

ROLE OF RESEARCH IN THE GLOBALIZATION OF AYURVEDA

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ABSTRACT

Ayurveda is a science of life with a holistic approach to health and personalized medicine. It is one of the oldest medical systems; this comprises thousands of medical concepts and hypothesis. Moreover, the comprehensive knowledge of the basic ideologies of *Ayurveda* is poorly acceptable scientifically due to lack of evidence. In the modern time, when the western medicinal system is reached almost at the top because of validated research and advanced techniques, there is an urgent need to validate basic principles as well as drugs used in the *Ayurveda* system of medicine with the help of advanced research methodology. Therefore, advancements in the ongoing research methodology are highly required for the promotion of *Ayurveda*. Unfortunately, due to lack of scientific validation in various concepts, this precious gift from our ancestors is trailing. Hence, evidence based research is highly needed for global recognition and acceptance of *Ayurveda*. The most important gain through this global recognition is the considerable increase in the export potential of the *ayurvedic* medicines, which needs further advancements in the research methodology. The present review highlights various fields of research including literary, fundamental, drug and clinical research in *Ayurveda*. Literary research is a soul of fundamental/conceptual research. However current research practices are focused more on clinical research. It is so far remained neglected branch of research. The review further focuses to improve the research methodology for *Ayurveda* with main emphasis on the fundamental research. This attempt will certainly encourage young researchers to work on various areas of research for the development and promotion of *Ayurveda*. This article provides an account of the research journey, including some detours like TDKL, Ayusoft, Ayurgenomics, Rasayana & stem cell therapy, Rasayana as cancer & vaccine adjuvants, reverse pharmacology etc towards the destination of several innovative projects, evidence based *Ayurveda* and global acceptance of integrative medicine.

Keywords: Adjuvants, Ayusoft, Ayurgenomics, Rasayana

INTRODUCTION

Ayurveda is an observational and research oriented science, even though at present era with the evolving world, every field of science requires justification, and for it research becomes mandatory. New diseases have evolved which are proving fatal and so it becomes the need of the hour to establish and validate our system of medicine and its efficacy which can be useful to humankind as a whole. Also, to make *Ayurveda* popular way of treatment modality worldwide, research efforts should be done. Famous scientist Darwin's theory states survival of the fittest; *Ayurveda* survived till date and proves to be fittest and attains the adjective of *Trikaalabadhita*. Thousands of years back our ancient seers have understood the geographical changes in atmosphere, climate and its effect on body and introduced *Ayurveda* for us¹.

Research and *Ayurveda*

In *Ayurveda*, each cell is considered to be inherently an essential expression of pure intelligence hence called self-healing science.² According to the World Health Organization, about 70–80% of the world populations rely on nonconventional medicines mainly of herbal sources in their healthcare³ Public interest for the treatment with complementary and alternative medicine is mainly due to increased side effects in synthetic drugs, lack of curative treatment for several chronic diseases high cost of new drugs, microbial resistance, and emerging diseases, etc⁴ We get many references in our *samhitha* explaining research e.g. *anveshana*, *parishodhana*, *anusandhan*, *manthan*, *vimarsha*, *parikshya* etc.⁵

Globalization

The word globalization was primarily used in economic who means “mutual exchange of technology and knowledge through world wide”. All the streams of science have been evolved as a process of continuous development. At the time of *ayurveda avartaran*, *Bhardwaj rishi* etc gathered to discuss and unite against spreading of diseases. International and na-

tional seminars called as *taddhit sambhasa parishad* (seminars and symposia) were also held in that time; we can say that the phenomenon of globalization has been started far ago⁶

