



CRITICAL ANALYSIS OF RASAYANA ACTIVITY OF DRAVYAS IN AYURVEDA

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ABSTRACT

Rasayana therapy is a wonderful treatment procedure of *Ayurveda*. A person can live healthy and happy long life by the proper use of *Rasayana* therapy. Science of Rejuvenation deals with guidelines which enable a man to retain his youthful strength up to old age and which generally serve to make the human systems invulnerable to disease and decay. This paper enlightens the details of *Rasayana* in the light of basic theories of *Ayurveda* with thorough discussions on many informative points which are sourced from modern medical knowledge in research point of view. Classification of *Rasayana*, importance of code of conduct, contraindications of *Rasayana* therapy, potential *Rasayana* functions are discussed in detail. An attempt has been made to explain the relationship of *Rasayana* with body and natural process of ageing.

While explaining the *Rasayana* action of a drug, the role and importance of metabolic factors and its different stages of absorption, its pathways and metabolic transformations, disequilibrium and the process of waste eliminations are tried to link appropriately. Anti-ageing as one of the focal areas of *Rasayana*, the discussion on controlling the biological clock of ageing through *Rasayana* opens up new areas for research. Paper also tried to explain important concept of longevity, Immunity and *Rasayana*. This paper is an effort to understand the action of drugs and modalities which we adapt for *Rasayana* therapy. The mechanism of action of *Rasayana* drugs are explained in the terms of Antioxidant property, Immunomodulatory property, Adaptogenic activity, Cell proliferation, Tissue protection and regeneration activity, Intellect promotion and stress relieving activity, Bactericidal and antimicrobial activity along with cardio tonic effect of *Rasayana* drugs.

KEYWORDS: *Rasayana*, *Dhatu*, Rejuvenation, Anti-ageing, Antioxidants.

INTRODUCTION

Rasayana therapy is a wonderful treatment procedure of *Ayurveda*. A person can live healthy and happy long life by the proper use of *Rasayana* therapy. Ayurvedic physicians had developed certain dietary and therapeutic measures to delay ageing and rejuvenating whole functional dynamics of the body system. *Rasayana tantra* represents the basic approach of *Ayurveda* which comprises preventive promotive and curative aspects of health and carries the most practical methods for management of health and disease through its measures as the *Rasayana chikitsa*.^[1]

Rasayana therapy is not a simple drug therapy but is a specialized therapeutic procedure involving the fundamental concept of *Ayurveda*. This revitalization and rejuvenation are known as the '*Rasayana chikitsa*' (Rejuvenation therapy). *Rasayana* therapy of *Ayurveda* is a dedicated stream of medication for immune promotive,

antidegenerative and rejuvenative health care and is known for preventing the effects of ageing and improving the quality of life of healthy as well as diseased individuals. Science of Rejuvenation deals with guidelines which enable a man to retain his youthful strength up to old age and which generally serve to make the human systems invulnerable to disease and decay.

Describing the effects of *Rasayana*, the classical texts of *Ayurveda* say that from *Rasayana* one attains longevity, improved harmony and intelligence, freedom from disorder, youthful vigor, excellence of luster, complexion and voice, optimum strength of physique and senses, command over language, respectability and brilliance. Rejuvenation therapy has unbelievable and wonderful effects. It promotes life, maintains positive health, and preserves youth and cure sleep problems, drowsiness, physical as well as mental fatigue, laziness and weakness. It maintains proper balance amongst

tridoshas. It produces stability, cures stiffness of muscles, stimulation of muscles, stimulate digestion and metabolism. Persons desirous of attaining long life, vitality and happiness can practice rejuvenation therapy with complete devotion according to the prescribed procedures. Numerous single and compound *Rasayana* medicines possessing diversified actions like immuno-enhancement, free-radical scavenging, adaptogenic or anti-stress and nutritive effects are described in *Ayurvedic* literature for their use in health promotion and management of diseases with improvement in the quality of life.

The classification to consider treatment for ageing (*Jara chikitsa*) as synonymous with *Rasayana-chikitsa* (*Rasayana* treatment) as one of the eight branches of Ayurveda is not only to specialize certain methods in any particular knowledge domain of the Ayurvedic system but as a process by which the body tissues attain its best capacity to perform their systemic activities.^[2] The concept of *Rasayana-chikitsa* as a branch has its own importance not only in the old age but need to be commenced in the early stage.^[3] As one the eight branches of Ayurveda, *Rasayana-chikitsa* is applicable in all branches of Ayurveda irrespective of any particular domain of knowledge and it has great relevance as a procedure to attain and maintain good health.

METHODOLOGY

Information collected from various *Ayurvedic* literatures and published articles, from few review articles and cross-references were collected. Published materials on recent research reports on *Rasayana* including original articles in Pubmed, Google Scholar, Pubmed Central Databases, Dhara online database and other allied databases were studied for the review. The search was conducted using keywords like *Rasayana*, Dhatu, Ayurveda, Rejuvenation, Antiaging, Antioxidants, Herbal tonics, Herbal supplements, Nootropic, Immunomodulatory herbs, Adaptogenic herbs etc; with their corresponding Mesh terms in combination like OR, AND.

Classification of rasayana

1) According to mode of action or administration of *Rasayana*

a) *Kutipraveshika Rasayana*

In this form of *Rasayana* the person is made to stay in a specially designed chamber for a certain period and is given *Rasayana* preparations.

b) *Vatatapika Rasayana*

In this form the person can carry out his normal work and still undergo *Rasayana* therapy.

c) *Droni Praveshika Rasayana*

This is a special type of *Rasayana* administered in a very spectacular manner, where a person is made to consume stomach full of the juice of divine herbs and made to lie down unconsciously in a wooden casket for a period of six

months. Although many textual references can be found regarding this procedure as being one that will enable an old person to completely regain his youth, but this has no known history of being performed anywhere in the near past.

2) According to purpose of administration

a) *Kamya Rasayana*- These are promoter of normal health. They boast body energy levels, immunity and general health hence the *Rasayana*. These are of 3 types

➤ *Pranakamya*- Promoter of vitality and longevity.

➤ *Medhakamya*- Promoter of intelligence.

➤ *Srikamya*- Promoter of complexion.

b) *Naimittik Rasayana* - Means things listed for a short and specific period, used for treating disease.

c) *Aajasrika Rasayana*- Is using food substances on regular basis for nourishment of body.

