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Development of antioxidant based therapeutics in Unani system of medicine

Abstract

During the last decades several studies have examined the potential role of oxidative stress in the development of various diseases like cancer, Parkinson's disease, Alzheimer's disease, atherosclerosis, myocardial infarction, chronic fatigue syndrome etc. Oxidative stress can cause toxic effects through the production of peroxides and free radicals that damage all components of the cell, including proteins, lipids, and DNA. Unani system of medicine has a wealth of antioxidants that can be incorporated to Unani formulations to prevent and treat diseases arising due to oxidative stress. Drugs like Bandarajoboya (Mellisa officinalis), Aabresham (Bombyxmori), Lehsun (Allium sativum) etc. have already been proven a potent antioxidants. Details can be read in full length paper.

Keywords: oxidative stress, antioxidants, reactive oxygen species

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Introduction

Oxidative stress

Oxidative phosphorylation is a normal metabolic pathway in which mitochondria releases energy (ATP-Adenosine triphosphate) by the oxidation of nutrients. As a result of this process ROS (reactive oxygen species) are released from cells which lead to the propagation of free radicals. These ROS (like superoxide, hydrogen peroxides, hydroxyl radical, hydro peroxide, hypochlorous acid, peroxynitrite, alkoxyl etc.) are used by the immune system to attack and kill pathogens.[1] within the cell they are required to maintain cellular homeostasis. It is estimated that mitochondrial membranes produce approximately 24nmol/O_2^-/minutes/ gram of tissue. Majority of which converted to H_2O_2 (hydrogen peroxide) by manganese superoxide dismutase (Mn-SOD). However, when these O_2^- generating sources remain activated after a physiological stimulus has abated, the continued production of O_2^- alters cellular redox homeostasis resulting in increased oxidative stress.[2] The production of ROS damage all components of the cell, including proteins, lipids and Deoxyribonucleic Acid (DNA)leading to various diseases like Cancer, Parkinson's disease, Sickle Cell Disease, lichen planus, vitiligo, Autism, Alzheimer's disease, Atherosclerosis, Myocardial Infarction, Chronic fatigue syndrome etc.[3–13]

Measurement of oxidative stress[14]

The presence of oxidative stress may be tested in one of three ways:

i. Direct measurement of the ROS

ii. Measurement of the resulting damage to biomolecules

iii. Detection of antioxidant levels

Directly measuring ROS might seem the preferred method, but many reactive oxygen species are extremely unstable and difficult to measure directly. Because of this, many scientists prefer to measure the damage on proteins, DNA, RNA, lipids, or other biomolecules e.g. Lipid per oxidation by MDA concentration assessment through blood sample. Another approach is to measure the levels of antioxidant enzymes and other redox molecules which serve to counterbalance ROS generated in the cell. Assays are available to measure the activity of specific antioxidant enzymes, such as catalase and superoxide dismutase.

Antioxidants and their mechanism of action

An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that can produce free radicals, leading to chain reactions that may damage cells. Antioxidants such as thiols or ascorbic acid (vitamin C) terminate these chain reactions. The term "antioxidant" is mainly used for two different groups of substances: natural chemicals found in body tissues and outside the body in the form of food, herbs or drugs. To balance the oxidative state, plants and animals maintain complex systems of overlapping antioxidants, such as glutathione and enzymes (e.g., catalase and superoxide dismutase) produced internally or the external source of antioxidants: vitamin A, vitamin C, vitamin E, Flavanoids, β-Carotene, lycopene and amino acids.[15–18]

Mechanism of action[2,19–21]

i. Antioxidants work by scavenging ROS

ii. Chelate transition metal ions along with reducing macrophage oxidative stress by inhibition of cellular oxygenases or by activating cellular antioxidants such as glutathione system (an endogenous anti oxidant) that regulates Nitric oxide cycle and reduces ROS. Hence, protects against free radical mediated oxidative damage.

iii. Some of them interacts with superoxide to stabilize it, chelate copper and iron and prevents the production of hydroxyl radicals.

iv. They bind covalently to reactive degradation products of peroxidised lipids, preventing them from reacting with other cellular targets.

v. They also contributes in the production of Nitric oxide (natural vasodilator that helps to maintain normal blood flow in the vessels)

vi. Endogenous antioxidant system work through anti-oxidant enzymes–SOD (Superoxide dismutases), Catalase, Heme

oxygenase, Glucose-6-phosphate dehydrogenase and glutathione peroxidases.

vii. SOD, dismutate O_2•− to H_2O_2 and oxygen.

viii. Catalase, catalyzes the decomposition of H_2O_2 to water and oxygen.

ix. Glutathione peroxidases utilize glutathione to reduce H_2O_2 and fatty acyl peroxides to water and lipid alcohols respectively.

x. Heme oxygenase catalyzes the oxygen-dependent regiospecific metabolism of heme to Fe(II), CO, and biliverdin, which, in turn, is converted to bilirubin via biliverdin reductase

xi. Glucose-6-phosphate dehydrogenase (G6PD) is the first and rate-limiting enzyme in the pentose phosphate pathway and the principal source of intracellular NADPH. NADPH is utilized as a reducing equivalent to maintain thiol redox balance and as a cofactor by other antioxidant enzymes.

