



Review Of Antioxidant Activity Of Rasayana Herbs Described In Ayurveda

sudipt kumar rath, ashashri shinde, pankaj gahunge, naresh kumar khemani

Dept. of Dravyaguna, NIA, Jaipur (INDIA)

Correspondence Author:- sudipt kumar rath Lecturer, Dept. of Dravyaguna, NIA, Jaipur (INDIA)

Email:- sudipt@gmail.com

Quest for a healthy and long life has always been attempted by mankind. With life expectancy rising, ageing with grace and leading a healthy & independent life will remain one of the main health concerns of all countries. Ayurveda, the oldest documented organised system of health care has also dealt this important health segment under aegis of Rasayana concept. The stress on prevention and promotion was anyways stressed more than the curative approach in Ayurveda. Many herbs and other natural products were used to delay the ageing process. These herbs are still being widely used in Ayurvedic parlance for this purpose. Many of these herbs are also been scientifically investigated and are complying the current understanding of ageing process. Therefore, the available literature was screened and a comprehensive list of herbs having Rasayana effect and potential anti-ageing effect was drawn. On basis of the already done investigations, the herbs from this list were established as anti-ageing agents. Thus, it is suggested that the remaining plants should also be investigated for their anti-ageing effect. This will help the researchers save valuable time and money.

Key words – Rasayana, Ayurveda, Anti ageing, Herbs, Anti-oxidant

INTRODUCTION

To live a long healthy life has remained a fundamental quest of humanity from the most primitive time. “*pasyema sardah satam / jivema saradah satam*” (Yajurveda) Vedas advocate that “leading a healthy and happy life” is the fundamental duty of human beings. In the quest of achieving this prevention of diseases is the prerequisite. Longevity by retarding the process of ageing and strengthening of positive factors in a human being are a must through which prevention can be realized to its fullest potential. References of sages like Cyavana¹ having enjoyed such a state by appropriate use of drugs like *Haritaki*, *Āmalaki*, *Silājatu* etc. has been documented in the texts of Āyurveda. This condition of health par excellence became possible by Rasāyana, one of the eight clinical specialities of Āyurveda.²

REVIEW OF CONCEPT OF RASAYANA

Jara or ageing is a natural and irreversible biological phenomenon in our life. Therefore, Āyurvedic texts recommend the use of *Rasāyana* drugs before these changes are established. *Rasāyana* as a specialty was developed with the aim of delaying of ageing and enhancing (strengthening) of positive factors. The ayurvedic concept of *rasayana* having similarities with modern concept of antiageing and latter by adaptogens and nootropics.

Childhood (excluding early childhood) and youth are the best period to use *Rasāyana* to delay ageing. The free radical theory of ageing and concepts of antioxidants supports the actions of *Rasāyana*. The health system in *Āyurveda* has three levels ---

- 1). **Disease to health** by appropriate treatment.
- 2). **Maintenance of health** by Dinacaryā, Ritucaryā and Sadvritta.

3). **Health par excellence** i.e. strengthening the positive factors in a person & attaining longevity by rasāyana.

Definition of Rasāyana

Various authors have defined Rasayana in their own way. The following is a compilation of these definitions.

- 1) Caraka³ defines rasāyana as the procedure by which a healthy person attains prasasta rasādi dhātus (ideal body tissue systems).
- 2) According to Cakrapāni⁴ along with seven rasādi dhātus Smriti (memory), Buddhi (intellect) and other mental functions are to be included.
- 3). Susruta⁵ describes rasāyana as the branch that deals with Vayah Sthāpana (delays ageing process), increasing the life span, intellect, strength and to develop resistance in the body to counteract the diseases.
- 4) Dalhana⁶ explains Vayah Sthāpana in two ways --
 - i. which promotes an age of hundred years or more.
 - ii. which maintains youth for a long time.
- 5) Cakrapāni⁷ interprets vayah as “taruna vayah”.
- 6) Dalhana⁸ defines rasāyana as acquiring the specific properties of rasa, guna, virya, vipāka and prabhāva of a dravya.
- 7) Cakradatta⁹ defines rasāyana as that which destroys jarā vyādhi.
- 8) Sivadāsa Sen¹⁰ interprets jarāvyādhi as old age and hence rasāyana as that which delays senescence. He also cautions that some interpret this by splitting jarā and vyādhi which is incorrect.
- 9) This view has been supported by Gangādhara Roy.¹¹
- 10). Bhāva Prakāsa¹² and Yogaratnākara¹³ have defined rasāyana dravya as that which destroys jarāvyādhi (delays senescence). vayah sthāpana (maintains youth), chaksusya – (maintains normal functioning of eye and other sense organs), vrisya (virilifier) & brimhana.

