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ORIGINAL ARTICLE

AGEING, AYURVEDA AND ANTIOXIDANTS

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Abstract:

Greying of our population bring an unprecedented increase in burden of chronic age related diseases & dependency. Oxidative stress and free radical involvement form the basis of ageing. Ayurvedic herbs being natural, affordable & rich in antioxidants offer antiageing & numerous health benefits. This article reviews a few herbs for their antioxidant contents and phytochemicals in health promotion, disease prevention & treatment.

KEY WORDS:

Antioxidants, Ageing, Ayurveda, Oxidative stress, Free radicals, Phytochemicals, Bioavailability.

INTRODUCTION

Increase in average life expectancy has consequently lead to the increase in the percentage of elderly people in our population. Ageing (though a natural phenomenon) is associated with progressive decline in the physiological functions and an increased risk of pathological changes leading to cardio-vascular disease, neuro-degenerative diseases, diabetes, osteoporosis, and so on.

Oxidative stress, which is an imbalance between free-radical species and antioxidant defence, can originate from an increase in free-radical production either by exogenous processes, such as pollution and cigarette smoking, or by endogenous processes, such as inflammation and respiratory burst etc. Free radical–initiated auto-oxidation of cellular membrane lipids can lead to cellular necrosis and a variety of pathological conditions such as cancer, CVD, and even ageing.

Experimental data indicate that herbal formulations offer an indirect protection by activating endogenous defence systems, thus suggesting that exogenous and endogenous antioxidants act in a coordinated fashion towards

OBJECTIVES

Various epidemiological studies have proved that accumulation of irreversible, oxidation induced damage resulting from the interaction of reactive oxygen species with the DNA, lipids or protein components of the cells is a major contributor in ageing and disease and an enhanced antioxidant status is associated with reduced risk of several diseases (1,2). However, even if the aging process itself is found to be unrelated to oxidative stress, then highly prevalent chronic age-related diseases all have increased oxidative stress i.e. an imbalance between oxidants and antioxidants(3).

So, in this era of increasing need for effective & affordable health promotion; challenges posed by

antibiotic resistant microbes, there is an increasingly unprecedented interest in AYURVEDA due to its holistic approach to health and disease and also it is a highly systematized medical system which rests on thousands of years of documented clinical observations & herbal pharmacopoeias.

Thus this article is an endeavour to review & evaluate a few Ayurvedic herbs on their antioxidant contents and active components in health promotion, disease prevention and treatment.

STUDY

WHO has recognised the important contribution of traditional medicine in providing essential health care. In India upto 70% of the population depend on traditional medicine to help meet their health care needs (4,5). About 960 plant species are used by Indian herbal industry, of which 178 are of high value exceeding 100 metric tonnes per year (6). It is also estimated that about 25% of the drugs prescribed worldwide are derived from plants (7) e.g. Morpine produced from Opium extracted from poppy seeds-Ahiphena (Papaver somniferum), Reserpine from Sarpagandha (Rauwolfia spp.), cardiac stimulant Digoxin from Hritpatri (Digitalis purpurea), Salicylic acid precursor of aspirin from Vetasa (willow bark-Salix spp.), antimalarial Quinine from Kunayana (Cinchona bark), Apocynin from the root of Kutaki (Picrorhiza kurroa) etc.

There are numerous antioxidants like carotenoids, flavonoids, lycopene, xanthophylls, lignans, etc. and phytochemicals like curcumin, capsaicin, carotene, lycopene, eugenol, gingerol etc. present in Ayurvedic herbs and spices which can alter the activity of several cell signalling pathways and hence cause modulation of inflammatory processes, regulation of cytoprotective mechanism, regulation of cell growth & differentiation (8,

content of some Ayurvedic herbs and formulations was performed which enables us to identify and rank potentially good sources of antioxidants (10, 11, 12).

Product	Manufacturer	Antioxidant content Mmol/100gm
Aamalaki (Emblica officinalis)	Himalaya herbal Health care	301.14
Arjuna (Terminalia arjuna)	Himalaya herbal Health care	146.95
Brahami (Centella asiatica)	Himalaya herbal Health care	10.40
Karela (Momordia charantia)	Himalaya herbal Health care	7.57
Neem (Azadiracta indica)	Himalaya herbal Health care	19.99
Triphala	Himalaya herbal Health care	706.25
Tulasi (Ocimum sanctum)	Himalaya herbal Health care	39.67
Shudd Guggulu (Commiphora mukul)	Himalaya herbal Health care	13.77
Tagara (Valeriana wallichi)	Himalaya herbal Health care	6.44
Lashuna - Garlic (Allium sativum)	Himalaya herbal Health care	0.80
Dalchini (cinnamon bark)	India	31.64
Laung (Syzygium aromaticum)	India	252.04
Kesar - Saffron	India	61.72
Saunth (Zingiber officinale)	India	11.31
Jira - Cumin seeds (Cuminum cyminum)	India	11.88
Ajwain fruit pods (Trachyspermum ammi)	India	28.42
Haldi –Turmeric (Curcuma longa)	India	13.60
Tejpatra - Bay leaves	India	18.54
Kali Mirch - Black Pepper (Piper nigrum	India	4.15
Pudina/Green mint leaves	India	142.58
Dhania/ Coriander seeds (Coriandrum sativum)	India	3.49
Elaichi/Cardamom (Elletaria cardamom)	India	1.85
Mulethi/Liquorice (Glycyrrhiza glabra)	India	2.71
Chyavanprash	Dabur India Limited	35.70
Chyavanprash	The Zandu Pharmaceutical Works	18.32

