive free radicals can result in oxidative stress. The use of antioxidants helps mitigate the significant risk that free radicals pose to human health. Antioxidants can get internal source from our bodies and external source of dietary supplement and green vegetables. Our body has several types of endogenous (from within the body) antioxidants, including superoxide dismutase, glutathione peroxidase and catalase. When our body produces excess free radicals or unable to obtain enough nutrients to produce these enzymes, damage can occur due to inadequate antioxidant defence in place. Examples of dietary sources of antioxidants include vitamin E, C, carotenoids, flavonoids, selenium, and polyphenols.

Studies show a strong correlation between antioxidant consumption, the presence of chronic and degenerative diseases and the prevention of disease. "Inversely related", higher amounts of antioxidants consumed, lower probability of developing chronic or degenerative diseases, and longer lifespan.

It is important to maintain a balance between free radicals and antioxidants (i.e., antioxidants) to maintain physiological function and prevent oxidative damage. In researchers reported that antioxidants helps to delay aging, also helps to lower the risk of metabolic diseases linked to inflammation and degeneration. Additionally, there appears to be an inverse correlation between the amount of antioxidants consumed and an individual's chance of developing a disease. Antioxidants may also help increase health and longevity (i.e., promoting

overall health and longevity) through the maintenance of redox homeostasis and the reduction of oxidative damage, as well as increasing the body's ability to cope with stressors and other disease-causing factors.

The term herb describes many parts of a plant (roots, stems, leaves, flowers and seeds) that have more than one use, for example, seasoning or flavouring food, and health. Herbs also contain antioxidants which help combat disease by neutralizing free radicals. Examples of herbs with antioxidant properties include oregano, milk thistle, thyme and turmeric. Antioxidants are defined as protecting cells from damage caused by free radicals (unbalanced molecules). Free radicals can cause cell damage and have been linked to a variety of health issues (cancer and cardiovascular disease). Thus, antioxidants are important in reducing oxidative stress (which can result in chronic diseases).^[1]

HUGE NUMBER OF INDIAN MEDICINAL PLANTS WHICH POSSES ANTIOXIDANT ACTIVITY SOME OF THAT ARE

Amla, tulsi, Gilroy, ashwagandha, Brahmi, neem, curry leaves, moringa, tomatoes, carrots, red chillies, green chillies, bittergourd, sweetpotato, pomegranate, finger millet, sesame seeds, tamarind, green tea, guava and jamun.^[2]

PHENOL FLAVANOL CHEMICALS HAVE ANTIOXIDANT EFFECTS

Phenol Content

Plants produce phenolic chemicals as secondary metabolites for protection. These phenolic compounds provide humans with a natural way to heal and repair damage done to cells by reactive oxygen species (ROS). Twenty Indian medicinal plants were analysed, and each had a total phenolic compound (TPC) analysis performed using Folin-Coatue reagent. TPC values were reported as milligrams of gallic acid equivalent/g of dry plant extracts. The TPC values observed ranged widely from 12.21 – 355.25 mg gallic acid equivalent/g dry extract. *Terminalia arjuna* stem bark had the highest TPC, followed closely by fruits of *Terminalia chebolic* and *Terminalia Billerica*. The phenolic compounds could be determined to be the primary contributor to any antioxidant potential, as there was an almost perfect correlation between the total antioxidant capacity and the ferric reducing power respectively. By comparing the robust antioxidant activity of the highest TPC extract against all medicinal plant extracts included in this study, one can conclude that phenolic compounds are primarily responsible for the therapeutic effect of the traditional herbal medicines analysed herein.