Thus, Rasayana in Ayurveda refers to attainment the best of body tissues to ensure a healthy and timely ageing and increase the Ayu or life span.

Ayu (the life span) according to *AYURVEDA* is mainly based on two factors.¹⁴

1. **DAIVA** - The work done in past life described as “daiva”.

2. **PURUSHARTHA**- Work done in present life.

When both of these are strong the individual enjoy long life span & when both of these are weak the person suffers a lot of miseries & lives a shorter life.

Again Caraka¹⁵ classifies Ayu into, *NIYAT*-(timely-100yrs), *ANITYAT*-(untime cessation of life due to any disease,accident etc.)(Ca.vi.3). *Susruta*¹⁶ explained some diseases as *swabhav krita*'(natural process) and ageing is one of these. So according to *Ayurveda* ageing is a timely and natural process.

Sharira (body) is defined as “*Shiryate tat shariram*”*su.sh*¹⁷ i.e. to wear and tear. It means this human body has to undergo daily wear & tear constantly from birth to death leading to tissue damage.

CONTEMPORARY VIEWS

Healthy ageing is a bio-psychological process involving three broad contributing factors.(Handbook of theories of ageing, by Vern Bengtson 2nd edition)¹⁸.

1. **SOCIAL STRUCTURAL INFLUENCES**-Gender, socioeconomic status, race, age.
2. **INDIVIDUAL INFLUENCES**- Psychological & behavioural.
3. **BIOLOGICAL INFLUENCES**- Inflammatory &oxidative damage, damage to irreplaceable molecules, cells & blood metabolic hormone...

Contemporary scientist have also been trying to unravel the mystery of ageing. Presented below are some of the theories put forth at different points in time.

1. **”WHY” THEORIES**-Why do animals &humans age?(2006 AFAR)¹⁹.
2. **”WHO”THEORIES**-Which populations age more quickly than others & which individuals die sooner than others?(2006 AFAR)²⁰.
3. **PSYCHOLOGICAL AGEING THEORY**- As people grow older their behaviour changes, their social interactions change & the activities in which they engage change.
4. **BIOLOGICAL THEORIES**-It classify ageing as genetic & non genetic theory

A) GENETIC (HEREDITY)THEORY -1) Error & fidelity theory

2) Somatic mutation theory

3) Glycation theory

B)NONGENETIC THEORY- 1)Effects of temp theory

2) Nutrient deprivation theory

3) Llipofuscin theory

5. THEORIES OF CELLULAR AGEING

a) Programmed cellular ageing theory

b) Ageing pacemaker theory

6. THEORIES OF THE ORGAN SYSTEM-

a)Autoimmune theory

b)Nonendocrine control theory

7. STRUCTURAL DAMAGE THEORY-It based on view that the molecular components of cells,

over time begin to malfunction & break down. (2002 macmillan Earl stadtmann)²¹

- a) wear & tear theory
- b) faculty reconstruction theory
- c) molecular cross-linkage theory
- d) mitochondrial damage theory²².

The damage based theories all speculate that the initial damage moves from the molecular level outward to the tissues & organs of the body eventually taking the form of degenerative diseases such as ; heart disease, cancer, diabetes, arthritis, senile dementia, Alzheimers disease & other life ending processes. But the most widely accepted structural damage theory & the one theory that encompasses all of the previous theories is the "*Free radical theory of ageing*"²³.

FREE RADICAL THEORY OF AGEING - Proposed by *Dr. Denham Harmon (1954)*²⁴ it states that ageing occurs when cells become permanently damaged from the life long & unrelenting attack of charged molecular fragments known as free radical.