3) According to mode of Action

a) *Samsodhan Rasayana* b) *Samashaman Rasayana*

4) *Aachara Rasayana*: This means how the person should behave while moving in the society.

5) According to Age

Table 1: Classification of *Rasayana* as per Specific preventive action in specific age group.

Sr. No	Age group in years	Desired Effect	<i>Rasayana</i> drugs
1	1-10	<i>Balya</i> (Cessation of childhood)	<i>Vacha</i> (<i>Acorus calamus</i>), <i>Swarna Bhasma</i> (gold calx)
2	11-20	<i>Vridhhi</i> (Growth decreases)	<i>Ashwagandha</i> (<i>Withania somnifera</i>), <i>Bala</i> (<i>Sida cordifolia</i>), <i>Kashmari</i> (<i>Gmelina arborea</i>)
3	21-30	<i>Chavi</i> (glow decreases)	<i>Amalaki</i> (<i>Emblica officinalis</i>) <i>Loha</i> (iron calx)
4	31-40	<i>Medha</i> (memory decreases)	<i>Shankhapushpi</i> (<i>Convolvulus microphyllus</i>), <i>Jyotishmati</i> (<i>Celastrus paniculatus</i>) <i>Vacha</i> (<i>Acorus calamus</i>), <i>Bramhi</i> (<i>Bacopa monneri</i>), <i>Swarna Bhasma</i> (gold calx)
5	41-50	<i>Tvak</i> (Skin lustre decreases so intended for sustaining health of skin)	<i>Bhringraja</i> (<i>Eclipta alba</i>), <i>Jyotishmati</i> , <i>Triphala</i> (three myrobalans), <i>Shatavari</i> , <i>Priyal</i>
6	51-60	<i>Drishti</i> (eyesight decreases, care of vision)	<i>Jyotishmati</i> (<i>Celastrus paniculatus</i>), <i>Triphala</i> (three myrobalans), <i>Shatavari</i> (<i>Asparagus racemosus</i>)
7	61-70	<i>Shukra</i> (seminal secretion decreases, libido)	<i>Atmagupta</i> (<i>Mucuna prurita</i>) <i>Pippali</i> (<i>Piper longum</i>)
8	71-80	<i>Vikrama</i> (loss of vigour and physical strength)	<i>Rasayana</i> may not be effective
9	81-90	<i>Buddhi</i> (intelligence decreases)	
10	91-100	<i>Karmedriya</i> (Locomotor power & activity decreases)	

6) According to *Deha Prakruti*

- a) *Vata Prakruti*- *Bala*, *Ashwagnagha*, *Guduchi*, *Shankhapushpi*, Ghee, Milk, Gold.
b) *Pitta Prakruti*- *Shatavari*, *Amalaki*, *Brahmi*, *Chyavanprash*, Milk, Ghee, Silver.
c) *Kapha Prakruti*- *Vacha*, *Bakuchi*, *Brahma Rasayan*, *Haritaki*, *Triphala*, Honey.

7) According to *Ritu Saatmya*

- a) *Aadankala*- *Sitavirya* and *Laghu guna Dravya* (*Amalaki*).
b) *Visarga Kala*- *Ushnavirya*, *Guru guna dravya* (*Bhallatak*).

Table 2: Ayurvedic *Rasayana* activities, their contemporary medical terms & established drugs.

Sr. No	<i>Rasayana</i> activity	Contemporary term	Indicated <i>Rasayana Dravya</i>
1	<i>Dheerghayu</i>	Longevity	<i>Amalaki</i> (<i>Emblica officinalis</i>)
2	<i>Smritivardhana</i>	Memory enhancer	<i>Mandookaparni</i> (<i>Centella asiatica</i>)
3	<i>Medhya</i>	Nootropics, Mood elevators, Anti-stress	<i>Brahmi</i> (<i>Bacopa monneri</i>), <i>Shankhapushpi</i> (<i>Convolvulus microphyllus</i>)
4	<i>Tarunyakara</i>	Youthfulness enhancer	<i>Guduchi</i> (<i>Tinospora cordifolia</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>)
5	<i>Prabha varna kara</i>	Skin glow, complexion improviser	<i>Jyotishmati</i> (<i>Celastrus paniculatus</i>), <i>Yashtimadhu</i> (<i>Glycyrrhiza glabra</i>)
6	<i>Swarya</i>	Quality of voice improver	<i>Vacha</i> (<i>Acorus calamus</i>), <i>Yashtimadhu</i> (<i>Glycyrrhiza glabra</i>)
7	<i>Dehendriyabala, Swastha oorjaskara, Arogya vardhana</i>	Nervine tonic, Immuno-modulator, Antioxidant, Adoptogenic, Cytoprotective	<i>Guduchi</i> (<i>Tinospora cordifolia</i>), <i>Ashwaganda</i> (<i>Withania somnifera</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>)
8	<i>Balya</i>	Strength promoters	<i>Bala</i> (<i>Sida cordifolia</i>)
9	<i>Jeevaneeya</i>	General tonic	<i>Jeevanti</i> (<i>Leptadenia reticulata</i>), <i>Yashtimadhu</i> (<i>Glycyrrhiza glabra</i>)
10	<i>Bramhaneeya</i>	Anabolic, Tissue regenerative	<i>Shatavari</i> (<i>Asparagus racemosus</i>)
11	<i>Vayasthapana</i>	Anti-aging	<i>Amalaki</i> (<i>Emblica officinalis</i>)
12	<i>Vrushya</i>	Aphrodisiac	<i>Ashwagandha</i> (<i>Withania somnifera</i>), <i>Kapikacchu</i> (<i>Mucuna prurita</i>)
13	<i>Kanti vardhana</i>	Excellence of luster	<i>Bhringaraja</i> (<i>Eclipta alba</i>), <i>Jyotishmati</i> (<i>Celastrus paniculatus</i>)

Table 3: Dhatu (body tissue) specific promotive Rasayana.

