Open Access Journal
International Journal of Medical Research and Pharmaceutical Sciences
Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI-10.5281/zenodo.569478 Impact Factor- 3.109

A REVIEW ON ROLE OF ANTIOXIDANT PROPERTY OF HERBS IN HYPERTENSION

Teena Johny[1], Sumitha SK[2], Krishnaveni K[*3], Krishna Ravi[4], Rosmi Jose[5], Shanmuga Sundaram R[6] and Sambath kumar R[7]

[1,2,4&5]Post Graduate, Department of Pharmacy Practice, J.K.K. Nattraja College of Pharmacy, Komarapalayam-638183, Tamil Nadu

[*3]Assistant Professor, Department of Pharmacy Practice, J.K.K. Nattraja College of Pharmacy, Komarapalayam-638183, Tamil Nadu

[6]Professor, Department of Pharmacology, J.K.K. Nattraja College of Pharmacy, Komarapalayam-638183, Tamil Nadu

[7]Professor, Department of Pharmaceutics, J.K.K. Nattraja College of Pharmacy, Komarapalayam-638183, Tamil Nadu

Keywords:
Hypertension, herbs, antioxidants

Abstract

Hypertension is the most common factor for cardiovascular disease and a major public health. Herbal medicines may protect against cardiovascular diseases by contributing to the total antioxidant defense system of the human body. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species (ROS), such as superoxide, hydrogen peroxide, singlet oxygen, peroxyl radicals, hydroxyl and peroxynitrite radicals. The natural products should be considered as the best in primary healthcare because of better cultural acceptability, safety, potent, inexpensive and lesser side effect. This review describes the role of antioxidant property of herbs used in hypertension. Several herbal medicines and supplements have been studied as potential therapeutic agents in the management of hypertension and its complications. Available data suggests that the extracts of most of these herbs or compounds derived from them may provide a safe and effective adjunctive therapeutic approach for the treatment of hypertension.

Introduction

Hypertension becomes a major public health challenge around the world because of its high prevalence and association with other cardiovascular diseases.[1,2]Current data suggests that oxygen free radicals are mainly involved in the pathogenesis of hypertension and a variety of antioxidant therapies are used for the treatment of hypertension.Hypertensive effects of oxidative stress are mostly due to endothelial dysfunction resulting from disturbances of vasodilator systems, particularly degradation of nitric oxide (NO) by oxygen-free radicals.[3]Moreover, the antioxidant enzymes, which dispose, scavenge and suppress the formation of free radicals, have been noted to produce an important defense mechanism against oxidative stress.[4-6]The present review article discuss the potential role of herbal antioxidant in hypertension.

Pathogenesisof Hypertension

Blood pressure is defined as the force exerted against the walls of arteries as it flows. There are differentmechanisms for the development of hypertension. The rise in peripheral resistance leads structural narrowing of small arteries and arterioles, decrease in the number and density of capillaries results in hypertension.[7,8,9]Apart from this, HT has been linked with reduced peripheral venous compliance, enhancing the venous return and cardiac preload, ultimately causing diastolic dysfunction.[10]increased peripheral resistance leads disturbances in renal salt and water management, particularly abnormalities in the intra-renalrenin-angiotensinsystem and dysfunctioning of the sympathetic nervous system.[11,12]

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI-10.5281/zenodo.569478 Impact Factor- 3.109

There is no evidence showing the exact relationship between oxidative stress with hypertension But oxidative stress may play a role in the pathophysiology of hypertension. Human and animal studies have demonstrated that HT is accompanied by increase in oxidative stress.[13]

Excessive reactive oxygen species (ROS) have emerged as a central common pathway by which disparate influences may induce and exacerbate hypertension. Potential sources of excessive ROS in hypertensioninclude nicotinamide adenine dinucleotide phosphate (NADPH) oxidase, mitochondria,xanthine oxidase, endothelium-derived NO synthase, cyclooxygenase1 and 2, cytochrome P450 epoxygenase, and transition metals.

Reactive oxygen species (ROS) producing enzymes involved in increased oxidative stress within vascular tissue include NADPH oxidase, xanthine oxidase, and mitochondrial superoxide producing enzymes. Superoxide produced by the NADPH oxidase may react with NO, thereby stimulating the production of the NO/ superoxide reaction.[3]

Hypertensive effects of oxidative stress are mostly due to endothelial dysfunction resulting from disturbances of vasodilator systems, particularly degradation of nitric oxide (NO) by oxygen-free radical.[14-16]

Antioxidants

Oxidation is a chemical reaction that transfers electron from a substance to an oxidizing agent.Oxidation reactions can produce free radicals, which start chain reactions that damage cells.[17]

Antioxidants compounds are exogenous or endogenous in nature which either prevents the generation of toxic oxidants, intercept any that are generated and inactivate them and thereby block the chain propagation reaction produced by this oxidants.[18,19]

Classification of anti-oxidants

It is of two types

1. ***Based on solubility***

(a) Hydrophilic antioxidants- They are soluble in water.
Water soluble antioxidants react with oxidants react withoxidants in the cell cytoplasm and blood plasma.

