

A Review On Anti-Oxidant Activity Of Herbs Used In Siddha System Of Medicine Listed Under Kayakarpam Regimen

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Abstract:

Background:The Siddha medicine is a very ancient system of medicine that is followed in Southern part of India especially in the state of Tamil Nadu. It was founded by Siddhars, who believe in the art of immortalizing the corporeal human body. The Siddha pharmacology is enriched with flora, fauna and mineral resources. The Hallmark of Siddha system is kayakarpam which impart immunity to diseases and counteracts the aging process which is attained through 'karpavizhtham' (medicines) and 'karpayogam' (regimens of life). Kayakarpam make our body competent and strong. The antioxidants present in Kayakarpa herbs disable the hazardous effects caused by free radical. Freeradical cause age related problems, cancer, atherosclerosis, and arthritis...etc[1]

Objective: To review the anti-oxidant activity of herbs used in Siddha system of Medicine listed under Kayakarpam regimen.

Materials and Methods: A total of 35 articles, which included 3 siddha literatures authorised by The Directorate of Indian Medicine and Homoeopathy and 32 published articles were reviewed for the anti-oxidant property of the herbs. PubMed search engine was used to collect the information from the published articles. The search strategy was done with the keywords "total phenolic content", "Oxygen Radical Absorbance Capacity", "DPPH(2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity".

Results:The five kayakarpa herbs listed in this article does contain free radical scavenging activity, due to its total phenolic content, a potent anti-oxidant relating to the concept of kayakarpam regimen stated in Siddha literatures thereby leading to anti-ageing effect

Conclusion:As in recent years there is an intensified search for effective non-toxic natural compounds with antioxidant property which possess the anti-aging activity, this review will help in sufficing the search of economically available herbs. While the role of anti-oxidants in combating age-related ailments is promising, further research is needed to understand their effectiveness in day-to-day basis

Key words:Kayakarpam, Siddha, Oxygen Radical Absorbance Capacity, DPPH radical scavenging activity.

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I. Introduction

Siddha is the medical science dedicated to the longevity of life, for the wellbeing of humanity. Kayakarpam is the set of specific therapies, which can actually alter the metabolism of body and thereby reverses the physical degeneration. Metabolism in human body consists of a series of reactions that occur within cells of living organisms to sustain life. Metabolism can be split into a series of chemical reactions that comprise both the synthesis and degradation of complex macromolecules known as anabolism or catabolism, respectively. Anabolism utilises energy to make macromolecules and biomolecular polymers. Catabolism releases energy when these are broken down into simpler molecules[2]. All living things naturally produce free radicals as part of their physiological processes, which are produced during regular cellular operation or from external sources like pollution, medication, cigarette smoke or through radiation. They act as both beneficial as well as toxic compounds to the body[3]. When an overload of free radicals cannot gradually be destroyed, they get accumulated and lead to phenomenon called "Oxidative damage" or "Oxidative Stress"[4].

II. Effect Of Reactive Oxygen Species In Human Body

Reactive oxygen species (ROS) can be from exogenous and endogenous sources and are produced from molecular oxygen as a result of cellular metabolism. Reactive oxygen species have a dual role in both physiological as well as pathological conditions. The human body continuously produces reactive oxygen species, which are then eliminated by antioxidant defenses[5]. They are involved in many redox-governing activities of the cells for the preservation of cellular homeostasis, acting as potential signaling molecules to control several normal physiological functions[6]. When overproduced it can lead to oxidative stress resulting in the damage of cell structures that cause various diseased states. In humans, oxidative stress is involved in the development of cancer, Parkinson's disease, Alzheimer's disease, atherosclerosis, heart failure, myocardial infarction, fragile X syndrome, sickle cell disease, lichen planus, vitiligo, autism, infection, chronic fatigue syndrome and depression[7].

III. Aging

Aging results from the impact of accumulation of molecular and cellular damage over time, leading to deterioration in the physical and mental capacity, growing the risk of disease and ultimately death. Beyond biological changes, ageing is often associated with other life transitions such as retirement, relocation to more appropriate housing and the death of friends and partners. By 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050, the world's population of people aged 60 years and older will double (2.1 billion). The number of persons aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million[8]. Some of the common conditions associated with aging include atherosclerosis, osteo arthritis, diabetes, cardiomyopathy, respiratory disorders and neurodegeneration. There are two primary types of modern biology theories of human aging: damage or error theories and programmed theories. According to the programmed hypotheses, aging occurs according to a biological schedule, possibly an extension of the one that governs childhood development and growth. Variations in gene expression that impact the systems in charge of upkeep, repair, and defense reactions would determine this regulation. The damage or error theories attribute aging to environmental insults to living things that result in accumulated damage at different intensities[9]. Some causes of aging include but are not limited to oxidative stress, glycation, telomere shortening, side reactions, mutations, aggregation of proteins, etc. Given that the causes of aging work in concert, it is also determined that many, including free radicals, play important roles in the process of aging rather than any one cause being the primary one. Therefore, if we remove or simply reduce the increase of a few or even just one of the causes of aging, health and/or lifespan may be greatly increased[10].