Flavonoid Content

Flavonoids, a specific class of polyphenols, were quantified using a colorimetric assay and expressed as rutin equivalents (RE). Across the selected species, the total flavonoid content (TFC) ranged from 3.37 to 147.79 mg RE/g of dry extract. Similar to the phenolic results,

Terminalia arjuna stem bark contained the highest concentration of flavonoids (147.79 μ m 11.68 mg RE/g), followed by *Curcuma longa* rhizome and *Mentha arvensis* leaves. Interestingly, the study observed that high phenolic content did not always guarantee high flavonoid levels; for instance, plants like *P. emblica* had high phenols but relatively lower flavonoids. While flavonoids do contribute to the plant's antioxidant profile, they correlated to a lower extent compared to total phenolics. This suggests that other non-flavonoid phenolic species, such as tannins or coumarins, also play a significant role in the overall antioxidant capacity of these medicinal plants.^[3]

LIST OF RICH PHENOL AND FLAVONOID CONTAINING HERBS

Amla (*emblica officinalis*), Turmeric (*Curcuma longa*), Tulsi (*Ocimum sanctum*), Pomegranate (*Punica granatum*), Jamun (*Syzygium cumini*), Moringa oleifera, Ashwagandha (*Withania somniferous*), Guiducci (*Tinos Pora cordifolia*), Neem (*Azadirachta indica*), Ginger (*Zingiber officinale*), Onions (*Allium cepa*), Strawberries (*Fragaria × ananases*), Broccoli (*Brassica oleracea*), Apples (*Malus domestica*), Grapes (*Vitis vinifera*), Herbs Thyme (*Thymus vulgaris*), Oregano (*Origanum vulgare*), Parsley (*Petroselinum crispum*), Ginkgo Biloba (*Ginkgo biloba*), Teas (Green, Black (*Camellia sinensis*), Chamomile (*Matricaria chamomilla*) And Blueberries (*Vaccinium corymbosum*).^[4]

ROLE OF ANTIOXIDANT IN TREATMENT OF DISEASES AND HEALTH CARE

ROLE OF ANTIOXIDANTS IN DIABETES

Diabetes Mellitus (a.k.a. Type 1, 2) is an extremely serious lifelong metabolic disorder caused by hyperglycaemia (high blood glucose levels). The most prevalent type is known as type 2 diabetes which constitutes 95% of the total global prevalence of diabetes.

- The underlying cause of type 2 diabetes is oxidative stress and an accompanying decline in antioxidant status thereby leading to damage from free radicals (reactive oxygen species) to cells and tissues of the body.
- Type 2 diabetes can lead to long-term complications, such as blood vessel disease (e.g., atherosclerosis), nerve damage (e.g., neuropathy), kidney disease (e.g., nephropathy), and heart attack (e.g., myocardial infarction), as a result of long-term hyperglycaemia.
- The best way to manage type 2 diabetes is by slowing digestion and absorption of carbohydrates in the diet through inhibition of starch-hydrolysing enzymes (e.g., alpha-glucosidase).

PLANT PROFILE

Momordica Charania

SYNONYM: Bitter gourd, Bitter melon, Karela

BIOLOGICAL SOURCE; It consists of the dried fruits of *Momordica Charania* Linn.

FAMILY: Cucurbitaceae

CHEMICAL CONSTITUENTS: Charantin, Momordicin, Polypeptide-P, Vicine Triterpenoids, Alkaloids.

USES: Antidiabetic, Anthelmintic, Laxative, Antioxidant, Used in skin diseases.



Fig. 1.

ANTIOXIDANTS ACTIVITY

This article provides evidence that several traditional medicinal plants in Iraq can be used as treatments for type 2 diabetes and other related conditions associated with hyperglycaemia (high blood glucose levels). Evidence was provided for an anti-diabetic mechanism through the inhibition of certain enzymes in the digestive system. A strong correlation was found between total phenolic content (TPC) and inhibition of these carbohydrate-hydrolysing enzymes, which suggests that polyphenols are responsible for most of the anti-diabetic activity noted. The following plants have been confirmed to have anti-diabetic activity: *Cyperus rotundus*, *Prosopis fractal*, *Mentha piperita*, *Glycyrrhiza glabra* and *Matri Caria chamomilla* and are all used traditionally in Iraq to manage diabetes and other related conditions.^[5]