Free radicals(FR) are molecules containing an unpaired electron they are unstable & highly reactive. They are products of cellular metabolism. Our body cells replenish themselves & produce energy to run the processes of the body. When this happens certain molecules are left behind. they are missing electron & therefore will go looking for another one. that free radical steal electron from cells, DNA, enzymes & cell membranes. So removal of this electron changes there chemical structure it causes damage & don't function normally.²⁵

Free radicals not only by products of cellular metabolism but in recent era they introduced in to our bodies from other places like cigarette or cigar smoke, radiation, alcohol, air & water pollution ingesting artificial products can lead to higher levels of free radical in the body. Certain gases & even sunlight can affect the FR level in our body. This is the main reason of ageing which appears like a disease, over 80 degenerative diseases are now known to be linked to FR induced oxidative stress. According to Dr. Harmon such diseases are not separate entities but rather different forms of expression of ageing process.²⁶

1. FREE RADICAL DAMAGE:²⁷

A)OXIDATIVE STRESS- The relation between diseases can be explained by the concept of oxidative stress. Dr. Harmon first proposed that ageing is a consequence of cellular damage caused by reactive oxygen species & reactive nitrogen species. the generation of ROS & RNS occurs in animals mainly in mitochondria. where more than 90%of the oxygen used by cells result in the production of superoxide radicals. Oxygen itself is toxic especially through inactivation of proteins with iron-sulfur center & it interacts with nitric oxide to form peroxynitrite which may damage cells by promoting membrane lipid peroxidation & nitration of protein. Oxygen and Hydrogen peroxide cause the production of hydroxyl radicals (OH) which damage proteins, lipids & DNA.

B)MOLECULAR DAMAGE:- Attack by free radical can impair cell function & lead to cell death eventually resulting in diseased state.

C)DNA:- Oxidative damage to DNA results in generating a spectrum of pyrimidine & purine damaged products & change in DNA base result in mutagenesis & carcinogenesis.

D)CARBOHYDRATES:- Free radicals such as OH react with carbohydrates producing a-carbon-centered radical, this leads to chain breaks.

E)PROTEINS:- Damage to proteins by ROS/RNS can generate a range of stable & reactive products such as protein hydroperoxides that can generate additional radicals these stable oxidised proteins gradually accumulate with ageing & produces various diseases such as Alzheimer`s disease.

F)LIPIDS:- Reacted with FR can undergo the highly damaging chain reaction of lipid peroxidation leading to both direct & indirect effects which is highly detrimental to the functioning of the cell..

G)CELL MEMBRANES:- Damage by ROS/RNS to cell membranes comprising integrity leads them vulnerable to attack by viruses, bacteria & other invaders.

H)AGEING PROCESS:-It depends on the presence of amount of FR in our body. The body has defence mechanism called as antioxidants, but sometimes our body can be overcome with too many FR at this point we become sick while our bodies are being overtaken by free radicals.

ANTIOXIDANTS:-

Antioxidants are the substance which present in our body by nature they fight with FR therefore it is also called as free radical scavengers.(SOD) superoxide dismutase, glutathione peroxidase, glutathione reductase, thioredoxin, thiols & disulfide, vit-e, vit-c are antioxidants which come from vegetables, fruits, herbs & our food.

ACTION OF ANTIOXIDANTS:- The nature of antioxidants is to neutralise free radical in body. it have extra electron to share with unpaired free radicals in their presence they latch on to free radicals so they won't steal electron from other vital places, so antioxidants makes unstable & reactive free radicals changing to stable & unreactive. By this way antioxidant stop damage of free radicals.

STAGES OF ANTIOXIDANT ACTION:- Antioxidants capable of neutralising free radicals or their actions act at different stages. They act at the levels of prevention, interception & repair.

1)Preventive antioxidants attempt to stop formation of ROS include SOD.²⁸

2) Interception of free radical:-It is mainly by radical scavenging. includes vit-e, vit-c , glutathione, thiol compounds, carotenoids, flavenoids.etc.²⁹

3)REPAIR:- At the repair & reconstitution level mainly repair enzymes are involved³⁰

ANTIOXIDANT ACTIVITY OF AYURVEDIC HERBS:-

Ayurvedic medicines have a unique holistic approach & it is usually customised to an individual constitution. Ayurvedic knowledge could help immensely in developing new medicines from medicinal plants, which are rich sources of antioxidants. Current estimate indicates that about 80% of people in developing countries still rely on Traditional System of Medicines that are largely based on various species of plants & animals for their primary healthcare.³¹

Global aged population(>60yr)numbered 900 million & it is speculated that by 2050 this number would rise upto 2 billion. Worldwide the population of older individuals is growing at a rate of 46%/year as against the population as a whole at 92.2% annually. India stands second in possessing maximum aged population in the world.³²

Besides deterioration of quality of life due to untimely ageing in the world population needs to be addressed & a suitable solution either in the form of medication or dietary supplement needs to be explored. Ayurvedic herbs do offer potential solution in this segment, but these potentials need to be validated using systematic protocols & proper explanation. recent investigations have shown that the antioxidant properties of ayurvedic plants could be correlated with oxidative stress defence different human diseases & ageing process.³³

So AODS have coevolved with aerobic metabolism to counteract oxidative damage from ROS. Also in this regard total phenol content has received the greatest attention due to the fact that there is a direct relation between total phenol content of the plant with its free radical scavenging potential it can proved by experiments.