Antioxidant rich Triphala (an Ayurvedic formulation of three herbs namely Haritaki (Terminlaia chebula), Vibhitaki (Terminalia bellirica), Aamalaki (Emblica officinalis) has shown to have anti inflammatory, antibacterial & wound healing properties(13), and cancer chemoprotective potential(14).

Laung (Clove) a well known household spice, with its high antioxidant content and phytochemicals like tannins, terpenoids, eugenol, & gallic acid plays a crucial role in orchestration of immune & inflammatory responses and serve as antioxidant (15). Ayurvedic herbal pharmacopoeias mentioned its deepana (appetizer), chardi vinashana (antiemetic), shwasaghna (antiasthmatic) properties (16).

Arjuna (Terminalia arjuna) another Ayurvedic herb which is used as single drug or in formulations has been found to be cardioprotective & gastroprotective (17, 18).

Aamalaki- The Indian Gooseberry (Emblica officinalis) ascorbic acid (Vitamin C) which is itself an antioxidant and it has been considered as rasayana (rejuvenating) & vayasthapana (anti-ageing) in Ayurvedic texts (19).

Adarak/Saunth (Gingiber officinale) is a rhizome with a spicy aroma due to presence of ketones especially [6]-gingerol,[6]-paradol, [6]-shogaol , and zingerone etc. It has been reported to decrease age related oxidative stress (20) and found to guard against hepatotoxicity by suppressing oxidative consequences (21). Ginger (250mg capsule) was found to be as effective as NSAIDs-Mefenamic Acid (250mg) & Ibuprofen (400mg) in relieving pain in women with primary dysmenorrhoea (22). India is the largest producer of ginger with its use as a remedy to treat various ailments for over 5000 years. This has been described in ancient texts as vatavibandhanuta (carminative), deepana (appetizer) and digestive (23).

Haldi /Turmeric (Curcuma longa), also called 'Indian Saffron' is a principal spice in Indian cuisines. In sanskrit it has 53 different names. 'Erode' a city in the Tamil Nadu state of largest producer of turmeric and is known as Yellow city or Turmeric city. In Ayurvedic medicine, turmeric is a well-documented treatment for various respiratory conditions, liver disorders, anorexia, rheumatism, and considered the best drug in diabetes and urinary disorders (24). It is a cholagogue, as it stimulates bile production in the liver and encourages excretion of bile via the gallbladder, which improves digest fats. As a dietary supplement, it favourably enhances the activities of pancreatic lipase, chymotrypsin, and amylase. After eating turmeric, secretion of gastrin hormone from the antrum of the stomach is inhibited as it possess local membrane-anesthetizing activity at the antrum of the stomach, which then inhibits secretion of gastrin thus found useful in healing peptic ulcers (25, 26) .Curcumin a botanical phenolic compound in turmeric is found to scavenge free radicals, increase antioxidant enzymes, inhibit lipid peroxidation thus showing strong antioxidant and anti inflammatory properties (27).

The herbal extract from the resin of the Commiphora mukul or mukul myrrh tree, known as guggul, is widely used in Indian Ayurvedic medicine. The presumed bioactive compounds, guggulsterones, are suggested to be involved in controlling cholesterol metabolism (28).

Tulasi/
cineole, estragole, and eugenol(29).

Cardamom extracted from the herbs Elettaria (green—Chotti elaichi) and Amomum (black- Badi elaichi) of the family Zingiberaceae. It Cardamom too
(30).

(31).

Dalchini/
α-
etc. Cinnamon
including catalase, superoxide dismutase and these enzymes help maintain GSH levels, essential for (32).

Dhania/Coriander --

Zira/Cumin- and it
chemoprotective properties (33).

Kesar/

The carotenoid - α-crocin golden-yellow
(34).

Herpes zoster and postherpetic neuralgia have been treated with a topical licorice (Glycyrrhiza glabra) as Glycyrrhizen, one of the active components of licorice, has been demonstrated to inhibit the replication of

varicella zoster in vitro (35) .
Valerian an active component of Tagara (Valariana spp.) is found to treat insomnia caused by nervousness.
Methi/fenugreek is a leguminous herb that is cultivated in India. The seeds are used as a food ingredient and spice, and they are reported to contain high amounts of protein and fibre. The clinical effects of fenugreek, and particularly, the hypoglycaemic effects, may be secondary to the fibre content, which potentially may affect gastric emptying and may result in a decrease in postprandial blood glucose levels. Other bioactive compounds, such as the alkaloid trigonelline and steroidal saponins, have been reported to have an insulin like effect (36).
Karela/ bitter melon fruit contains cucurbitane-type triterpenoids, steroidal saponins called charantins, insulinlike peptides, and alkaloids, which are postulated to have effects on carbohydrate metabolism (37).