Need for globalization⁷

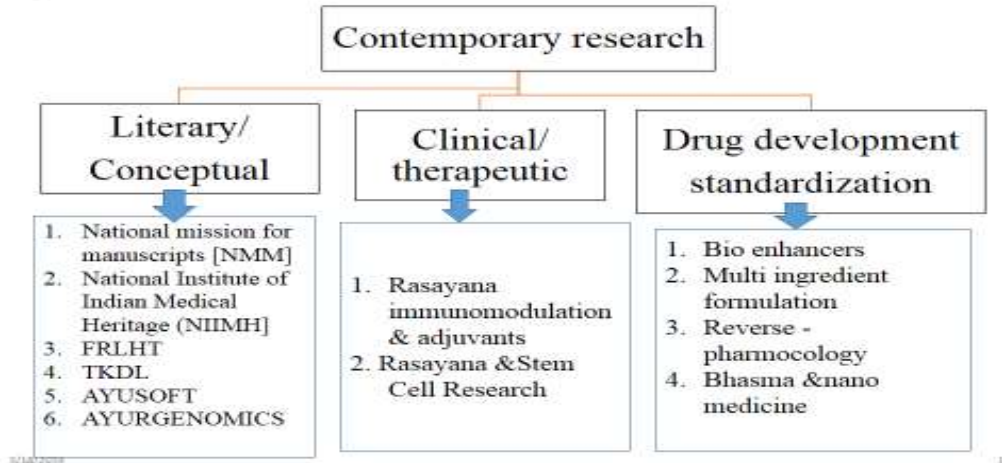
- To bring *Ayurveda* in the main stream of medicine system for meeting the new coming challenges to the human health and to improve the quality of health care system globally; there by highlighting the glimpses of ancient traditional medicine & keeping our Indian heritage alive.
- To re-write the misconceptions about *Ayurveda* in the Western minds and replace it with advises about self-healthcare and cure through *Ayurveda*.
- Besides all issues, the most important gain through this global recognition is the considerable increase in the export potential of the *Ayurvedic* medicines. India uses more than 600 varieties of herbal and a number of non-herbal mineral and animal products for its drug manufacture. India with its bio-diversity is perhaps the richest nation with herbal medicine wealth⁸
- The international herbal market is approximately \$61 billion. Annual turnover of Indian *Ayurvedic* industry is \$ 0.8 billion (Rs 35,000 million). The Indian market is growing at 15-20% per annum (Rs 7,000 million or \$150 million). With world demand growing at 1% annually (\$ 610 million), the size of export market for medicinal plants appears bigger than the Indian domestic market⁹

Dimensions of Contemporary *Ayurvedic* Research¹⁰

The overall spectrum of contemporary research activities in *Ayurveda* includes

- Literary and conceptual study,
- Clinical and therapeutic research,
- Drug development research and its standardization

Dimensions of contemporary ayurvedic research In globalization



Role of literary research in the globalization of ayurveda

Literary research even though base of any research has so far remained neglected branch of a research. Entire knowledge base of *ayurveda* is preserved in ancient literature e.g. *Vedas, samhitas, samgraha*, texts, and manuscripts. Use of modern technology in ayurvedic literature research is overlooked which is need of an hour for storage and retrieval of data in texts. Literary research can be helpful to solve unsolved or doubtful concepts as hidden linkages can be drawn from it. Some such initiatives towards the conservation of manuscripts as a part of literary research are:

National Institute of Indian Medical Heritage (NIIMH)¹¹

The National Institute of Indian Medical Heritage (NIIMH) provides resource materials to those who are interested in studying and documenting the historical aspects (AYUSH) along with Modern Medicine. This Institute, which is only of its kind in South East / Asia located at Hyderabad. The Institute is functioning under the administrative control of Central Council for Research in Ayurvedic Sciences (CCRAS), Department of AYUSH, Ministry of Health & Family Welfare, and Govt. of India. It has global access owing to its enormous collection of research materials on History of Medicine. The Insti-

tute's library is unique with collection of more than 10,000 books.

Projects of NIIMH are Ayush research portal (ARP), collection and digitization of medical manuscripts, Research Management Information System (RMIS), Integrated Clinical Decision Support System [ICDSS]. Out of these projects only ARP, CDMM projects are connected with the literary research work.

- **Ayush Research Portal (ARP)**

Development and Maintenance of "*Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH)*" research works in an organized fashion to avoid duplication of work, to encourage interdisciplinary research and generate evidence for wider acceptance of AYUSH systems worldwide.

- **Collection and Digitization of Medical Manuscripts (CDMM)**

Number of original Manuscripts collected-282, Total No of Digitization: 5102 (Medical Manuscript - 2580, Rare Medical Books - 1220, Rare Medical Journals issues (1302), Descriptive Catalogues prepared for 5102 digitized manuscripts, rare books and journals.