(b) Hydrophobic antioxidants- They are soluble inmembranes from lipid peroxidation

2. ***Based on line of defence***

(a) First line defence (preventive antioxidant)[21,22]
These are enzymes like superoxide dismutase (SOD), catalyse (CAT), glutathione peroxidase (GTX), glutathione reductase and some minerals like Se, Mn,Cuetc.SOD mainly acts by quenching of superoxide (O2),catalyse by catalyzing the decomposition of hydrogen peroxide (H2O2) to water and oxygen.

(b) Second line defence (Radical scavenging antioxidant)[21,23]
These are glutathione, Vitamin C, uric acid, albumin, bilirubin, vit E, carotenoids, flavonoid etc. carotene is an excellent scavenger of singlet oxygen.Vit C interacts directly withradicals like O2,OH.GSH is a good scavenger of many freeradicals like O2,OH and various lipid hydroperoxides andmay help to detoxify many inhaled oxidizing air pollutantslike ozone.

(c) Third line defence (Repair and de-novo enzymes)[21,24]
These are a complex group of enzymes for repair ofdamaged DNA, protein, oxidized lipids and peroxides andalso to stop chain propagation of peroxyl lipid radical.These enzymes repair the damage to biomolecules andreconstitute the damaged cell membrane. Some commonherbal antioxidants found used in beverages, food, andcosmetics, herbal antioxidants have quickly become verypopular among consumers for their strong rejuvenatingabilities.[25]

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI-10.5281/zenodo.569478 Impact Factor- 3.109

Types of the antioxidants based on their supplementation source are as follows[26]

a) Antioxidants minerals:-These are co factor of antioxidants enzymes. Their absence will definitely affect metabolism of many macromolecules such as carbohydrates. Examples include selenium, copper, iron, zinc and manganese.

b) Antioxidants vitamins: - It is needed for most body metabolic functions. They include-vitamin C, vitamin E and vitamin B

c) Phytochemicals -These are phenolic compounds that are neither vitamins nor minerals.

- Flavonoids are phenolic compounds that give vegetables fruits, grains, seeds leaves and flowers
- Carotenoids are fat soluble colour in fruits and vegetables.
- Beta carotene which is rich in carrot and converted to vitamin A when the body lacks enough of the vitamin.
- Lycopene has high in tomatoes
- Zeaxantinis high in spinach and other dark greens.

Mechanism of antioxidant property of herbs in hypertension

The exact mechanism of herbal antioxidant property in hypertension is unknown. Some clinical trials shows the relationships are given below in table 1.

Table (1): Mechanism of antioxidant property of herbs in hypertension

Plant name	Common name	Parts used	Mechanism of antioxidant property of herbs in hypertension	Reference No.
Gingko biloba	Ginkgo	Leaves	ACE inhibition and maintenance of cellular antioxidant capacity as well as preserving vascular reactivity towards endothelium dependent and independent vasodilators while inhibiting responses to vasoconstrictors.	27
Passiflora edulis	Yellow Passion	Leaves	Reduces the oxidative stress related to a hyperproduction of reactive oxygen species such as O_2^-, OH^-, and H2O2 or deficiency in the antioxidant defense system.	28,29
Crataegus	Hawthron	Leaves, buds flower	Relaxation of coronary arteries, which directly increases blood flow or through an increase in contraction and relaxation velocities, which increases the diastolic interval. Decreased PE-induced vasoconstriction by increased the synthesis and release of nitric oxide, glutathione peroxidase (GPX-Sc) and oxidized glutathione reductase (GR) and increased glutathione levels.	30,31
Vaccinium corymbosum	Blueberries	Berries	An efficient terminator of fatty acid free radical chain reactions by hydrogen molecules which in terms terminate free radical chain reactions by forming stable compounds. To neutralize free radicals which are unstable molecules	32

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI-10.5281/zenodo.569478 Impact Factor- 3.109