Presented below a list of herbs which are attributed with Rasayana effect. Some of these plants have been reported to have anti oxidant activity.

Sanskrit name	Latin name	Family	References in Sambhita
1)HARITAKI	Terminalia chebula Retz.	Combretaceae	Ca.chi-1/1,1/2,1/3,42-47 ³⁴
2)AMALAKI	Emlica officinalis Gaertn.	Euphorbiaceae	Ca.chi.1/1,1/2,1/3 ³⁵
3)BIBHITAK	Terminalia bellirica Roxb.	combretaceae	Ca.chi.1/1,1/2,1/3 47-47 ³⁶ .
4) PIPPALI	Piper longum Linn.	Piperaceae	Ca.chi.1/3,32-40 ³⁷
5)BHALLATAK	Semecarpus anacardium linn.f.	Anacardiaceae	Ca.chi1/2,13-20 ³⁸
6)GUDUCHI	Tinospora cardifolia (Wild.)Miers ex Hook.f.&Thoms.	Menispermaceae	.ca.chi.1/2-12,1/3-30 ³⁹
7)SATAVARI	Asparagus racemosus Wild	Liliaceae	Ca.chi. 1/2-12 ⁴⁰
8)BRAHMI	Bacopa monniei (Linn.)Pennell	Scophulariaceae	Ca,chi.1/4-6 ⁴¹
9)JIVANTI	Leptadenia reticulata W.&A.	Asclepiadaceae	Ca.chi.1/2-12 ⁴²
10)YASHTIMADHU	Glycyrhizza glabra Linn.	Fabaceae	Ca.chi.1/2-12 ⁴³
11)MANDUKPARNI	Centella asiatica(Linn.) Urban	Umbelliferae	Ca,chi.1/2-12 ⁴⁴
13)VIDANG	Embelia ribes burm.f.	Myrsinaceae	Ca.chi.1/2-9 ⁴⁵
14)APARAJITA	Clitoria ternatea Linn.	Fabaceae	Ca.chi.1/2-12 ⁴⁶
15)BALA	Sida cordifolia Linn.	Malvaceae	Ca.chi.1/2-12 ⁴⁷
16)ATIBALA	Abutilon indicum(Linn.)SW.	Malvaceae	Ca.chi.1/2-12 ⁴⁸

17)CHANDANA	Santalum album Linn.	Santalaceae	Ca.chi.1/2-12 ⁴⁹
18)AGURU	Aquilaria agallocha Roxb.	Thymeleaceae	Ca.chi.1/2-12 ⁵⁰
19)DHAVA	Anogeissus latifolia Wall.	Combretaceae	Ca.chi.1/2-12 ⁵¹
20)SHINSHAPA	Dalbergia sissoo Roxb.	Fabaceae	Ca.chi.1/2-12 ⁵²
21)ASAN	Pterocarpus marsupium Roxb.	Fabaceae	Ca.chi.1/2-12 ⁵³
22)PUNARNAVA	Boerhavia diffusa Linn.	Nyctaginaceae	Ca.chi.1/2-12 ⁵⁴
23)SARIVA	Hemidesmus indicus R.Br.	Asclepiadaceae	Ca.chi.1/2-12 ⁵⁵
24)VIDARI	Pueraria tuberosa DC.	Dioscoreaceae	Ca.chi.1/4-6 ⁵⁶
25)STHIRA	Desmodium gangeticum DC.	Fabaceae	Ca.chi.1/4-6 ⁵⁷
26)VACHA	Acorus calamus Linn.	Araceae	Ca.chi.1/4-6 ⁵⁸
27)MEDA	Polygonatum verticillatum Royle.	Liliaceae	Ca.chi.1/4-6 ⁵⁹
28)MAHAMEDA	Polygonatum cirrhifolium Royle.	Liliaceae	Ca.chi.1/4-6 ⁶⁰
29)PAYASYA	Roscoca procera Wall.	Liliaceae	Ca.chi.1/4-6 ⁶¹

EVIDENCE BODY

Some evidences which reaffirms that *Rasayana* herbs have antioxidant activity, are given below.