TKDL [Traditional Knowledge Digital Library]¹²

TKDL (traditional knowledge digital library) is the intellectual weaponry system of India to fight against the evils of bio-piracy. The main objective of TKDL

[Traditional knowledge digital library] is to maintain the authenticity, simplicity, Genuineness, originality, ethnicity and honesty of Indian systems of medicine. TkdL is a collaborative Project of council of scientific & industrial research (CSIR) and ministry of (*ayush*), to safeguard the interests of ethno pharmacological and rich medicinal cultural heritage of India. It is definitely a unique idea itself to defense against the exploitations Of India's Traditional Knowledge. TKDL can be accessed in 5 different languages. These are- Spanish, German, English, French and Japanese. This initiative has been taken to remove the unreachability of The India's Traditional Medicinal Knowledge. Because, most of the texts were written in local languages like Sanskrit, Hindi, Tamil, Urdu etc. Thus playing its role in the globalization process as a part of literary research

National mission for manuscripts [NMM]¹³

The National mission for manuscripts was established in February 2003, by the Ministry of tourism and culture, Government of India. The Mission has the mandate of identifying, documenting, conserving and making accessible the manuscript heritage of India. NMM is working towards fulfilling its motto, 'conserving the past for the future'. There are 50 manuscript conservation centers [MCC]'s are there in different states of the country which includes the south ,east, north, western parts of the country. Out of which 30 centers are working now. Thus, playing its role in the globalization as a part of literary research.

The Foundation for Revitalization of Local Health Traditions (FRLHT)¹⁴

The Foundation for Revitalization of Local Health Traditions (FRLHT) Trust was established in 1991. It has nurtured and sponsored two major programs viz., the Institute of Ayurveda and Integrative Medicine (I-AIM), established in 2011. The university of Trans-Disciplinary Health Sciences and Technology (TDU), since 2014. In order to revitalize Indian Medical Heritage. TDU-FRLHT had started the Centre for theoretical foundations (CTF) for the preservation of the Indian Medical heritage.

Centre for theoretical foundations (CTF) -Medicinal Manuscripts Program its objectives are cataloguing, training in medical manuscript ology, digitalization of medical manuscripts, Publication of unpublished / important medical manuscripts with translations. Till date, it has brought out a valuable work on dietetics called '*Kshemakutuhalam*' and '*Bhojanakutuhalam* with English translation and annotations.

Role of conceptual research in the globalization of Ayurveda

Ayurgenomics

Ayurgenomics is an integrative approach of *Ayurveda* and genomics for discovery of predictive markers for preventive and personalized medicine¹⁵ its main aim is to integrate *Ayurveda* into mainstream contemporary biology and to achieve global acceptability of the concepts. However, some immediate outcomes are-

- a) Development of Database of *Prakriti* Phenome of individuals belonging to multigenerational families and older age groups,
- b) Determination of predictive markers for disease predisposition.

Ayusoft¹⁶

Ayusoft is a collaborative project between the Government of India's Centre for Development of Advanced Computing (C-DAC) and the University of Pune. *Ayusoft* converts the logic of classical Ayurvedic texts into comprehensive, authentic, intelligent and interactive knowledge repositories with the help of complex analytical tools. The *AyuSoft* database includes more than 5 lakh records, capturing information from nine texts, including the *Brihatrayee* and *Madhava Nidana*. Information related to diseases, causative factors, symptoms, treatment guidelines, drugs, dietary recipes, lifestyle changes and treatment procedures can be searched and making it easily accessible globally.

Role of clinical research in the globalization of Ayurveda

Rasayana, immunomodulation and adjuvants¹⁷

Rasayana tantra is one of the eight specialties of *Ayurveda*. It concerns with rejuvenative therapy, dietary regimens and immunomodulation. Rejuvenative

therapies include special health promoting behavior and drugs. Reviews of the current literature available on *rasayana* indicate that immunomodulation is the most studied property/activity. Immunomodulating agents that are free from adverse reactions and those that can be administered for long duration, if possible throughout life, to obtain a continuous immune activation are highly desirable for prevention of diseases. The significance of the *rasayanas* as immunomodulating agents compared to other conventional immunomodulators is that they activate the immune function without altering the other basic parameters of the body¹⁸

Vaccine adjuvants /Cancer adjuvants

Newer vaccines like subunit and DNA vaccines are weakly immunogenic and require adjuvants. Most cancer chemotherapeutic agents are immunosuppressant and cytotoxic. *Ayurveda* based *rasayanas* may offer better and safer immunodrugs that can be used as adjuvants in vaccines (*Asparagus racemosus* and *Withania somnifera* enhanced protective immune response in diphtheria, pertussis and tetanus vaccination) and in cancer treatment as cancer adjuvants e.g. (*Anacyclus pyrethrum*, *Asparagus racemosus*, *Chlorophytum borivilianum*, *Brahma rasayana*, *Aswagandha rasayana* are the formulations studied for their stimulatory property of the acquired immune system).

