

Possible Correlates of Free Radicals and Free Radical Mediated Disorders in Ayurveda with Special Reference to Bhutagni Vyapara and Ama at Molecular Level

J.S. Tripathi and R. H. Singh

Dept. of Kayachikitsa, Institute of Medical Sciences, Banaras Hindu University, Varanasi.

Received : 10.05.1998

Accepted : 24.07.1998

ABSTRACT : *The description of metabolic processes, operating at various levels insider the body, has been essentially covered in Ayurveda under thirteen types of Agnis and their functions at different levels, which are often compared with the enzymes and biochemical which take part in biological and / or biophysical transformations and reactions. When these Agnis, at different levels, get disordered they lead to the production of certain undesired elements or byproducts in the system, which are called as 'Ama' in ayurveda and are considered as very important morbid factor responsible for causation of a variety of diseases and playing key role in genesis of most of the diseases.*

The present article attempts to correlate the most recent concept of today's medicine i.e., Free Radical concept with that of the concept of Agni and Ama, described in Ayurveda and thereby opens newer vistas of search for remedies from Ayurvedic research, which may be helpful in the prevention and care of Free Radical Mediated Diseases.

The recent years have seen increasing interest in the role of free radical oxidative damage in human diseases. Free Radicals comprise an atom or molecule which have an unpaired electron. Its consequent tendency to acquire an electron from other substances makes it highly reactive. Thus free radicals are highly reactive species that have potential to oxidize biological molecules including proteins, lipids nucleic acids etc. However, not all reactive oxygen species are free radicals. Some of the important free radicals generated in our body are – superoxide radical, hydroxyl radical, & nitric oxide radical. The Hydroxyl radical is extremely toxic but short lived. The sources of these reactive species are – xanthine oxides, which generates super oxides (e.g. during reperfusion injury of ischaemic organs), cyclooxygenase and

lipoxygenase in the sytosol, which produce hydroxyl and peroxy radicals. Stimulated Neutrophils produce superoxides, cytochrome oxidase system located in mitochondria produce superoxide radicals during metabolism. Other sources of Free radicals in the body are lysosomes and peroxisomes nuclear endoplasmic reticulum, plasma membrane and all phagocytic cells. Thus, under normal conditions, free radicals are continuously produced as intermediates in cellular metabolism. The exogenous sources of F.R.'s include oxidant toxins (e.g. Doxorubicin), Drug oxidations (e.g. paracetamol), Ionizing radiations, Environmental pollution, cigarette smoke and sunlight. Most transition metals are good promoters of free radical reactions, most important being Ferrous (Iron) and

Copper. Hence, Iron overload is cytotoxic and may be fatal.

As these molecules are generated within these cells and are highly reactive, therefore they act in situ i.e., very close to the site where, they are generated and most structures in the vicinity are vulnerable. Free radicals attack double bonds in polyunsaturated lipids within cell membrane causing lipid peroxidation. This leads to irreversible loss of fluidity and structural integrity of the membrane, resulting in loss of membrane functions and ultimately, cell death. Degradation products can damage nucleic acids, leading to mutagenesis and carcinogenesis.

They cause oxidation of vital enzymes, leading to dysfunction, inactivation and damage to structural proteins like collagen and Elastin. Oxidised proteins are accumulated in ageing.

Free radicals cause depolymerization of poly saccharides like hyaluronidase leading to structural and functional dysfunctions. Damage to carbohydrate moiety of cellular receptors produce loss of cell functions.

Free radicals also include DNA strand break and base modification. Thus individual bases of DNA strands can be altered leading to mutagenesis and carcinogenesis.

Free radical oxidative damage has been found to be increased in patients with a variety of diseases and natural antioxidant defences have been found to be defective in many of the same diseases. Free radicals released by disease process, infections, trauma, toxins etc. may be secondary factors in perpetuation of diseases. Some of the diseases where free radicals play a significant role, either directly or indirectly are Rheumatoid Arthritis, inflammatory get

disorder like ulcerative colitis, connective tissue diseases, atherosclerosis, reperfusion injury diseases like Myocardial infarction, cerebral ischaemia and stroke, Intestinal ischaemia, Acute Renal necroses, cancer, parkinsonism, Alzheimers dementia, diabetes mellitus and Ageing process. The implication of free radicals with ageing can be substantiated by accumulation of age pigment.

Lipofuscin, with Ageing, which is associated with lipid peroxidation, an outcome of lipid damage by free radicals.