1. Triphala:- (combination of fruits of *Terminalia belerica*, *Terminalia chebula* & *Emblica officinalis*)

When *triphala* was tested for superoxide radical scavenging activity using xanthine and xanthine oxidase assay, it was observed that in addition to reacting with superoxide radical, it also inhibited uric acid formation, indicative of xanthine oxidase enzyme inhibitory activity.⁶²

Triphala was found to be effective in inhibiting γ -radiation induced damage in microsomal lipids and plasmid pBR322 DNA. The phytochemical analysis showed that triphala is rich in polyphenols (38 \pm 3%) and tannins (35 \pm 3%).Based on these studies it is proposed that triphala is an effective antioxidant, which can act as a good radioprotector.

2) *pippali*:- (*piper longum*)

When *pippali* (petroleum ether extract of root & piperine from root of *pippali*) was tested for their antioxidant activity by DPPH scavenging method and estimation of lipid peroxide & glutathione values in myocardial ischemic rat. It was observed that pet ether extract & piperine pretreatment decreases lipid peroxide level & maintain glutathione contain near normal in treated rats.⁶³

It has been found that at 50 mg mL⁻¹ concentration pet ether extract and piperine exerts 74.12 and 72.13% of inhibition. The present study shows that the extract of the root of the plant and piperine exert anti-oxidant activity and are protective in the myocardial ischemic condition

When study was carried out on effect of methanolic extract of fruits of *piper longum* (PLM) on the biochemical changes, tissue peroxidative damage & abnormal antioxidant levels in adriamycin (ADR) induced cardiotoxicity in wistar rats⁶⁴.

ADR administration showed significant decrease in the activities of marker enzymes aspartate transaminase, alanine transaminase, lactate dehydrogenase & creatine kinase in heart with a concomitant increase in their activities in serum. But a significant increase in lipid peroxide levels in heart of ADR treated rats was also observed. Pretreatment with PLM ameliorated the effect of ADR on lipid peroxide formation & restored activities of marker enzymes. Histopathological studies of heart revealed degenerative changes & cellular infiltrations in rats administered with ADR & pretreatment with PLM reduced the intensity of such lesions. The results indicate that PLM administration offers significant protection against ADR induced oxidative stress & reduces the cardiotoxicity by its antioxidant activity.

3) *BHALLATAK*:- (*Semicarpus anacardium*)

When aqueous extract of nuts of *semicarpus anacardium* was tested for antioxidant activity in AKR mouse liver during the development of lymphoma, by the activities of antioxidant enzymes catalase, superoxide dismutase and glutathione transferase, & also by observing the activity of LDH (lactate dehydrogenase) a tumour marker.⁶⁵

The activities of antioxidant enzymes decreased gradually as lymphoma developed but, LDH activity increased progressively. Administration of the aqueous extract of *S. anacardium* to lymphoma-transplanted mouse led to an increase in the activities of antioxidant enzymes & LDH activity decreased significantly, indicating a decrease in carcinogenesis. Based on these studies it is proposed that the aq. Extract of *s. anacardium* more effective than doxorubicin, a classical anticarcinogenic drug, by its action on antioxidant enzymes and LDH in the liver of mice with developing lymphomas.

The effect of *Semicarpus anacardium* Linn. nut extract (SA) on the level of Lipid Peroxides (LPO) and activities of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and reduced glutathione (GSH) in the lymphocytes and lymphoid organs of adjuvant induced arthritic rats and untreated arthritic rats, by measuring the levels of reactive oxygen species (ROS), in spleen, thymus, and lymphocytes of control and experimental animals & also evaluate Anti-arthritic profile from the changes in the paw edema and arthritic scores of arthritic and drug-treated rats.⁶⁶

A significant increase in the level of LPO, ROS and decreased levels of antioxidant enzymes in arthritic rats were observed. On treatment with the drug. The increment in CRP level and ESR observed in arthritic animals were found to be significantly restored in SA treated rats. *Semicarpus anacardium* Linn. nut extract significantly decreased the paw edema and arthritic score in arthritic rats by their antioxidant activity, but in untreated arthritic rats, there was a significant edema in the hind paw.