Sr. No	Dhatu	Rasayana
1	Rasa	<i>Draksha</i> (<i>Vitis vinifera</i>), <i>Shatavari</i> (<i>Asparagus racemosus</i>), <i>Kashmari</i> (<i>Gmelina arborea</i>), <i>Ksheer</i> (milk)
2	Rakta	<i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Bhringaraja</i> (<i>Eclipta alba</i>), <i>Svarnamakshika Bhasma</i> (copper pyrite)
3	Mansa	<i>Ashwagandha</i> (<i>Withania somnifera</i>), <i>Bala</i> (<i>Sida cordifolia</i>), <i>Rajat Bhasma</i> (silver calx)
4	Meda	<i>Guggulu</i> (<i>Commiphora wightii</i>), <i>Shilajit</i> (<i>Asphaltum punjabinum</i>), <i>Haritaki</i> (<i>Terminalia chebula</i>), <i>Guduchi</i> (<i>Tinospora cordifolia</i>)
5	Asthi	<i>Vanshalochana</i> (Bamboo silica)
6	Majja	<i>Shankhapushpi</i> (<i>Convolvulus microphyllus</i>), <i>Loha Bhasma</i> (iron calx), <i>Swarna Bhasma</i> (gold calx)
7	Shukra	<i>Kapikacchu</i> (<i>Mucuna prurita</i>), <i>Vidarikanda</i> (<i>Pueraria tuberosa</i>), <i>Shatavari</i> (<i>Asparagus racemosus</i>), <i>Ashwagandha</i> (<i>Withania somnifera</i>), <i>Swarna Bhasma</i> (gold calx)

Table 4: Rasayana for specific Prakriti.

Sr.No	Prakriti	Single drug
1	Vata	<i>Taila</i> (Sesame oil), <i>Bala</i> (<i>Sida cordifolia</i>), <i>Ashwagandha</i> (<i>Withania somnifera</i>)
2	Pitta	<i>Goghrita</i> (Cow ghee), <i>Goksheera</i> (Cow milk), <i>Shatavari</i> (<i>Asparagus racemosus</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Guduchi</i> (<i>Tinospora cordifolia</i>)
3	Kapha	<i>Madhu</i> (Honey), <i>Bhallataka</i> (<i>Semecarpus anacardium</i>), <i>Guggulu</i> (<i>Commiphora wightii</i>), <i>Pippali</i> (<i>Piper longum</i>)

Table 5: Rasayana as per therapeutic requirement.

Sr.No	Therapeutic requirement	Indicated Rasayana
1	<i>Agni Vardhaka</i> (Strengthening digestive fire)	<i>Pippali</i> (<i>Piper longum</i>), <i>Chitraka</i> (<i>Plumbago zeylanica</i>), <i>Vidanga</i> (<i>Embelia ribes</i>)
2	<i>Srothas Shodhana</i> (Cleansing channels)	<i>Pippali</i> (<i>Piper longum</i>), <i>Guggulu</i> (<i>Commiphora wightii</i>), <i>Bhallataka</i> (<i>Semecarpus anacardium</i>), <i>Kasturi</i> (Musk)
3	<i>Rasa Dhathu Vardhaka</i> (Increasing lymph)	<i>Kshira</i> (Milk), <i>Draksha</i> (<i>Vitis vinifera</i>), <i>Kashmari</i> (<i>Gmelina arborea</i>)

Table 6: Rasayana as per seasons and place.

Sr. No	Ritu-Kala (Seasons)	Rasayana drugs
1	<i>Adana Kala</i> (Exhausting i.e. February-July)	<i>Shita Virya</i> and <i>Laghu Guna</i> (<i>Amalaki</i>)
2	<i>Visarga Kala</i> (Replenishing i.e. August January)	<i>Ushna Virya</i> and <i>Laghu Guna</i> (<i>Pippali</i> , <i>Bhallataka</i>)
	Desha (place)	Rasayana drugs
1	<i>Sadharana</i> (General)	<i>Guduchi</i> (<i>Tinospora cordifolia</i>)
2	<i>Jangala</i> (Arid)	<i>Ashwagandha</i> (<i>Withania somnifera</i>)
3	<i>Anupa</i> (Wet)	<i>Pippali</i> (<i>Piper longum</i>)

Table 7: Organ - System specific curative Rasayana.

Sr.No	Organ or System	Single drug as Rasayana	Compound formulation
1	Brain	<i>Brahmi</i> (<i>Bacopa monnieri</i>), <i>Mandookaparni</i> (<i>Centella asiatica</i>), <i>Guduchi</i> (<i>Tinospora cordifolia</i>), <i>Yashtimadhu</i> (<i>Glycyrrhiza glabra</i>), <i>Shankapushpi</i> (<i>Convolvulus microphyllus</i>)	<i>Kushmanda Rasayana</i> , <i>Medhya Rasayana</i>
2	Heart	<i>Arjuna</i> (<i>Terminalia arjuna</i>), <i>Shalaparni</i> (<i>Desmodium gangeticum</i>), <i>Pushkaramoola</i> (<i>Inula racemosa</i>), <i>Guggulu</i> (<i>Commiphora wightii</i>)	<i>Arjuna ksheerapaka Chandraprabhavati</i>
3	Lungs	<i>Bharangi</i> (<i>Clerodendrum serratum</i>), <i>Vasa</i> (<i>Adhatoda zeylanica</i>), <i>Rasona</i> (<i>Allium sativum</i>)	<i>Agastya Rasayana</i> , <i>Chyavana prasha</i>
4	Liver and spleen	<i>Katuki</i> (<i>Picrorhiza kurroa</i>), <i>Pippali</i> (<i>Piper longum</i>), <i>Bhringaraja</i> (<i>Eclipta alba</i>)	<i>Loha Rasayana</i>
5	Skin	<i>Tuvaraka</i> (<i>Hydnocarpus laurifolia</i>), <i>Chandana</i> (<i>Santalum album</i>), <i>Haridra</i> (<i>Curcuma longa</i>), <i>Manjistha</i> (<i>Rubia cordifolia</i>)	<i>Gandhaka Rasayana</i> , <i>Triphala Rasayana</i>
6	Eye	<i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Yashtimadhu</i> (<i>Glycyrrhiza glabra</i>), <i>Triphala</i> (three myrobalans)	<i>Triphala Ghrita</i> , <i>Jeevantyadi Ghrita</i> , <i>Amalaki Rasayana</i>
7	Ear	<i>Sariva</i> (<i>Hemidesmus indicus</i>)	<i>Karna purana</i> with <i>Sarshapa</i> and <i>Tila taila</i>
8	Nose	-	<i>Anu taila PratimarshaNasya</i>
9	Female reproductive system	<i>Shatavari</i> (<i>Asparagus racemosus</i>), <i>Ashoka</i> (<i>Saraca asoka</i>), <i>Kumari</i> (<i>Aloe vera</i>)	<i>Phala ghrita</i>
10	Male reproductive system	<i>Ashwagandha</i> (<i>Withania somnifera</i>), <i>Kapikacchu</i> (<i>Mucuna prurita</i>), <i>Gokshura</i> (<i>Tribulus terrestris</i>)	<i>Ashwagandha Rasayana</i>
11	GIT	<i>Pippali</i> (<i>Piper longum</i>), <i>Haritaki</i> (<i>Terminalia chebula</i>)	<i>Pippali Vardhamana Rasayana</i> , <i>Bhallataka Rasayana</i>
12	Urinary system	<i>Gokshura</i> (<i>Tribulus terrestris</i>), <i>Punarnava</i> (<i>Boerhaavia diffusa</i>)	<i>Chandraprabha vati</i>
13	Nervous system	<i>Rasona</i> (<i>Allium sativum</i>), <i>Guggulu</i> (<i>Commiphora wightii</i>), <i>Bala</i> (<i>Sida cordifolia</i>), <i>Nagabala</i> (<i>Grewia hirsuta</i>)	<i>Bruhat vata chintamani</i>
14	Endocrine system	<i>Shilajat</i> (<i>Asphaltum punjabinum</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Haridra</i> (<i>Curcuma longa</i>), <i>Guggulu</i> (<i>Commiphora wightii</i>), <i>Haritaki</i> (<i>Terminalia chebula</i>)	<i>Shilajatu Rasayana</i>