Antioxidants are the substances, whose presence in relatively low concentration significantly inhibits or retards the rate of oxidation of the oxidisable substances. Human body has its own antioxidance defences to protect against hazardous effects of oxidative stress given by free radicals. The major ones are intracellular and extracellular antioxidants. The intracellular antioxidant include enzymes like – Manganese containing superoxide Dismutase (SOD), catalase, selenium contacting Glutathione peroxidase (GSH) and Glutathione reductase; biological membrane antioxidants like alpha Tocopherol and Ascorbic acid, which arrest chain reaction of lipid peroxidation. Extracellular antioxidants include – transferrin & Lactoferrin (Iron binding proteins), ceruloplasmin (copper containing enzyme), Albumin & Haptoglobin – Haemopexin complex, which prevent the chances of lipid peroxidation.

Concept of Agni and Ama

The concept of ‘Agni’ in Ayurveda in an unique approach to the understanding of the physiology of digestion and metabolism. The ‘Agni’ is derived from the ‘tejas’ tatva of pancamahabhutas. Hence, it is closely

aligned to the entity of pitta dosa. The Ayurvedic classics essentially describe thirteen types of 'Agni-vyapara' on slightly varied perspective, but for all practical purposes, the entire phenomena can be identified at following levels-

1. Tejas Tatva of pancamahabhutas
2. The pitta Dosa of Tridose – active at five levels –pacak, Ranjaka, Bhrajaka, Alocaka and sadhaka.
3. Jatharagni or pacakagni – Acting at the level of GIT.
4. Pacakamsas – Which are essentially the constituents of pacakagni but are functionally located in seven Dhatus.
5. Sapta Dhatwagnis – Responsible for specific tissue metabolism.
6. Panca Bhutagnis – Responsible for metabolism at molecular level i.e at the level of Bhutas.

There term 'Ama', which literally means unripe or immature or incompletely formed is referred in Ayurvedic medicine as the factors which arise or events which follow as a consequence of hypo functioning of Agni. Thus 'Ama' is the product of faulty digestion and metabolism resulting due to 'Mandagni' i.e. hypo functioning of 'Biofire'. It possesses the properties of Visa or poison or toxic substances and is responsible for a variety of local and systemic disorders. Describing Amavisa as a serious toxic condition comparable to acute state of poisoning, Vagbhat, observes, that it is intensively toxic and may endanger life and as the lines of treatment of Ama dosa and visa are of opposite kind, the former has to be treated as one of the fatal prognosis. Ama also refers to some such intermediate or byproduct of metabolism which have a tendency to create blockage in the microchannels of the body i.e. 'srotovarodha'.

The above discussion clearly suggest that Ama which is a product of faulty digestion and metabolism, is a very important morbid factor responsible for the causation of a variety of local and systemic diseases. It is believed that Ama plays the key role in the genesis of all diseases hence it should be looked for at all the level of Agnis. As the Agni is identifiable at the six levels, the entity of Ama will also have to be identified at all these levels. Thus Ama essentially is not a single entity but is a category or conditions with some common denominators identifiable at any level of the biological organism.

For all practical purposes, jatharagni is the master agni and is considered to govern the function of all agnis and is responsible for digestion of food and any malfunctioning at this level of Agni leads to the production of Ama in the form of Ama Rasa. This kind of Ama will naturally produce such disorders which will be of short term and will be localized to digestive system. Common classical examples of diseases produced by the Ama at this level are visucika, Alasaka and Vilambika and similar other acute gastro-enteropathies.

Besides above mentioned form of Ama, another dimension of Ama can be identified at systemic level i.e . at the level of body tissues. In such situations, tissue metabolism remains inadequate leading to prolonged accumulation of a variety of unwanted and incompatible products in the system, which could be responsible for the genesis of different kinds of systemic 'Amaja' like Amavata i.e. Rheumatoid diseases.

Similarly 'Agni-vyapara' operating at the level of pancamahabhutas is comparable to molecular metabolism. Few decades ago, when the modern medical science was not

developed to the level of today including the concept of free radicals and allied phenomena, it was believed that deficiency of this higher dimension of Agni might results into such metabolic errors and production of such incompatible products of finer metabolism, which should be identified at the most subtle and paranormal levels of life processes. It was found difficult to identify and interpret such as advanced concept of metabolism conceived in Ayurveda in terms of the contemporary sciences. In the present era of scientific advancement, we have “Free radicals”, as a causative factor of diseases, which may be

identified as Amat the level of Bhutagnis i.e. at the molecular level and at the finest level of life process based on the similarity of the characteristics discussed earlier. The wide range of natural intracellular antioxidant mechanism involving several enzymes and chemicals like superoxide dismutase, catalase, Glutathione peroxides etc., operating at molecular level appears to have been covered in Ayurveda under Bhutagni – vyapara, the deficiency of which will lead to increased generation of Free Radicals and consequent morbidity, which is the foremost consideration in deciding the genesis of Ama factors, as conceived in Ayurveda.

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