IV. Role Of Anti-Oxidants

An antioxidant is a chemical substance that, in small quantities relative to an oxidizable substrate, considerably inhibits or delays the substrate's oxidation. Biologically significant reactive oxygen species (O_2^- , H_2O_2 , OH, HOCl, ferryl, peroxy, and alkoxy) can be scavenged by antioxidants, or they can act to stop their creation or repair any damage they already cause[5]. Anti-oxidants are essential in slowing down the aging process by scavenging the damaging free radicals and lowering the oxidative stress. Free radicals have the potential to harm the cells and accelerate aging[11]. Antioxidant Supplements Can Prevent or Reverse Age-Related Alterations in Antioxidant Defense. Oxygen-derived free radicals (ORFs) are thought to play a role in age-related cellular damage, and interventions that target ORFs may help slow the aging process[12]. Due to the complex nature of anti-oxidants and ROS, high dose of a particular anti-oxidant like Vitamin C, Vitamin E and β carotene resulted in no effect. Thus an alternate approach is required and anti-oxidant rich foods would be the promising approach as they contain a large number of different antioxidants that have been carefully selected by plant evolution to protect all of the plant's cells from oxidative damage[13]. In order to analyze the anti-oxidant capacity of various kinds of anti-oxidants, the Oxygen Radical Absorbance Capacity (ORAC) was developed by the National Institute on Aging in the year 1992[14]. The anti-oxidant capacity is also analyzed through in vitro assays like Total Anti-oxidant activity (TAA), DPPH radical scavenging assay, Hydroxyl radical scavenging assay, Superoxide radical scavenging assay, Nitric oxide radical scavenging assay, Hydrogen peroxide scavenging assay and Total Phenolic Contents. The phenolics are the potent anti-oxidants present in various plants.

V. Kayakarpam

The word kayakarpam means ('kaya' – body, 'karpam' – ability or competent) to make our body competent and youthful. Kayakarpam therapy focuses on curing degenerative diseases and prolonging life by harmonizing the mind, body and psyche through purification, nourishment, rejuvenation and normalizing the vitiated humor. Anti-aging property can be achieved through Herbo mineral medicines (Karpavizhtham) and

yoga practices which streamlines the body mechanisms (Karpayogam). It is broadly classified into two categories, for prevention of diseases (pothu karpam) and for restoring the health from diseases (sirappu karpam)[15]. Not only the antioxidants present in these herbs prolongs the life but also the essential nutrients play an important role in well-being.

VI. Dietary Regimen (Paththiyam)

Calorie restriction without malnutrition, also referred to as Dietary restriction (DR), is the best-studied longevity-promoting intervention, attributing to energy balance, limiting fat accumulation through reduced energy intake[16]. It also provides a broad spectrum of health benefits. In the interim of Kayakarpa therapy (Karpavizhtham and Karpayogam), the following food items enlisted in Table 1 are to be taken into account. Sexual intercourse, languish, laziness is strictly to be withdrawn. As per the siddha literatures, sour tasted foods tend to raise body temperature and thereby reducing the efficacy of drugs what we intake. Oil bath plays a vital role in enhancing the benefits of Karpaherbs immediately after the course of Kayakarpa therapy[17]. Fish and other meat items are rich source of methionine, the dietary methionine restriction improves the biomarkers of metabolic health[16]. Dietary restriction also protects against oxidative damage and, of course, oxidative damage is probably an inevitable component of fuel use.

Table 1: Dietary Regimen to consider during the course of Kayakarpa therapy[17]

Food items not to be taken	Food items to be taken
<ul style="list-style-type: none"> • Tamarind • Salt • Oil products • Dried Fish • Mustard • Spicy foods • Onion • Asafetida 	<ul style="list-style-type: none"> • Milk • Ghee • Fruits • Honey

VII. Kayakarpa Herbs, It's Major Constituents And Their Anti-Oxidant Activity

Emblica officinalis(Nellikai): The Indian gooseberry contains a rich number of phenolic compounds. The phenolic compounds are higher in concentration in raw or immature fruit and decreases with the stages of maturity. The initial total phenolic content was $184.0 \text{ mg}100\text{g}^{-1}$ [18]. The Literature in Siddha states to use dried fruit powder with honey or fruit marinated in honey in kayakarpa therapy regimen[17]. The polyphenolic extract of *P. emblica* fruits have the potent of free radical scavenging activity and could prevent oxidative stress induced by heavy metal toxicants[19]. When five *Phyllanthus emblica* cultivars in china were subjected for cellular anti-oxidant activity, their oxygen radical absorbance capacity were measured and the values were (832 ± 100 , 774 ± 52 and $704\pm28 \mu\text{mol}$ of quercetin equivalents/100 g) for Qingyongan, Binggan and Boligan types respectively showing higher cellular anti-oxidant activity[20].