Table 8: *Rasayana* as per source of drugs.

Sr. No	Herbal origin	Herbo-mineral origin	Mineral origin
1	<i>Guduchi</i> (Tinospora cordifolia), <i>Mandookaparni</i> (Centella asiatica), <i>Shankapushpi</i> (Convolvulus microphyllus), <i>Haritaki</i> (Terminalia chebula), <i>Amalaki</i> (Emblica officinalis)	<i>Chandraprabha</i> <i>Brahma Rasayana</i>	<i>Swarna</i> , <i>Shilajatu</i> , <i>Abhraka (Satva)</i> , <i>Swarna makshika</i> , <i>Gandhaka</i> , <i>Lauha</i> , <i>Hiraka</i>

Table 9: *Rasayana* as per their reported biological activities.

Sr. No	Reported activity	Mechanism of action	Indicated <i>Rasayana</i>
1	Free Radical Scavenging / antioxidant activities	Enzymes such as superoxide dismutase, glutathione peroxidase, glutathione reductase, and catalase have been used to assess the antioxidant action	<i>Ashwagandha</i> (Withania somnifera), <i>Aamalaki</i> (Phyllanthus embelica) <i>Durva</i> (Cynodon dactylon)
2	Immunomodulatory activity	Humoral as well as cellular mechanisms, regulators of the immune system, such as cytokines, percentage neutrophil adhesion, phagocytic activity, and Th1/Th2	<i>Akarkara</i> (Anacyclus pyrethrum), <i>Shatavari</i> (Asparagus racemosus), <i>Ashwagandha</i> (Withania Somnifera), <i>Shweta Musali</i> (Chlorophytum borivilianum), <i>Brahma Rasayana</i> , <i>Aswagandha Rasayana</i>
3	Maintenance of Central Nervous System Function	Nootropic, Cognition enhancer, anti-amnesic, anti-depressant, neuroprotective, acetylcholinesterase inhibition	<i>Sankhapuspi</i> (Convolvulus pluricaulis) <i>Ashwagandha</i> (Withania somnifera), <i>Brahmi</i> (Bacopa monnieri Linn), <i>Mandukaparni</i> (Centella asiatica Linn), <i>Brahma Rasayana</i>
4	Radio-protective Effect	Free radicals scavenging, repairing of radiation injury, reduction of serum and liver lipid peroxides, ameliorate the oxidative damage	<i>Guduchi</i> (Tinospora Cordifolia), <i>Triphala</i> , <i>Brahma Rasayana</i>
5	Aphrodisiac activity	Testosterone-like effects, anabolic, anti-stress, tonic, revitalizing, rejuvenating	<i>Akarkara</i> (Anacyclus pyrethrum), <i>Shatavari</i> (Asparagus racemosus), <i>Shweta Musali</i> (Chlorophytum borivilianum), <i>Talmuli</i> (Curculigo orchioides), <i>Ashwagandha</i> (Withania Somnifera),
6	Anti-ulcer activity	Gastroduodenal lining protective, strengthening mucosal defence, increases mucin secretion, decreases cell shedding, anti-stress	<i>Shatavari</i> (Asparagus racemosus), <i>Brahmi</i> (Bacopa monnieri Linn), <i>Mandukaparni</i> (Centella asiatica Linn), <i>Yashtimadhu</i> (Glycerrhiza glabra), <i>Sankhapuspi</i> (Convolvulus pluricaulis)
7	Anti-giardial activity	Increased macrophage migration index (MMI) and phagocytic activity	<i>Pippali rasayana</i> - (prepared from <i>Pippali</i> (Piper longum) and <i>Palash</i> (Butea monosperma)
8	Anti-cancer Property	Antimetastatic, immune stimulating, activate macrophages, antibody - dependent complement-mediated tumour cell lysis, natural killer cell activity, cytoprotective	<i>Ashwagandha</i> (Withania Somnifera), <i>Guduchi</i> (Tinospora Cordifolia), <i>Aamalaki</i> (Emblica officinalis), <i>Brahma Rasayana</i> , <i>Aswagandha Rasayana</i> , <i>Narasimha Rasayana</i> , <i>Amrithaprasha</i> and <i>Chyavanaprasha</i>

RESULT AND DISCUSSION

Mechanism of action of *Rasayana*-

Rasayana promotes nutrition by direct enrichment of the nutritional quality of *rasa* means nutritional blood, by promoting nutrition through improving *agni* means digestion, metabolism and by promoting the competence of *srotas* means microcirculatory channels in body.^[4] It has been reported that the '*Rasayanas*' are rejuvenators, nutritional supplements and possess strong antioxidant activity. They also have antagonistic actions on the oxidative stressors, which give rise to the formation of different free radicals. They are used mainly in ageing, atherosclerosis, cancer, diabetes, rheumatoid arthritis, autoimmune and Parkinson's disease. Their anti-stress actions have made them therapeutically more important.^[5]