Carica papaya	Papaya	Leaves	Increases the concentrations of phytochemicals, non enzymatic antioxidants (carotenes, ascorbic acid and α-tocopherol) and the activities of enzymatic antioxidants (glutathione peroxidase, catalase and catalase)	33
Clerodendrum inerme	Indian privet, glory bower	Leaves	Reducing ability free radical scavenging activity.	34,35
Mangifera Indica	Mango	Leaves	Limits the oxidative stress and cellular damage due to nutritional deficiency of antioxidants.	35,36
Paned ginseng	Ginseng	Root	Stimulates NO release phosphorylation of GR, PI3K, Akt/PKB, and eNOS.	37
Cymbopogon Citrate	Lemongrass tea	Leaves	Inhibition of lipoperoxidation	38
Curcuma longa	Turmeric	Rhizomes	React directlywith reactive species and to induce an up-regulation of variouscytoprotective and antioxidant proteins. Increasethe synthesis and concentration of reduced glutathione (GSH) inastrocytes and neurons by induction ofγGCL	39

Conclusion

Oxidative stress involved in the pathogenesis of hypertension is the imbalance between oxidants and antioxidants.Antioxidant works through inhibiting lipid peroxidation, increasing the concentrations of phytochemicals, non enzymatic antioxidants (carotenes, ascorbic acid and α-tocopherol) and the activities of enzymatic antioxidants (glutathione peroxides, catalase and catalase).

Current reveals researches that many herbs having antioxidant property involved in antihypertensive action.Daily consumption of food rich in antioxidants helps in preventions of cardiovascular disease, aging, diabetes mellitus and maintains good health.Futher studies have to be conducted to determine the complete benefits of antioxidants in cardiovascular diseases.

References

1. *Whitworth JA.WHO/International society of hypertension (ISH) Statement on management of hypertension. Journal of Hypertension2003; 21(11):1983-1992.*
2. *Wiysonge CS, Bradley HA, VolminkJ,MayosiBM,Mbewu A, Opie LH. Betablockers for hypertension.Cochrane Database System Review 2012; 11: CD002003.*
3. *Mujahid B, Vibhor S, NishatA, Ankushetal. Review article-Role of Antioxidants in Hypertension.Journal Indian Academy of Clinical Medicine 2011: 12; 122-127.*