ROLE OF ANTIOXIDANTS IN CANCER

- A long-term illness primarily caused by the breakdown of vital parts of the body by oxygen.
- The breakdown of cellular components by free radicals and reactive oxygen species (ROS) is a main cause of how the body grows and causes cancer.
- Antioxidants found in plants can help to restore, maintain and repair the damage to cells caused by free radicals and ROS.
- There is an interest in looking to herbal medicine for treatment instead of synthetic chemical drugs because many plant-based medicines or substances contain compounds that fight or reduce cancer and tumors while having fewer adverse effects than synthetic chemical medicines.

PLANT PROFILE

SYNONYM: Sadabahar, Vinca, Periwinkle, Madagascar periwinkle.

BIOLOGICAL SOURCE: It consists of the dried whole plant or leaves and root of *Catharanthus roseus* (L.) G. Don.

FAMILY: Apocynaceae

CHEMICAL CONSTITUENTS: Indole alkaloids (major active constituents)

Vincristine, Vinblastine, Ajmalicine, Serpentine, Flavonoids, Tannins, Phenolic compounds

USES: Source of anti-cancer drugs (Vincristine, Vinblastine), Used in leukaemia and lymphoma, Antihypertensive (Ajmalicine), Antidiabetic (traditional use)



Fig. 2.

ANTIOXIDANT ACTIVITY

Oxidative stress caused by free radicals and reactive oxygen species (ROS) created during normal metabolism can create oxidative injury to lipids, proteins, and DNA. This type of injury is one cause (or etiologic) of many chronic diseases, such as cardiovascular disease, atherosclerosis, and cancer. Plants produce numerous types of secondary metabolites (phenolic acids, flavonoids, quinones, and tannins) that can function as natural antioxidants by neutralizing the damaging actions of free radicals. Because of the perception of being safe, and because many antioxidant compounds have demonstrated specific antitumor and anticarcinogenic activity, there has been considerable focus on naturally occurring phytochemicals in recent years. Plant-derived polyphenols may be a good source of phytomedicine for prevention and treatment of degenerative diseases by repairing cells and protecting them from oxidative injuries caused by ROS.^[6]

ROLE OF ANTIOXIDANTS IN ANTI AGING:

- There are many different types of disorders associated with free radicals that occur in an older person. These include arthritis, neurodegenerative diseases, and inflammation that is ongoing (chronic).
- Reactive oxygen species (ROS) can cause different types of damage to the basic building blocks of life (DNA and lipids).
- High levels of ROS can trigger apoptosis (programmed cell death) that is initiated by the mitochondria, leading to a large number of cells dying off prematurely.
- One of the goals in support of aging is the development of new particles with fewer side effects that are also potent enough to improve people's overall health and well-being.

PLANT PROFILE

SYNONYM: Haldi, Haridra, Indian Saffron.

BIOLOGICAL SOURCE: Turmeric consists of the dried rhizomes of *Curcuma longa* Linn.

FAMILY: Zingiberaceae

CHEMICAL CONSTITUENTS: Curcuminoids (5–6%), Curcumin (major active constituent), Demethoxycurcumin, Bisdemethoxycurcumin.

Volatile oils (3–5%)

Turmerone, Atlantone, Zingiberene.

USES: Anti-inflammatory, Antioxidant, Antiseptic, Wound healing agent, used in skin disorders, Carminative (improves digestion), Used in diabetes management.



Fig. 3.