In order to investigate mechanism of action of the *Rasayana* i.e. *Tinospora cordifolia* studies are carried out on the proliferative fraction of the bone marrow of mice by flow cytometry and found that compared with normal mice, there was a significant increase in the proliferative fraction in the bone marrow in mice treated with the *Tinospora cordifolia*. Some *Rasayana* activate mononuclear cells to produce cytokines like GM-CSF and IL-1 in a dose dependent manner. These results indicate it is possible that the *Rasayana* (particularly those with *madhur vipaka* that are advocated as adaptogens in *Ayurveda*) primarily activate immune cells, leading to secretion of cytokines, which in turn act on multiple target organs to produce the innumerable effects

ascribed to these treatments.^[6]

Administration of herbal preparation, *rasayana* has been found to enhance the natural killer cell activity in normal as well as in tumor bearing animals. *Brahma rasayana* is found highly active. *Brahma rasayana* and *Aswagandha rasayana* were found to activate antibody dependent cytotoxicity significantly. *Aswagandha rasayana* also found to activate macrophages. *Rasayana* are also found to stimulate antibody dependent complement mediated tumour cell lysis.^[7]

The *Rasayana* herbs seem to exert their effect through immunosuppressant, immunostimulant and immunoadjuvant activities or by affecting the effector arm of the immune response. It has been found that the nervous, endocrine and immune systems are all interrelated. Immune products like various cytokines have been found to stimulate the hypothalamus-pituitary-adrenal axis and corticotrophin release factor (CRF), which ultimately enhances the production of adrenal corticotrophic hormone (ACTH) resulting into increased secretion of glucocorticoids which have an overall suppressive effect on the immune system.

Stress also acts on the same axis and brings about changes in the immune status of the body. These *rasayana* drugs probably reduce stress levels by affecting antioxidant levels. So, these *rasayana* drugs act as potent antioxidants and neuroendocrine immunomodulators.^[8]

Table 10: The list of contemporary terminologies used to study *Rasayana* drugs.

1	Antioxidant Action	6	Cell Proliferation & Regeneration
2	Immunomodulatory Action	7	Tissue Protection & Regeneration
3	Improving Immune Status	8	Intellect promotion (<i>Medhya</i>) & Stress relieving
4	Antiaging Action	9	Bactericidal & Anti-microbial
5	Adaptogen Activity	10	Cardio Tonic effect

Antioxidant Action

Rasayana drugs acts as Antioxidants. Antioxidants are substances that reduce oxidative damage such as that caused by free radicals. Free radicals are highly reactive chemicals that attack molecules by capturing the electrons and thus modifying chemical structures. Well known Antioxidants include a number of enzymes and other substances such as vitamin C, Vitamin E and beta carotene (which is converted to vitamin A) that are capable of counteracting the damaging effect of oxidation. Antioxidants are also commonly added to food products like vegetable oils and prepared foods.

Researches show that Antioxidants are useful for protection of heart disease. This is because oxidation plays a big role in formation atherosclerotic plaque which is a main pathological event in coronary heart disease. So, there is significant role of antioxidant in coronary heart disease. Antioxidants are having role in preventing diabetes mellitus also.

Antioxidant rich diet may prevent Diabetes. Taking Antioxidants rich food especially vitamin E, may lower risk of Type II DM. A new study shows that people whose diets had the highest levels vitamin E were 30% less likely to develop type II DM. In addition, researchers found that people who ate a lot of carotenoids, a type of antioxidant found in colourful fruits and vegetables, also had a lower risk of developing type II DM. Oxidative damage to cells is also important phenomenon in aging process. So, Antioxidants are also helpful in delaying aging. Antioxidants may possibly reduce the risk of cancer and age-related macular degeneration.

Plants have inbuilt mechanism to degenerate such oxidants. Several Ayurvedic herbs have been identified with antioxidant effect in the current review. Many *Rasayana* drugs like *Aamalaki*, *Ashwagandha* acts are Antioxidants. Main constituents of *Aamalaki* are vitamin C, carotene, and riboflavin. It is having a role in cellular oxidation reduction. They have also a role in collagen

fibrin synthesis, helps in formation of fibrin and absorption of iron. Withanolide in *Ashwagandha* also acts as Antioxidants by increasing levels of three natural Antioxidants like super oxide- dismutase, Catalase, Glutathione peroxidase. In a clinical study of 3 months duration *Guduchi* (*Tinospora cordifolia*) and *Asvagandha* (*Withania somnifera*) were found as antioxidants. *Guduchi* was found to be more effective natural antioxidant over others.^[9]

Brahmi (*Bacopa monniera*) known *Ayurvedic* drug for memory enhancing and for sedation also exhibited anti-lipid peroxidative property. For the first time the effect of alcohol and hexane fractions of Brahmi have been studied on lipid peroxidation induced by FeSO₄ and cumene hydroperoxide. Alcohol fraction showed greater protection with both inducers. Results were compared with known antioxidants tris, EDTA and a natural antioxidant vitamin E was also examined on hepatic glutathione content. *Brahmi* is found more potent antioxidant on comparison with other antioxidants used in the study. The mechanism of action could be through metal chelating at the initiation level and also as chain breaker. The authors of the work opined that *Brahmi* might serve as a medicine of aging and several nervous disorders because free radicals are involved in these pathologies.^[10]

1. Immunomodulatory Action

Immunity is accepted as *deha balam* (*vyadhiksamatva shakti*). However, immunity is complex biochemical and neuro-humoral activity still to understand completely. Several *rasayana* drugs are proved to influencing immunology schedules in the human body. *Rasayana* drugs also acts as immunomodulator. An immunomodulator is a drug used for its effect on the immune system. Clinical problems that require an evaluation of immunity include chronic infections, recurrent infection, unusual infecting agents and certain autoimmune syndromes. The type of clinical syndrome under evaluation can provide information regarding possible immune defects.

Certain *Rasayana* drugs act as Immunomodulator, strengthening of immunity is done in various ways – by promoting bodily defence mechanisms like increasing the WBC count, improving immune function. Bodily defence mechanism is promoted. Certain *Rasayana* drugs also increase number of immune cells known as T cells & B cells helping to fight infections.