4. *Cotgreave IE, Moldeus P, Orrenius E.Host biochemical defence mechanism against prooxidants.Annual Review ofPharmacology and Toxicology 1988; 28:189–212.*
5. *Chobanian AV. Clinical practice. Isolated systolic hypertension in the elderly.New England Journal of Medicine 2007;357(8):789–796.*
6. *Widder JD.Attenuation of angiotensin II-induced vascular dysfunction and hypertension by overexpression of Thioredoxin. Hypertension 2009;54(2);338–344.*
7. *Desir GV.Human renalase: a review of its biology, function, and implications for hypertension.Jounal ofAmerican Society ofHypertension 2012; 6(6):417-426.*
8. *Chen X.Antioxidant effects of vitamins C and E are associated with altered activation of vascular NADPH oxidase and superoxide dismutase in stroke-prone SHR.Hypertension2001;38(3):606–611.*
9. *Montezano AC, Touyz RM.Oxidative stress, Noxs and hypertension: focus on translation and clinical research.Antioxidant redox signal2014; 20(1):164-182.*
10. *Zieman SJ, Melenovsky V, Kass DA.Mechanisms, pathophysiology and therapy of arterial stiffness.ArteriosclerosisThrombosis Vascular Biology 2005; 25(5):932–943.*
11. *Navar LG.Counterpoint: Activation of the intrarenalreninangiotensin system is the dominant contributor to systemic hypertension.Journal of applied physiology 2010; 109(6):1998–2000.*
12. *Lambert E.Point: Chronic activation of the sympathetic nervous system is the dominant contributor to systemic hypertension.Journal of AppliedPhysiology 2010; 109(6):1996–1998.*
13. *Oparil S, ZamanMA,Calhoun DA. Pathogenesis of hypertension.Annals of Internal medicine2003; 139(9):761-776.*
14. *Carr A, Frei B.The role of natural antioxidants in preserving the biological activity of endothelium-derived nitric oxide.Free RadicalBiology and Medicine 2000; 28:1806-1814.*
15. *Abad CM.Hypertension Caused by Primary Hyperaldosteronism: Increased Heart Damage and Cardiovascular Risk.RevastaEsponala Cardiology 2012; 25: 98-103.*
16. *Rathaus A, Bernheim J.Oxygen species in the microvascular environment: regulation of vascular tone and the development of hypertension.Nephrology Dialysis Transplantation2002;17(2):216-221.*
17. *Sangh P, Sanjay P.A Review on Herbal Antioxidants, Journal of Pharmacognosy and Phytochemistry 2012, 1(4), 26-37.*
18. *Rangan U, Bulkley GB.Prospects for treatment of free radical-mediated tissue injury, New York.1993,700-718.*
19. *Halliwell B, Gutteridge JM. The antioxidants human extracellular fluids.Archieves of Biochemistry and Biophysics1990; 280(1):1-8.*
20. *Singh RP, Sharad S, Kapur S. Free radicals and oxidative stress in neurodegenerative diseases: Relevance of Dietary Antioxidant., Journal of India Academy of Medicine 2004;5(3):218-25.*
21. *Jadhav SS, Salunkhe VR, Magdum CS.Daily Consumption of Antioxidants:-Prevention of Disease is better than Cure. Journal of Nutrition 2004; 3(1): 34-40.*
22. *Sies H.Antioxidant Function of Vitamins.Annalysis of thenewAcadmy of Science.1992; 669:7-20.*
23. *Halliwell B.Free Radicals, Antioxidants, and Human Disease: Curiosity, Cause, or Consequence.Lancet 1994; 344(8942):721-724.*
24. *Ames B.Natural Antioxidants in Human Health and Disease. Academic Press. San Diego 1994. 14-25.*
25. *Michael A, Weiner.Herbal Antioxidants in Clinical Practice.The Journal of Orthomolecular Medicine1994; 9(3):34-40.*
26. *Thomas JA.Oxidative stress, oxidant defense, and dietary constituents. In Modern Nutrition in Health and Disease.Philipia 1994.501-512.*
27. *Xiong XJ,Liu W,Yang XC,Feng B, Zhang YQ, Li SJ, Li XK, Wang J.Ginkgo biloba extract for essential hypertension: A systemic review.Phytomedicine2014; 21(10):1131–1136.*
28. *Maricelmda SS, Maria B, Debora CD. Effects of Passiflora edulis (Yellow Passion)on Serum Lipids and Oxidative Stress Status of Wistar Rats.Journal of medicinal food 2012; 15(1):78-82.*
29. *Patel SS, Mohamed TS, Ravi B, Shrestha NK, Verma, Gauthaman K. Passiflora incavnata Linn:A phytopharmacological review.International Journal of Green Pharmacy 2009; 3(3):277-280.*
30. *Verma SK, Jain V, Verma D and Khamesra R.Crataegus oxyacantha-A cardioprotective herb.Journal of Herbal Medicine and Toxicology2007; 1(1):65-71.*
31. *Sacred Earth Plantprofile hawthorn (Crataegus monogyna). Available from: http://www.sacredearth.com/ethnobotany/plantprofiles/hawthorn.php. [Accessed on: 6 July,2016].*

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI-10.5281/zenodo.569478 Impact Factor- 3.109

32. *Vejendla R, Keerthi K Shrutika C. Review: signature on medicinal plants used in hypertension. International journal of pharmacy and technology2011; 3(3): 1333-1355.*
33. *Asaolu MF, Asaolu SS, Adanlawo IG.Evalution of phytochemicals and antioxidants of four botanicals with antihypertensive properties.International Journal of Pharma and Bio Sciences2010;1(2):1-7.*
34. *Jasvinder KC, Renu S.Comparison of antioxidant activity with different solvents in two medicinally important sps.of clerodendrum.World journal of pharmacy and pharmaceutical science 2010;3:1100-1105.*
35. *Nguessan K, Tiébré MS, Aké AE, Zirihi GN. Ethnobotanical Study of Plants Used to Treat Arterial Hypertension, in Traditional Medicine, by Abbey and Krobou Populations of Agboville (Côte-d'Ivoire). European Journal of Scientific Research 2009; 35(1):85-98.*
36. *Oulare K, Barry MS, Bah F, Keita N, Haba NL, Balde AM.Anti-oxidative activity of fruit extracts of some medicinalplants used against chronic diseases (diabetes, hypertension) in Kankan, Guinea.Journal of Plant Sciences2015;3(1-2):1-5.*
37. *Chang HL, Jong-HK.A review on the medicinal potentials of ginseng and ginsenosideson cardiovascular diseases.Journal of Ginseng Research 2014; 38(3):161-166.*
38. *Olorunnisola SK, Asiyanbi HT,Hammed, Simsek AM.Anti-oxidant properties of lemon grass tea.International Food Research Journal 2014;21(2):455-462.*
39. *Georgia K,Viktoria Y, Ashok KS. Cardiovascular protection by curcumin,Molecular aspects,India.Journal of Biochemistry and Biophysics 2012; 49(9):306-315*