4) *VIDANG*:- (*Embelia ribes*)

When Aq.extract of vidang tested for significant blood glucose and blood pressure lowering potential & increased endogenous antioxidant defense against free radicals produced under hyperglycaemic conditions& methionine-induced hyperhomocysteinemia and oxidative stress in brain⁶⁷.

Aqueous *E. ribes* extract (100 mg/kg) pretreatment orally for 40 days in isoproterenol (ISO)-treated rats significantly decreased the heart rate,systolic blood pressure, increased levels of serum lactate dehydrogenase, serum creatine kinase and myocardial lipid peroxides and significantly increased the myocardial endogenous antioxidants (glutathione, superoxide dismutase and catalase) levels. Thus *E. ribes* extract pretreatment improved myocardial injury and enhanced the antioxidant defense against ISO-induced myocardial infarction in rats and exhibited cardioprotective property (Bhandari et al., 2008). Chronic treatment with ethanolic *E. ribes* extract enhanced the antioxidant defense against MCAO- induced focal cerebral ischemia in rats and exhibited neuroprotective activity .

5)YASTIMADHU:- (*Glycyrrhiza glabra*)

This study was undertaken to explore the free radical scavenging, antimicrobial and cytotoxic activity of the methanolic extract of *Glycyrrhiza glabra* (*Fabaceae*) using DPPH, disc diffusion and brine shrimp lethality bioassay methods⁶⁸.

Different degrees of effect was noticed in case of different methods of study. The extract possessed potent cytotoxic activity having LC 50 value of 0.771µg/ml. On the other hand, the free radical scavenging activity was found moderate having IC 50 value of 87.152 µg/ml.

6)BRAMHI:- (*Bacopa monniera*)

When methanolic extract of *Bacopa monniera* was tested for in vitro antioxidant properties and total phenolic content using three in vitro models by Nitric oxide scavenging activity, DPPH free radical scavenging assay⁶⁹.

Reducing power activity was also concentration dependant with IC50 value being 455.78±1.03µg/ml,104.82±1.96µg/ml and 96.13±0.86µg/ml respectively. The total phenolic content was found out to be 27.76±1.87mg/gm GAE.based on these studies it is proposed that brahmi is an effective antioxidant

7) SHATAVARI:- (*Asparagus racemosus*)

when crude extract and a purified aqueous fraction of *Asparagus racemosus* tested against membrane damage induced by the free radicals generated during gamma radiation induced lipid peroxidation as assessed by the formation of thiobarbituric acid reactive substances(TBRS)&lipid hydroperoxides(LOOH)⁷⁰. An active fraction consisting of polysaccharides (termed as P3) was effective even at a low concentration of 10 microg/ml. Both the crude extract as well as the P3 fraction significantly inhibited lipid peroxidation and protein oxidation. The antioxidant effect of P3 fraction was more pronounced against lipid peroxidation,as assessed by TBARS formation, while that of the crude extract was more effective in inhibiting protein oxidation. Both the crude against radiation-induced loss of protein thiols an inactivation of superoxide dismutase. The inhibitory effects of these active principles, at the concentration of 10 microg/ml, are comparable to that of the established antioxidants glutathione and ascorbic acid. Hence the results indicate that extracts from *A. racemosus* have potent antioxidant properties in vitro in mitochondrial membranes of rat liver.

8)GUDUCHI:- (*Tinospora cordifolia*)

when Dried and powdered leaves of *T. cordifolia* were tested for its antioxidant activity extracted with hexane, chloroform, methanol, ethanol and water. Total phenolic and flavonoid contents of different solvent extracts were determined. Of the different solvent extracts, ethanol extract had the highest phenol and flavonoid content of 5.1 ± 0.25 mg/g and 0.52 ± 0.02 mg/g respectively. Antioxidant assays were carried out by using different in vitro models such as total reducing power, total antioxidant activity, lipid peroxidation inhibitory activity, DPPH radical scavenging activity and superoxide radical scavenging activity⁷¹.

Ethanol extract showed the highest total antioxidant activity of 41.4 ± 0.45 μ M Fe(II)/g. The EC₅₀ values of ethanol extract for lipid peroxidation inhibitory activity and DPPH radical scavenging activity was found to be 0.1 and 0.5 mg/ml respectively. The anti-oxidant activities of other solvent extracts were poor when compared to the ethanol extract. These results suggest that, the active antioxidant compounds are better extracted in ethanol and there is a direct correlation between the total polyphenols extracted and its anti-oxidant activity. The in vitro anti-oxidant activity of *T. cordifolia* justifies the ethno medical use of this plant. When *Tinospora cordifolia* stem methanolic extract was tested for its in vitro antioxidant activity in 3 models viz. DPPH (1,1 - diphenyl -2 - picryl hydrazyl)

free radical screening activity, superoxide radical scavenging activity and reducing power assay⁷².