A compound comprising *Punarnava* (*Boerhavia diffusa*), *Guduchi* (*Tinospora cordifolia*), *Daruharidra* (*Berberis aristata*), *Haritaki* (*Terminalia chebula*) and *Ardra* (*Zingiber officinale*) had a maximum cure rate of 73 percent at a dose of 800 mg/kg/day in hepatic amoebiasis reducing the average degree of infection to 1.3 as compared to 4.2 for same- treated controls. In immunomodulation studies, humoral immunity was enhanced as evidenced by the haemagglutination titer. The T-cell

counts remained unaffected in the animals treated with the formulation but cell-mediated immune response was stimulated as observed in the leukocyte migration inhibition (LMI) tests.^[11]

In another study conducted at Amala Cancer Research institute, Kerala, India it is confirmed that the *Rasayanas* as immuno-modulators. Administration of *Brahma rasayana*, *Amrita prasa rasayana* and *Narsimha rasayana* were found to enhance the proliferation of lymphocytes in response to mitogens. Some were found to induce the proliferation of bone marrow cells in culture. Natural killer cell activity was also found enhanced in both normal and tumour bearing animals treated with *Rasayana*.^[12]

2. Improving Immune Status

Pippali Rasayana was tried in 41 patients of Giardiasis. It has significantly reduced the clinical signs and symptoms. Stool became free of parasites and in haematological profile, Hb percentage increased and eosinophil count decreased. No side effects were observed. It is hypothesized that the drug possibly acts through some cidal constituents present in it and also by improving immune status of patient.^[13]

It is pointed in an extensive review on cancer treatment by *Ayurvedic* drugs it is visualized that the *Ayurvedic* drugs may act anti-cancerous by improving immunological status of the recipient and by rendering protection from side effects of radiation and chemotherapy. Turmeric (*Haridra*), *Emblica officinalis* (*Aamalaki*), *Phyllanthus amarus* (*Bhumyamalaki*) and *Picrorhiza kurroa* (*Katuki*) were found to inhibit skin carcinogenesis and hepato-carcinogenesis induced by NDEA (N-Nitroso diethyl amine – a carcinogenic and mutagenic organic compound, classified as a nitrosamine). *Rasayanas* were found immuno-stimulants and could produce bone marrow proliferation and differentiation. *Rasayana* was found useful in the patients undergoing chemotherapy and radiation therapy. Polyphenols from plants are anti- metastatic compounds.^[14]

A volatile fraction from Neem oil (*Nimba Taila*) named as NIM-76 on i.p. injection caused an increase in polymorpho-nuclear leukocytes with a concomitant decrease in lymphocyte counts. This immunomodulatory action was due to an enhanced macrophage activity and lymphocyte proliferation response, while the humoral component of immunity was unaffected.^[15]

3. Antiaging Action

Aging is progressive change related to passage of time. By the age 50-60 years of life age related changes begin to reflect like reduced power of muscle, reduced vision, memory and locomotion function, there is gradual decline in homeostasis and immune function predisposes them to infection, digestive problem and malignancy. Free radicals cause oxidative damage to various biological

molecules e.g. hydroxyl radicals can damage cell membrane and lipoproteins by a process called lipid peroxidation which may contribute to aging process. Certain *Rasayana* drugs like *Ashwagandha* inhibits copper induced lipid peroxidation and also inhibits oxidative protein modification. *Rasayana* also acts as Antioxidants so they help in delaying Aging.

4. Adaptogen Activity

Rasayana of *Ayurveda* can be considered as adaptogenic drugs. They increase endurance and sustaining capacity in individuals by promoting *deha bala*. A number of medicinal plants have been used in Indian system of Medicine as adaptogens, but due to lack of scientific evaluation, both experimental and clinical, these drugs have not achieved due recognition.

Satavari root (*Asparagus racemosus*), *Haritaki* (*Terminalia chebula*) and *Aamalaki* fruits extract (*Embllica officinalis*) and their fraction was evaluated for positive endurance promoting properties in a new model. Cold-hypoxia-restraint rat model was modified and developed to evaluate improvement in physical work performance and endurance in adverse stressful environment, which is an essential characteristic of adaptogen endurance to a stressful condition. The results were compared with *Panax ginseng* (50 mg/kg, p.o. x 5 days) as control. Crude extract of all the three plants studied in a dose of 200 mg/kg. p.o. for 5 days showed significant ($p < 0.001$) adaptogen activity (35-80%) in all the parameters.^[16]

Encouraging results are found in one experimental model developed with albino rats to study the adaptogenic effect of herbal compound, and *Asvagandha*. The same drugs are given to 200 soldiers, who had spent one year at higher altitudes (3000 - 6000 M ht.). It is observed that psycho-physiological performance, physical performance and sensitive indices of oxygen availability to the tissues were improved by the intake of these drugs up to a period of three months stay in high mountains (4800 - 6000 metres). As these adaptogens intake provided protection from high altitude stress they have been suggested as health food supplements. These studies are also indicated that *Ayurvedic* herbal preparations viz. *Rasayana* and *Vajikarana* drugs as the preparation of real value.^[17]

The results of another study have suggested that the continued employment of *Tulasi* (*Ocimum sanctum*) can cause the restoration of the humoral response in immunosuppressive state thereby making them protective from infections.^[18]

5. Cell Proliferation & Regeneration:

A study was performed to assess the immunopotentiating capabilities of *Asvagandha* (*Withania somnifera*) to avoid the immunosuppression produced during radiation treatment in mice. Administration of a 75% methanolic extract of the *Asvagandha* plant was found to significantly increase the total WBC count in

normal Balbic mice and reduce the leucopenia induced by sub lethal dose of gamma radiation. Treatment with *Asvagandha* was found to increase the bone marrow cellularity significantly. It had normalized the ratio of normochromatic erythrocytes and polychromatic erythrocytes in mice after the radiation exposure. Major activity of *Asvagandha* seemed to be in the stimulation of stem cell proliferation.^[19]

6. Tissue Protection & Regeneration:

Several epidemiological studies have suggested that dairy products (*Kshira varga*) intake is associated with a decreased incidence of colon cancer. In one extensive study conducted on healthy human volunteers to study the effect of milk products it is concluded that a shift from a dairy product-rich to a dairy product -free diet resulted in a significant effect on an accepted risk marker for colon cancer. The protective mechanism of dairy products is found to beat the level of tumor promotion rather than initiation.^[20]

7. Intellect promotion (*Medhya*) & Stress relieving

Acara Rasayanas visualize the code of conduct to lead stress free life in turn fetches longevity. However, the herbs that are proved to reduce the stress are also of paramount importance.