Rasayana – stem cell research¹⁹

Over 200 *Rasayana* herbs have mentioned in *Ayurveda*. Each *Rasayana* has a specific tissue affinity and target action. The specific affinity for a tissue is termed as *Gaamitva* in *Ayurveda* that Literary mean ‘reaching the target’. The tissue specific action of various botanical drugs is helpful in selection of appropriate *rasayana* for a particular patient. There are certain organ and tissue specific *Rasayana* such as *Medhya rasayana* for the brain, *Hridaya rasayana* for the heart, *Twachya rasayana* for the skin, and *Chakshusya rasayana* for the eyes.

Regeneration of tissues after the disease condition like osteoarthritis, age related macular degeneration (AMD), Alzheimer’s, injuries, trauma, heart attack, stroke, accident, or aging remains a challenge to

modern medicine. Tissue-specific *rasayanas* could be tried for differentiation of stem cells and regenerate specific tissue of choice. *Rasayanas* known for their tissue specificity could also be tested in stem cells to reveal their differentiation inducing activity. Stem cell could possibly form a right kind of platform for testing potency of specific *Rasayanas*

Role of drug research in the globalization of Ayurveda

Reverse pharmacology

Post marketing failures of blockbuster drugs have become major concerns of industries, leading to a significant shift in favor of single to multi targeted drugs and affording greater respect to traditional knowledge²⁰. A new trans-disciplinary endeavor called Reverse Pharmacology has recently emerged which is designed as an academic discipline to reduce three major bottlenecks of costs, time and toxicity²¹. RP can be perceived to comprise of three phases. First, the experiential phase that include robust documentation of clinical observations of the drugs. Second, the exploratory studies for tolerability, drug-interactions, dose-range and preclinical studies in relevant in vitro and in vivo models to evaluate the target-activity. Third phase includes experimental studies, basic and clinical, at several levels of biological organization. The scope of reverse pharmacology is to understand the mechanisms of action at multiple levels of biology and to optimize safety, efficacy and acceptability of the leads in natural products based on relevant science. In this approach as the candidate travels a reverse path from ‘clinics to laboratory’ rather than classical ‘laboratory to clinics’²²

Gananath Sen laid the foundation of Reverse Pharmacology of medicinal plants by pursuing clinically documented effects of *Ayurvedic* drugs²³. This process of natural product drug discovery was later named ‘reverse pharmacology’ by Ashok Vaidya²⁴. A large number of molecules have come out of the *Ayurvedic* clinical base, including *Rauwolfia* alkaloids for hypertension, *psoralens* in vitiligo, *Holarrhena* alkaloids in amoebiasis, *guggulsterones* as hypolipidemic agents, *piperidines* as bioavailabil-

ity enhancers, *baccosides* in mental retention, *picrosides* in hepatic protection, *curcumines* in inflammation and *withanolides*, and many other steroidal lactones and glycosides as immunomodulators

Concept of bio enhancers²⁵

Ayurveda has made a major innovative contribution to the drug discovery process through bio enhancers; are also called as drug facilitators which mean the agent capable of enhancing bioavailability and bio efficacy of a particular drug with which it is combined with out any typical pharmacological activity. They are also called as the absorption enhancers means the functional excipient added to the formulations to improve the absorption of a pharmacologically active drug. In 1979 *piperine* was discovered as the first bioavailability enhancer by cketal he observed that a majority of *ayurvedic* formulations contained *pippali*; based on this he done one hypothesis and found that *piperine* an active principle present in the drug *piper (p.longum)* increased the bio availability of different drugs by 30%-200%.

Advantages of bio enhancers:

The dosage is reduced; drug resistance are minimized ;toxicity of drug is minimized as in case of anticancer drugs; drug cost is reduced; and finally Ecological benefits includes saving rare plants which are used in medicine, as the dose of the drug is reduced only fewer plants are destroyed to use in medicines.