The total phenolic & total tannins were quantitatively estimated in stem parts of guduchi in 7.2 % w/w and 8.7 % w/w present respectively. The greater amount of phenolic and tannins compounds are present in methanolic extract of guduchi stem shows more powerful free radical scavenging effect .

9) NAGBALA:- (*Grewia hirsuta*)

The study was designed to scientifically evaluate the cardioprotective potential of the ethanol extract of *Grewia hirsuta* (GH) on Doxorubicin (DOX) induced cardiotoxicity, in albino rats by oxidative stress and cardiomyocyte cell death.⁷³

Effect of GH oral treatment for 14 days at two doses (250 mg and 500 mg/kg body weight) was evaluated against DOX induced cardiotoxicity. The pretreatment of DOX- induced rats with BA significantly prevented the altered biochemical variation such as marker enzymes (SGGH, SGOT, CPK, ALP and LDH), lipid profile (LDL, VLDL, TGs, HDL and Total cholesterol), and antioxidant parameters (SOD, GSH, CAT, GPx, MDA, and GR) to near normal status also Serum urea, and uric acid which increased on DOX administration, registered near normal values . Histology of Dox-induced heart of rats pretreated with GH showed a significant recovery from cell damage. on the present study it has been proposed that the antioxidant activity of GH have cardioprotective effects in DOX-induced oxidative damage may and also inhibition of lipid peroxidation of cell membrane.

10) MANDUKPARNI:- (*Centella asiatica*)

This study was carried out for finding Antioxidative activity and total phenolic compounds of root, leaf and petiole extract of four accessions of *Centella asiatica* (L.) Urban, namely CA 01, CA 05, CA 08 and CA 11, was measured using the ferric thiocyanate (FTC) method and thiobarbituric acid (TBA) test & then compared with that of α -tocopherol (natural antioxidant) and butylated hydroxytoluene or BHT (synthetic antioxidant)⁷⁴.

The results showed that CA 01 and CA 05 had the highest antioxidative activities among the accessions tested & both leaf and root of *C. asiatica* had high antioxidative activity, which was as good as that of α -tocopherol. The total phenolic content, determined according to the Folin-Ciocalteu method, varied from 3.23 to 11.7 g/100 g dry sample, and showed strong association ($r^2=0.90$) with antioxidative activity. The results suggest that phenolic compounds are the major contributors to the antioxidative activities of *C. asiatica*. # 2003 Elsevier Science Ltd. All rights reserved.

11)APARAJITA:- (*Clethra ternatea*)

In this study the potential antioxidant activity of *C. ternatea* extracts as measured by DPPH scavenging activity and an extract containing eye gel formulation was investigated⁷⁵.

Aqueous extracts were shown to have stronger antioxidant activity (as measured by DPPH scavenging activity) than ethanol extracts (IC₅₀ values were 1 mg/mL and 4 mg/mL, respectively). Aqueous extracts incorporated in to an eye gel formulation were also shown to retain this activity, however, it was significantly less than a commercial antiwrinkle cream included for comparison. The total phenolic content was 1.9 mg/g extract as gallic acid equivalents. The data from this study support the use of *C. ternatea* extracts as antioxidant inclusions in cosmetic products

12)BALA:- (*Sida cordifolia*)

This study was carried out to find out the comparative antioxidant potential of ethanol extracts of *Sida cordifolia*. leaf, stem, root, and whole plant by anti-lipid peroxidation, free-radical scavenging, reducing power, nitric oxide scavenging, superoxide scavenging antioxidant assay, and further estimation of total phenolic content and HPTLC studies were carried out. Various antioxidant activities were compared with standard antioxidants such as BHA, α -tocopherol, and ascorbic acid⁷⁶.