In *Ayurveda*, many drugs have been mentioned to improve the *Medha*, e.g., *Asvagandha*, *Brahmi*, *Shankapushpi*, *Jatamamsi*, *Bala*, *Jyotishmati*, and *Guduchi*, etc. These drugs have also been mentioned as *Rasayana* (rejuvenative and restorative). The beneficial effects of these drugs for the treatment of psychological and psychosomatic disorders suggest that they might be having sedative and tranquillizing properties. Recent studies and researches done so far also suggests that *Medhya* drugs as mentioned in *Ayurvedic* texts, keep the mind calm and cool, reduce anxiety and apprehension thus producing sedation and tranquillity.^[21]

Sankhapushpi (*Convolvulus pluricaulis*) is an age-old remedy for different mental ailments. *Caraka* said it as the intellect promoter. It is an important ingredient in different formulations like *Brahma Rasayana*, *Agastya Haritaki* etc. The whole plant is medicinal and even in fairly high doses, the drug is found to be non-toxic. It is found effective in reducing different types of stress. In one study, 89 school going children kept on this drug for 1 year and proved that it enhanced the mental agility of the children.^[22]

The efficacy of *Asvagandha* (*Withania somnifera*) (tablets 0.5 gm, 1-2 tab. b.d.) and *Satavari ghritam* (*Asparagus racemosus*) (1-2 tsp. b. d.) as internal medication and *Lakshadi thailam* as external massage are used to enhance the non-specific general immunity of 50 preschool children. The study indicated that the non-specific immunity of children is greatly enhanced as reflected in increased haemoglobin content, and decreased episodes of pyrexia of unknown origin,

infectious disease and eye infections.^[23]

8. Bactericidal & Anti-microbial:

Several *Rasayana* drugs have been found with anti-microbial activity. The ultimate purpose of *Rasayana* drugs is also achieved by their bactericidal and anti-microbial activities. Here the action is to be presumed to indirect. By the virtue of promoting immunity the drugs might have contained microbes.

The study showed that both aqueous and organic extracts of Valli *Kantakarika* (*Solanum trilobatum*), *Asvagandha* (*Withania somnifera*), *Dugdika Bh.* (*Euphorbia pilulifera*), *Nimba* (*Azadirachta indica*), *Aamalaki* (*Embllica officinalis*), *Tulasi* (*Ocimum sanctum*), *Lasuna* (*Allium sativum*) and *Vasa* (*Adhatoda vasica*) have bactericidal activity against Mycobacterial tuberculosis in vitro.^[24]

The study of Anti-bacterial activity of *Rasakarpura* (Mercuric chloride) a known *rasayana* of mercurial origin revealed the safety margin and efficacy against different bacterial strains.^[25] The anti-diphtherial properties of *Bhallatakasava* And *Suksma Triphala* possessing Known *rasayana* drugs like *haritaki*, *aamalaki* and *Bhallataka* were found to have bactericidal activity on diphtheria causing microorganism *Corynebacterium diphtheria*.^[26]

Alcoholic extract of *Bhallataka* (*Semecarpus anacardium*) dry nuts showed bactericidal activity in three-gram negative strains e.g. *Escherichia coli*, *Salmonella typhi* and *Proteus vulgaris* and two-gram positive bacteria, namely *Staphylococcus aureus* and *Corynebacterium diphtheriae*. Alcoholic extract of different parts of the plant showed antibacterial property against *Corynebacterium diphtheriae*. Alcoholic leaf extract showed bactericidal activity against all the five tested strains.^[27]

9. Cardio Tonic effect

Makaradvaja a popular *Ayurvedic rasayana* is given to the rabbits orally for a period of two weeks. It has resulted in increase in ventricular contraction force evident of cardio tonic effect.^[28]

Mechanism of action *Rasayana* at cell level

Ghosal has studied comparatively and suggested possible mode of action on *Ayurvedic* herbo-mineral vitalizers (*Rasayanas*) is worth mentioning. The herbal (Polyphecnolic / humic) ingredients, by complexation with the ions of transitional metals (Fe, Cu, Mn) and those of fixed valency states become thermo stable and water-soluble. These assemblies become readily available to living cells as sources of micronutrients and of energy. The herbal ingredients in the assemblies also act as reductants and backing pumps for regeneration of the metal ions into their lower valency states. The total assembly acts as biocatalyst, for biological energy conservation and for signal transduction.^[29]

CONCLUSION

The *Rasayana* term by definition, give sharp memory, intellect and longevity, and along with freedom from illness, also restore youth. Also found in a series of experiments that the *Rasayana* plants are immunostimulant in nature^[30]. The present paper analyses various types and mode of action of *Rasayana* to support the above concept, its role as a prophylactic medication and significance in the prevention of diseases in both healthy as well as diseased individuals. Scientific studies have proven their preventive, curative and promotive aspects of health.

Querying in available literature reveals that several newer physio-pharmacological terminologies are used to explain the *Rasayana* effect of the drugs. Irrespective of language these studies provide us a greater understanding and clarity about *Rasayana* drugs. It is now we had recognized *Rasayana* effect through these terminologies like Antioxidant, Improving Immune Status, Adaptogen activity, Tissue Protection & Regeneration, Intellect promotion, Stress relieving, Cell Proliferation & Regeneration, Bactericidal & Anti-microbial Activity and Cardio-tonic effect. Immunomodulation is another important tool for *Ayurveda* doctors. One has to promote immunity potentials of an individual in any given condition to obtain better results. It is now evident adding one suitable *Rasayana* drug along with the treatment provides better results.