Prevention of diseases and Antioxidants[22]

Antioxidants play a crucial role in human body in the prevention of a number of diseases and maintenance of health-

i. Prevent cardiovascular diseases, cancer and other age related diseases like Parkinson's disease, Alzheimer's disease etc.

ii. Improves vision

iii. Reduce serum total cholesterol levels and prevents oxidation of LDL thus lowers the weight and prevents obesity related diseases like Hypothyroidism, CVDs, Metabolic syndrome, DM etc.

iv. Fight against a number of Skin related problems and keep your skin healthy.

v. Reduce systolic BP

vi. Act as Immunoboosters and improves human's immunity.

vii. Detoxify body thus reduces stress and insomnia.

Unani drugs as Antioxidants[23–25]

In Unani literature a number of drugs have been mentioned that works as antioxidants Table 1. There is a long list of such type of drugs. And the list goes on. The above mentioned drugs can be used as single or in formulation like syrups, tablets, capsules decoction etc.

Table 1 Unani drugs as Antioxidants

S.No	Drugs/Scientific names	Antioxidant Content (mmol/100 g)
1	Amla(Emblica officinalis)	301.14
2	Arjun(Terminalia arjuna)	146.95
3	Brahmi Booti(Centella asiatica)	10.40
4	Darchini(Cinnamomum zeylanicum)	139.89
5	Asl as soos (Glycyrrhiza glabra)	11.58
6	Panwaad(Casia tora)	68.21
7	Neem(Azadirachta indica)	89.23
8	Halela(Terminalia chebula)	706.25
9	Rehan(Ocimum sanctum)	39.67
10	Zanjabeel(Zingiber officinale)	24.37
11	Maweez munaqqa(Vitis vinifera)	108.13
12	Ajwa'een(Hyoscyamus niger)	28.42
13	Saadhaj Hindee(Cinnamomum tamala)	31.29
14	Sage(Salvia officinalis)	102
15	Qaranfal(Myrtus caryophyllus)	465.32
16	Zufaa (Hyssopus officinalis)	38
17	Zeera safed(Cuminum cyminum)	11.88
18	Badiyan(Foeniculum vulgare)	18.91
19	Kabab chini(Pimenta dioica)	102
20	Funduq(Corylus avellana)	35.51
21	Tamar hind(Tamarindus indica)	12.42
22	Badranjboya(Mellisa officinalis)	125.33
23	Pudina (Mentha spicata)	116.4
24	Baboona (Leonurus cardiaca),	13.19
25	Khardal(Brassica juncea)	10.30
26	Bisbasa(Myristica fragrans)	43.52
27	Filfil siyah(Piper nigrum)	50.96
28	Karanja(Pongamia pinnata)	21.51
29	Gul e surkh(Rosa damascena)	153.90
30	Akleel ul jabal(Rosmarinus officinalis)	66.92
31	Zafraan(Crocus sativus)	61.72
32	Doodhi khurd(Euphorbia hirta)	61.19
33	Zard chob(Curcuma longa)	15.68
34	Nilgiri(Eucalyptus globulus)	47.30
35	Kari patta(Murraya koenigii)	84.07
36	Ood Saleeb(Paeonia officinalis)	55.13
37	Sada bahar(Catharanthus roseus)	71.4
38	Hulba(Trigonella foenum)	54.79
39	Zaitoon(Olea europaea)	28.6
40	Jamalgota(Rhamnus purshiana)	47.15
41	Aabresham(Bombyx mori)	23.7
42	Mastagi(Pistacia lentiscus)	34.6
43	Aas(Myrtus communis)	27.2
44	Lemun(Citrus aurantifolia)	235.47 - 888.59
45	Saad koofi(Cyperus rotundus)	229
46	Marzanjosh(Origanum vulgare)	63.2
47	Hasha(Thymus vulgaris	56.3
48	Rumman(Punica granatum	55.5
49	Damm ul akhwain(Dracaena cinnabari)	2897.11
50	Nabar (Ribes nigrum	97.83

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Conclusion

There is a large body of evidence connecting the effects of oxidative stress on human body resulting in the development of a number of diseases. However, various clinical studies on the role of antioxidants and prevention of numerous health related conditions have been demonstrated. Keeping in mind, the health related benefits of antioxidants, there consumption needs to be heighten. Unani system of medicine has a hoard of such type of drugs possessing antioxidant properties. The need of hour is just to develop antioxidant based therapeutics following clinical trials. Such type of therapeutics can be developed in different formulations according to the need of the patient. If succeeded, we can fight with the epidemic of oxidative stress induced conditions and diseases in time (i.e. Primary prevention).

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None.

Conflict of interest

The author declares that there is no conflict of interest.

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