The Indian system of medicine -Ayurveda dates back to about 3000 BC and is based on the concept that the human body consists of five energy elements that also make up the universe: (1) earth, (2) water, (3) fire, (4) air, and (5) space. The interactions of these five elements give rise to the three doshas (forces), seven dhatus (tissues), and three malas (waste products). All diseases are attributed to an imbalance among the three doshas. It is based on holistic approach, by which the individual is kept in a biologically balanced state, and allows the mobilization of biological reserves through spontaneous adjustments and the building up of better bodily defence system to take care of physiological problems.

This has been observed that dietary antioxidants exist in various bioactive forms & in appropriate doses with polyphenols & carotenoids being the largest group. They have different functions and are produced by plants to protect plant cells against oxidative damage. These Ayurvedic and common Indian spices when taken in their crude usual form produce a complementary and/or synergistic effects through their several phytonutrients and promote health or produces protective effects against diseases without compromising normal functions of the body than taken in the form of antioxidant supplements like vitamin C, vitamin E, B-carotene etc.(38).

The antioxidant molecules play an important role in the diet-led prevention of oxidative stress–related chronic diseases, and the health benefits associated with consumption of herbal products have been attributed in part to free-radical scavenging, ameliorating neurotoxicity and metal-chelating activities(39).

RESEARCH NEEDS & RECOMENDATIONS

Despite the historical use of herbs and botanicals in providing health benefits and in treating various ailments there is considerable scepticism regarding their effectiveness probably due to paucity of definitive and consistent data on their efficacy and lack of knowledge about their identification, processing, standardization, precise mechanism of action etc. So here are a few recommendations regarding areas of research providing a lot of scope in the usage of more stable, natural and bioavailable forms with more evidence based data.

Identification of plant as a whole and of their active and adjuvant phytochemical constituents is the primary need of the hour. Genomic testing, chemical fingerprinting techniques must be incorporated in definitive authentication and quality control of herbs. Herbal products are constrained by their unknown and unidentifiable active chemical constituents. So bioavailability of the herbs and their formulations need to be identified and standardized and assessed.
Though the composition of a natural product can vary with season, growing conditions, preparation & storage. There is also adulteration, contamination, & misidentification of herbs. So clinical products must be produced by GMP from source material acquired through good agriculture and collection practice, be botanically validated, be chemically & biologically standardized.
As these herbs are perishable products so incorporation of some innovative ways in delivering the healthy properties of plant extracts are needed. As plant extract varies in solvent used, so identifying the most suitable extraction process, analyzing the chemical stability & biovailability of the extract are badly needed.
Pharmacokinetics of the herbs & their formulations largely depends upon the procurement, storage, processing, digestion, assimilation and metabolism which needs to be preclinically assessed and standardized.
Evidence based clinical practice & research is must for its acceptance by the intellectuals. Evidences need to be verified legitimately & scientifically. With a plausible biological basis, herbal products can be evaluated through double blind placebo controlled multicentre trials. A wide range of biomarkers need to be investigated in controlled human trials. WHO has published a number of guidelines for assessment of

clinical efficacy & safety (40, 41).
Poorly managed collection and cultivation practices could lead to the extinction of endangered plant species and the destruction of natural resources. It has been suggested that 15,000 of 50,000–70,000 medicinal plant species are threatened with extinction. The efforts should be central to the preservation of both plant populations and knowledge on how to prepare and use herbs for medicinal purposes.
There is not necessarily a direct relationship between antioxidant content of a food sample consumed and the subsequent antioxidant activity on target cell. Numerous factors influence the bioavailability of phytochemical antioxidants. With the present study herbs with high antioxidant properties are identified, but further investigation regarding biological relevance & mechanism involved in antioxidant activity need to be identified.

CONCLUSION

Plants, herbs & spices have been used since the time immemorial for health promotion & treatment of diseases. Plants sources form the basis of today's modern medicine & contribute largely to the commercial drugs manufactured today. A worldwide chronic disease epidemic of obesity, diabetes, CVDs and increase in ageing population is bringing an increase in the burden of chronic age related diseases & dependency. Among many theories of ageing, oxidative stress theory is the most supported one. Compelling support for the involvement of free radicals in disease development supported the role of antioxidants & micronutrients present in herbs in modulation of cell signalling & modification of gene expression. Ayurveda (Life Science) has a privilege of being the most ancient medical system with two basic principles – preservation of health and treatment of the diseased. This plant based Indian system of medicine offers many potent clinical effects in preventing oxidative stress related diseases through the dietary phytochemical antioxidants. As Hippocrates has rightly quoted “Let food be thy medicine and medicine be thy food” this stands correct with the powerful antioxidant properties of common Ayurvedic herbs & spices.

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