Figure 1: *Emblica officinalis*



Piper nigrum(Milagu): The climbing vine native to India contains total phenol, total flavonoid and piperine contents of $1421.95 \pm 22.35 \text{ mg GAE}/100 \text{ g}$, $983.82 \pm 8.19 \text{ mg CE}/100 \text{ g}$ and $2352.19 \pm 68.88 \text{ mg}/100 \text{ g}$, respectively in its pericarp[21]. The leaves contained the Oxygen Capacity Absorbance Capacity value of $3639.05 \mu\text{mol TE}/\text{g}$ [22]. Siddha literature recommends to use pepper fruit powder along with honey as adjuvant twice a day in kayakarpa regimen for 48 days[17]

Figure 2: *Piper nigrum*



Terminalia chebula (Kadukkai): Siddha texts states the usage method as follows, the epicarp is dried, powdered and taken along with water as adjuvant[23]. *T. chebula* is rich in bioactive compounds like tannins (chebulinic acid, chebulagic acid, gallic acid, chebulic acid, corilagin, and ellagic acid), flavonoids, sterols, amino acids, fructose, and resins[24]. The total phenolic content of 70% methanolic extracts of *T. chebula* was 127.60 ± 0.001 mg/ml gallic acid equivalent per 100mg fruit extract and the flavonoid content was 219.30 ± 0.01 mg/ml quercetin per 100mg fruit extract[25]. The polyphenolic extract of fruit showed DPPH radical concentration (IC₅₀ 14 μ g/mL), nitric oxide concentration (IC₅₀ 30.51 μ g/mL) and hydrogen peroxide scavenging activity (IC₅₀ 265.53 μ g/mL) under in vitro condition[26] and superoxide scavenging activity (IC₅₀ 13.42 ± 0.22 μ g/ml)[25].

Figure 3: *Terminalia chebula*



Zingiber officinale (Inji): The popular culinary herb contains phenolic compounds like gingerols and shogaols which has the anti-oxidant activity[27]. Dried ginger extracted with ethanol showed the highest Total Flavonoid Content level from the sun-drying (651.5 g Rutin Equivalent/100 g extract, 12.25-fold) and the Total Phenolic Content was 19.57mg Gallic Acid Equivalent/g extract. The DPPH scavenging activity is increased in dried ginger when compared to fresh ginger[28]. The dried root tuber of ginger is recommended to take along with sugarcane juice as adjuvant with reference to siddha texts[23]

Figure 4: *Zingiber officinale*



Azadirachta indica (Vaambu): The flower, leaf and bark of the tree are widely used in the siddha medicine preparation for ages. The flower or the dried tender leaves are suggested to be taken along with carum and salt (half to its ratio) in the process of Kayakarpa regimen[29] The active constituent of economically cheap and safe herb is azadirachtin and the others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinat, gedunin, salannin, and quercetin[30]. The amount of total phenolic content in the ethanolic crude extract of A. indica root was (238.81±0.98 mg/g of gallic acid equivalent). The ethanolic extract of flowers and seed oil at 200 µg/ml produced the free radical scavenging activity of 64.17±0.02% and 66.34±0.06% respectively, and the total phenolic content exhibiting high inhibition to DPPH radical. The essential oils of seeds exhibited the strongest free radical scavenging activity with IC50 value of 39 µg/ml[31].

Figure 5: *Azadirachta indica*



VIII. Conclusion

In era of rapidly changing environment and lifestyle, it is inevitable for us to be a victim of age-related problems. This review concludes that the herbs listed under kayakarpan indeed has the anti-oxidant activity with rich number of phenolic contents and free radical scavenging activity so as to promote healthy aging. The Siddha system concentrates mainly on preventing the disease and enhancing a healthy aging. This can be achieved through Kayakarpa therapy. The modern researches have paved the way for the better understanding of the benefits of those herbs with regards to the active constituents. While the role of anti-oxidants in combating age-related ailments is promising, further research is needed to understand their effectiveness in day-to-day basis and optimal use in promoting healthy aging. Embracing a balanced diet rich in anti-oxidants along with healthy lifestyle remains crucial for overall wellbeing and subdue the impact of free radicals on human body.

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