ANTIOXIDANTS ACTIVITY

Oxidative stress plays a major role in accelerating the biological aging process. When reactive oxygen species (ROS) are produced faster than the body can produce antioxidants, oxidative stress occurs, resulting in the accumulation of ROS and the irreversible oxidation of DNA, proteins, and lipids (substances that compose the cell wall). The cumulative cellular damage from the oxidation of DNA, protein, and lipids leads to enzyme inactivation and ultimately death of the cell. Research indicates that the deterioration of mitochondrial function, decreased energy production (ATP) and continued production of free radicals are some of the primary mechanisms that lead to accelerated aging. Natural antioxidants from medicinal plants are a key component of human health because they provide protection against the NO antioxidant system that is constantly generating ROS and assist the body in repairing and restoring cellular damage. Secondary metabolites, specifically phenolic compounds and flavonoids, are recognized to have the greatest potential for preserving cellular integrity and preventing or reducing the degenerative effects of the aging process.^[7]

ROLE OF ANTIOXIDANTS IN AUTOIMMUNE DISORDER

Rheumatoid arthritis is one of the types of rheumatoid disorder due to a systemic autoimmune mechanism. The primary joints affected are small joints (hand, wrist, foot) but also involve all internal organs (heart, lungs and eyes).

Pathophysiology - Pannus formation from the synovial membrane, with erosive joint destruction from enzymes released by activated fibroblasts and chondrocytes.

Manifestations - Durations less than 1 hour of morning stiffness after awakening swollen joints (minimum 3), fatigue and rheumatoid nodules.

Prevalence - Approximately 1-2% of world's population, 3:1 ratio of affected women vs affected men.

PLANT PROFILE

SYNONYM: Indian olibanum, Salai guggul

BIOLOGICAL SOURCE: It consists of the oleo-gum resin obtained from the bark of *Boswellia serrata* Roxb

FAMILY: Burseraceae

CHEMICAL CONSTITUENTS: Boswellia acids, Olibanum oil, Resin, Terpenoids.

USES: Antimicrobial, Wound healing, Antipyretic, Insecticidal.



Fig. 4.

ANTIOXIDANT ACTIVITY

Rheumatoid arthritis is a long-lasting illness where swear inflammation attacks the joints, affects joint cartilage and bone, and breaks down both tissues. As the body's immune system can't tell the difference between normal and abnormal tissue, it produces stuff that will injure the joints because the immune system thinks that the joints are infected. Exogenous triggers such as exposure to environmental elements and infection in genetically predisposed individuals lead to the development of this response. The synovial membrane associated with an affected joint becomes hypertrophied (thickened) and has many inflammatory white blood cells/lymphocytes in it that produce pro-inflammatory substances (e.g., high amounts of IL-1 and TNF-alpha). This leads to pain, swelling, and eventually a loss of motion at those joints. Common management of rheumatoid arthritis utilizes synthetic medications, but these medications may inflict adverse side effects leading to a great interest in an alternative source for the treatment of rheumatoid arthritis; the use of anti-inflammatory and anti-arthritis effects of plants has become highly researched for those with numerous side effects.^[8]

ROLE OF ANTIOXIDANTS IN GALL BLADDER

The gallbladder creates cholelithiasis, which is the creation of hard, stone-like deposits in the organ where bile the liver generated is collected. There are different types of stones: cholesterol stones (most commonly found)85-, pigment stones (made from the bilirubin in bile), and mixed stones (made from calcium carbonate and calcium salts). The formation of stones occurs as a result of bile being super saturated with cholesterol, and/or as a result of the gall bladder not emptying out properly, which then allows for the stones to form with minerals crystallizing and subsequently growing.

Cholelithiasis does not always result in symptoms; however, stones can result in "biliary colic" (pain), cholecystitis (inflammation), and/or blocking of the ducts that transport bile to other organs, leading to jaundice and/or acute pancreatitis.

Cholecystectomy (the removing of the gall bladder by an operation) is the standard treatment provided by the conventional medical community; therefore, it has become important to investigate and identify effective "luteolytic" (herbal stone dissolving) agents.

PLANT PROFILE

SYNONYM: Bhumi Amla, Bhumyamalaki, Stone breaker, Chanca piedra.

BIOLOGICAL SOURCE: It consists of the whole dried plant of *Phyllanthus niruri* Linn.

FAMILY: Phyllanthaceae.