Some of the bio enhancers include

1. Quercitine ,a flavonoid found in the citrus fruits,
2. Niargin is the major flavonoid glycoside found in the grape fruits,
3. Sinomenine is an alkaloid extracted from sinomenium glucoside thub,
4. Glycyrrhizin is a triterpenoid saponin found in *glycyrrhiza glabra*
5. Nitrile glycosides which are derived in the pods of moringa olefera, zingiber officinale had the powerful effect on the GIT mucous membrane and helps in the absorption of the antibiotics like azithromycin (85%), erythromycin (10.5%), amoxicillin (90%),

6. Allicin the active bio enhancer phyto molecule in garlic enhances the fungicidal activity of amphotericin B against fungi such as candida albicans, aspergillus fumigates, and yeast saccharomyces cerevisiae.

7. Aloe Vera whole leaf extract and gel inside it improve the absorption of vitamin C & E.

Bhasma & Nano Medicine²⁶

Herbo mineral formulations of *ayurveda* constituting *bhasma* as an ingredient are the superior forms of administration. *Bhasma*'s are the most ancient form of administration of the nano medicine. Analgesic, anti-inflammatory immunomodulatory activity, Anti-oxidant activity, Free radical scavenging activities of various *bhasmas* has been identified and nano technology is held responsible for all these properties due to its target oriented technology. *ayurvedic* pharmaceuticals are receiving a new thrust through reappraisal of *bhasma* preparations as novel nano technological applications. Nano particles are responsible for its fast and targeted action. These nano-particles are proposed to be delivered to the target through rapid cellular internalization. Subsequent actions upon RNA/DNA molecule and protein synthesis within the cell are further hypothesized as possible mechanisms for rapid onset of therapeutic actions of *bhasma* preparations.

Multi Ingredient Formulation²⁷

The recent trends indicate use of multi-drug therapy, particularly in the treatment of diseases like tuberculosis and HIV/AIDS. Multi ingredient formulations offer distinct advantages, particularly in the area of difficult- to-treat chronic diseases such as diabetes, asthma, hypertension, cancer, arthritis.

DISCUSSION

There has been a mushroom growth in the number of *Ayurveda* colleges in the last two to three decades which has led to a generalized dilution in the standards of education and research. *Ayurveda* is continuously facing constraints and difficulties from regulatory authorities and the scientific community, which is coming in the way of its global acceptance. The existing standalone institutions of *Ayurveda* to be

merged with other established centers/state universities/other medical colleges in order to work collectively in some extent of diseases like cancer, degenerative diseases etc. The current clinical research in *Ayurveda* colleges revolves around the 'one drug-one disease' model (or 'one intervention-one disease' model) which most of the times not suitable in *Ayurveda* practice based research must be the ideal mode of research in most of the circumstances which is possible by inducting clinicians into the education system. There is a need of more evidence based researches in the area of literary. In this connection, digital helpline for *Ayurveda* Research Articles provides a first of its kind resource to access research articles on *Ayurveda* must be improved and updated. Literary research is a soul of fundamental/conceptual research which, with possible integration with modern sciences would be useful for better health care practices for tomorrow.

CONCLUSION

In designing the research protocol, basic difference between the *ayurveda* and modern sciences and the fundamental principles of *ayurveda* like *prakrithi*, *Agni*, *srotas*, *Rasayana*, *shadkriyakala*, *agnibala*, *ojobala*, *manobala* should be considered. The core competency should be enhanced without compromising in the basic principles. Both *ayurveda* and western medicine go hand by hand with each other by involving experts both from *ayurveda*, biomedical specialties. Well established health institutions, experienced researchers & clinicians with knowledge of modern technologies should be involved in order to improve the quality of *ayurveda* research especially in lifestyle diseases, chronic degenerative, and cancer conditions in order to offer better health services to the society. Today, as the demand for herbal products is increasing day by day, enough availability of raw materials with reasonable prices is a big challenge. Establishment of research institutions near the forest belts, so that abundance of flora and fauna will be there, involvement of local tribes in order to cultivate, preserve and collect and storage of medicinal herbs improves both employment and quality of

drugs. So the areas such as research for development of *Ayurveda* education, observational studies to find out proof of concept etc., do not even need much funding or infrastructure, but only need good planning. Hence, there is a need to encourage more meaningful research in basic science disciplines of *Ayurveda*.

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