REFERENCES

1. Sharma PV Susruta Samhita of Acharya Susruta, Haridas Ayurveda series-9, Chaukambha, Visvabharati publications, Sutra sthana Varanasi, 2001.
2. Murthy, Srikantha KR Ashtanga Samgraha of Acharya Vagbhata, Chaukambha orientalia: Sutra sthana, Varanasi, 1997.
3. Murthy, Srikantha KR Ashtanga hridaya of Acharya Vagbhata, Chaukhabha Krishnadas Academy, Uttara sthana Varanasi, 2003.
4. K. K. Panday, Comprehensive human physiology, 1st Edition, Karshnadas Academy, Varanasi, 2000; 155-184.
5. U. Tatiya, K. V. Shastri, and S. J. Surana. Preparation and Standardization of Polyherbal *Rasayana* by Fermentation Process. Phcog Mag, 2008; 4(Suppl 15): S 100.
6. U.Thatte and S.Dahanukar. Evidence Based *Ayurveda*. Qua. Med. Rev, 2002; 53(4): 3-12.
7. V.P.Kumar, R.Kuttan and G.Kuttan.Effect of *Rasayana* A herbal drug preparation on cell- mediate immune response in tumour bearing mice. Indian J Exp. Bio, 1999; 37(1): 31-37.
8. P.Bansal, R.Sannd, N.Srikanth and G. S. Lavekar. Effect of traditionally designed nutraceutical on stress induced immunoglobulin changes at Antarctica. African Journal of Biochemistry Research, 2009; 3(4): 84-88.
9. De. R.K.; Tripathi, P.C., Role of Certain Indigenous

- Drugs Antioxidants In Ageing, International Seminar on Free Radicals Mediated Diseases & Ayurveda, Faculty of Ayurveda, -IMS, BHU, Varanasi, 1996; 2-4.
10. Yamini B Tripathi, Savita Chourasia, Ekta Tripathi, Anil Upadhyay & G P Dubey, Bacopa Monniera Linn. As an Antioxidant: Mechanism of Action, Indian Journal of Experimental Biology, 1996; 34: 523-526.
 11. Sohni, Y.R.; Bhatt, R.M., Activity of A Crude Extract Formulation in Experimental Hepatic Amoebiasis And in Immunomodulation Studies, Journal of Ethnopharmacology, 1996; 54(2, 3): 119-124.
 12. Pradeep Kumar Prajapati, Damodar Joshi, Govind Prasad Dube, An Experimental Study on Makaradhwa. Ancient Science of Life, 1997; 302-306.
 13. Abbas, S.S.; Tripathi, D.M.; Agarwal, A.K.; Singh, N.; Pandey, K.C., A Double-Blind Placebo Controlled Clinical Trial of *Pippalli Rasayana* (An Ayurvedic Herbal Preparation) In Cases of Giardiasis, Antiseptic, 1997; 94(8): 250-254.
 14. Ramadasan Kuttan, Contribution of Ayurveda To the Therapy of Cancer, Update Ayurveda '98, Mumbai, India, 1998; 1: 11-14.
 15. Sai Ram; Sharma, S.K.; Ilavazhagan, G.; Devendra Kumar; Selvamurthy, W., Immunomodulatory Effects of Nim-76 A Volatile Fraction from Neem Oil, Journal of Ethnopharmacology, 1997; 55(2): 133-139.
 16. Shukla, R; Prajapati, V; Anand, R; Patnaik, G.K. & Dhawan, B.N., Effective Rat Model for The Evaluation of Adaptogenic Substances, Indian Journal of Pharmacology, 1997; 29(1):
 17. Srivastava K.K, Adaptogens In High Mountains, Indian Journal of Natural products, 1995; 11.
 18. Khajurial, A; Shanna, M.L. & Sharma, O.P., Modulation of Specific and Nonspecific Immune Response by Ocimum Sanctum, Indian Journal of Pharmacology, 1997; 29(1).
 19. Girija Kuttan, Use of Withania Somnifera Dunal As an Adjuvant During Radiation Therapy, Indian Journal of Experimental Biology, 1996; 34: 854-856.
 20. Khajurial, A; Shanna, M.L. & Sharma, O.P., Modulation of Specific and Nonspecific Immune Response by Ocimum Sanctum, Indian Journal of Pharmacology, 1997; 29(1).
 21. Pandey, K. K., Pandey, S.B., Sedative and Tranquillizing Properties of Medhya Drugs, Aryavaidyan, 1995; 8(4): 198-200.
 22. Koshi, V., Prabhakar, C., Vaidyanathan, B., Effect of Sankhapushpi On the Physical and Mental Agility of Institutionalized Children - A Preliminary Study.
 23. Chatur Prabhakar; Koshy, V; Menon, S; Vaidhyathan, B., Effect of Withania Somnifera, (Aswagandha) Asparagus racemosus (Satavari) And Lakshadi Thailm In Improving the Physical and Mental Health of Pre-School Children, Medicinal and Nutritional Research Communications, 1994; 2: 15-18.
 24. Saroja, S.; Usha, K.; Shoba, P.; Meenakumari, V., Biochemical Profile of Selected Patients with Tuberculosis and Bacterial Activity of Certain Indigenous Plants on Tubercle Bacilli, Indian Journal of Nutrition and Dietetics, 1997; 34(8): 193-198.
 25. Chuddar, A.K., Rao, G., Nath, G., Dixit, S.K., Rasakarpura—An Effective Antibiotic of Ayurveda, National Conference on Shothahara (Antiinflammatory) Jeevanuhara (Anti- Bacterial) Ayurvedic Medicines, 14-15th March, 1999. New Delhi.
 26. Dalvi, S.J., Ravetkar, S.D., Kulkarni, P.H., Antibacterial Properties of Ayurvedic Preparations Bhallatakasava & Sukshma Triphala, Journal of NIMA, 1999; 41(5): 5-7.
 27. Nair, A.; Bhide, S.V., Antimicrobial Properties of Different Parts of Semicarpus Anacardium, Indian Drugs, 1996; 33(7): 323-328.
 28. Pradeep Kumar Prajapati, Damodar Joshi, Govind Prasad Dube, An Experimental Study on Makaradhwa. Ancient Science of Life, 1997; 302-306.
 29. Ghosal, S., Ayurvedic Herb mineral Vitalizers – Ancient and Modern Perspectives, Indian Journal of Indigenous medicine, 1996; 17(2)
 30. Saroja, S.; Usha, K.; Shoba, P.; Meena Kumari, V., Biochemical Profile of Selected Patients with Tuberculosis and Bacterial Activity of Certain Indigenous Plants on Tubercle Bacilli, Indian Journal of Nutrition and Dietetics, 1997; 34(8): 193-198.