Ethanol extracts were found to be a good scavenger of DPPH radical in the order roots > stem > leaves > whole plant with values 76.62%, 63.87%, 58% and 29% at a dose of 1 mg, respectively. All extracts of *Sida cordifolia*. (SC) have effective reducing power and free-radical scavenging activity. Only the root extract exhibited superoxide-scavenging activity and inhibited lipid peroxidation in rat liver homogenate. The highest antioxidant activity was observed in the root extract. The results obtained in the current study indicate that *S. cordifolia*. is a potential source of natural antioxidants.

13)ATIBALA:-(*Abutilon indicum*)

When organic solvent extract of atibala was tested for presence of antioxidant activity from the aerial parts and roots of atibala evaluated for their total antioxidant capacity (TAC), total phenolic content, and total flavonoid content. The Trolox equivalent antioxidant capacity (TEAC) of the extracts was found, employing ABTS and FRAP assays⁷⁷.

TEAC values ranged from 3.019 to 10.5 μ M for *n*-hexane and butanol fractions of *Abutilon indicum* respectively, using the ABTS assay. The FRAP assay showed reducing powers of the fractions in the order of butanol > ethyl acetate > chloroform > *n*-hexane and butanol > chloroform > hexane > ethyl acetate for *Abutilon indicum*. EC₅₀ and T_{EC50} values were determined using the DPPH free radical assay. The antioxidant/radical scavenging capacity of the extracts was found to be a dose-dependent activity. The results obtained in the present study indicate *Abutilon indicum* are potential source of natural antioxidants.

14)BAKUCHI:- (*Psoralea corylifolia*)

The antioxidant properties of aqueous and solvent extract of seeds of *Psoralea corylifolia* L. were evaluated *in vitro* employing different standard assays⁷⁸.

All the extracts tested were effective in quenching superoxide anion. Maximum superoxide scavenging activity was observed in the alcohol and water (1:1) extract(AWEP) at 200 μ g/ml. Lipid peroxidation was assessed by production of thiobarbituric acid reactive substances(TBARS) in RBC membrane and highest antioxidant activity (71.0 Percent) was observed in the alcohol waterextract at 50 μ g/ml. Maximum hydroxyl radical scavenging activity of 87.0 Percent was observed at 20 μ g/ml. Similarly maximum 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity of 89.0 percent was observed at 25 μ g/ml in alcohol water extract when compared with standard tocopherol and BHA. The results suggest strong antioxidant potential

of alcohol and water (1:1) extract of seeds of *P. corylifolia* that could play an important role in the modulation of oxidative stress.

15)CHITRAK:- (*Plumbago zeylanica*)

The isolation and spectral data for new flavonoid 2-(2, 4-Dihydroxy-phenyl)-3, 6, 8-trihydroxy-chromen-4-one from the roots of *Plumbago zeylanica* were determined and the antioxidant activity were studied by free radical scavenging and superoxideradical scavenging assays⁷⁹.

The antioxidant activity by DPPH is 96µg/ml and by NBT is 4.6µg/ml which grater than that of standard(Quercetin) 45 µg/ml by DPPH and 10µg/ml by NBT assay. The phytochemical investigation showed presence of flavonoids, tannins and saponins. The total phenolic and total flavonoid content was found to be 260±48.0 and 45.5±5.2 mg of GAE/g and CE/g respectively. From this study it was cleared that the chittrak root have effective antioxidant property .

16)BILVA:-(*Aegle marmelos*)

When *Aegle marmelos* fruit pulp was tested for antioxidant potentials and phytochemical nature by using standard methods⁸⁰.

Results of Phytochemical screening of the aqueous extract revealed the presence of steroid, terpinoids, saponins, tannis, lignin, flavonoids. Alcoholic extract showed the availability of alkaloids and devoid of saponin. *In vitro* antioxidant activity of the plant extract revealed that both the extracts showed good antioxidant power with IC50 value ranges for 37.11±3.50 to 158.99±59.46 µg/ml for aqueous extract and 35.02±8.10 to 283.06 ± 135.80µg/ml for alcoholic extract.

DISCUSSION:-

Around 29 herbs are described to have *Rasayana* effect. Out of these, 16 plants have been worked upon by various researchers to show anti-oxidant activity. Therefore, it is logical to suggest the rest 13 plants are likely to have anti oxidant activity.

Unlike chemically identified anti-oxidants, these plants are effective in multiples scavenging axes. Therefore, they can be used in multiple clinical conditions depending upon the acumen of the physician.

CONCLUSION

This review article aims to suggest a list of herbs which are *Rasayana* and on which research Should be carried out for anti-oxidant activity and followed by suitable clinical trial.

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