CHEMICAL CONSTITUENTS: LignansPhyllanthin, Hypophyllanthin, Flavonoids, Alkaloids, Tannins, Glycosides, Terpenoids.

USES: Dissolves gallstones, Hepatoprotective (protects liver), Used in jaundice, Anti-inflammatory, Diuretic, Antiviral, Used in urinary tract disorders.



Fig. 5.

ANTIOXIDANTS ACTIVITY

This study explores the healing effects of *Achyranthes aspera* methanolic extract from leaves against gallbladder stones. Gallstones form from an imbalance of bile components including cholesterol, bilirubin and calcium salts, after crystallization and solidification.

The researchers performed the study using an in vitro model that involved incubating human gallstones in different concentrations of (*Achyranthes aspera*) extract for 15 days. The data indicated a reduction in the registered weight and size of gallstones in a dose dependent manner. The highest concentration of (100 mg/ml) produced the greatest amount of gallstone weight loss. The production of "anti-lithiasis" effect was attributed to *Achyranthes aspera*'s action on inhibiting crystallization in gallstones, while also dissolving any existing mineral deposits. The antioxidant flavonoids present in (*Achyranthes aspera*) may also assist in alleviating oxidative stress that may be caused by gallbladder inflammation.

This provides possible evidence that this plant may be used as a non-invasive, effective, low cost and natural supplement or alternative therapy to surgical intervention for gallbladder stones.^[9]

ROLE OF ANTIOXIDANTS IN IRRITABLE BOWEL SYNDROME

IBS (irritable bowel syndrome).

- IBS is a functional gastrointestinal disorder in which there is a disturbance between the brain and the gut leading to any number of symptoms, without an observable damage occurring to the structure of the digestive tract.
- IBS can be classified using the stool pattern as one of four types: IBS with constipation (IBS-C), IBS with diarrhoea (IBS-D), mixed (IBS-M) and unclassifiable (IBS-U).
- The pathophysiology of IBS includes 4 key factors: abnormal gut motility, visceral hypersensitivity (high sensitivity to pain from the gut), low grade mucosal inflammation and abnormalities in gut microbiota.
- Typical presenting symptoms for patients suffering from IBS are recurrent abdominal pain, bloating, gas and urgency to defecate, with relief following defecation.
- Approximately 10%–20% of the population worldwide suffers from IBS, with an increased incidence among women and younger age groups.

PLANT PROFILE

Isabgol

SYNONYM: Isabgol, Ispaghula, Psyllium, Spigel seeds.

BIOLOGICAL SOURCE: It consists of the dried ripe seeds and husk of *Plantago ovata* Forssk.

FAMILY: Plantaginaceae.

CHEMICAL CONSTITUENTS: Mucilage (20–30%) – Arabinoxylans (major active constituent), Fixed oils, Proteins, Iridoid glycosides, Starch.

USES: Bulk-forming laxative, used in IBS (especially constipation type), Soothes intestinal mucosa, Reduces cholesterol, Controls mild diarrhoea, Used in haemorrhoids.



Fig. 6.

ANTIOXIDANT ACTIVITY

Irritable bowel syndrome (IBS) is a functional GI disorder that affects one's quality of life significantly and is characterized by chronic abdominal pain, bloating, and altered bowel habits. Conventional pharmacotherapy has provided only partial relief or there are many unpleasant side effects associated with it, the article addresses the increasing role of herbal medicine as a multi-targeted alternative. These are medicinal plants that have been shown to modulate GI motility, reduce visceral hypersensitivity, and have anti-inflammatory effects through various mechanisms of action. For example, peppermint oil has been cited as being able to block calcium channels in the smooth muscles of the gut, therefore alleviating painful spasms, whereas turmeric and artichoke could help to improve bile flow and decrease intestinal inflammation. While numerous herbal remedies have demonstrated a positive effect in clinical trials, it is critical that these extracts be standardized and that additional well-designed studies are performed so that these natural approaches can be incorporated into routine IBS management.^[10]

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