

FUTURE PROSPECTS OF AYURVEDA: UNVEILING THE PRESENT AND EXPLORING NEW HORIZONS

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INTRODUCTION

Ayurveda, also known as the "Science of Life," is a system of medicine which originated in ancient India thousands of years ago. It has survived and flourished from ages till date. Rooted in the profound understanding of the interconnectedness between the mind, body, and spirit, Ayurveda offers a comprehensive approach to health and well-being, emphasizing balance, harmony, and the promotion of a vibrant life.

Ayurveda, the ancient Indian system of medicine, has stood the test of time for thousands of years, providing holistic approaches to healing and promoting well-being. As we step into the future, the world of Ayurveda is undergoing an intriguing transformation, blending its timeless principles with cutting-edge technology and scientific advancements. This convergence of tradition and innovation paves the way for exciting possibilities and opens new avenues for the practice and understanding of Ayurveda.

In recent years, Ayurveda has experienced a global resurgence, with individuals seeking alternative healthcare solutions. This renewed interest has sparked a wave of research and experimentation, driving the evolution of Ayurvedic practices into the realm of modern healthcare. There are many avenues yet to be explored by the torch bearers of the system like researchers, practitioners and experts in the field who carry the responsibility of keeping the system agile and contributing to their growth in the future. As we embark on this journey, we delve into the futuristic trends in Ayurveda that are reshaping the way we approach health, wellness and longevity.

The healthcare system around the world faced a unique challenge by the pandemic Covid 19. It has brought about a great awareness about health and made the human race focus on lifestyle and diet and led to a paradigm shift in healthcare industry with its focus from illness to wellness. For instance, Indian granny's recipe kadha which was given least importance and vehemently avoided earlier suddenly found an upgraded status. As a result, Kadha or Kashaya was voted as the 'The Drink of 2020' [Shubhashree MN, et al. "A cross-sectional survey to assess the efficacy of home remedies during Covid times from a Pharmacovigilance perspective," JPADR, vol 4 No. 1, March 2023] Ayurveda practitioners have contributed significantly during the times of Covid in reaching out to the grassroot levels. Ayurveda interventions like Ashwagandha (*Withaniasomnifera*) and Shunti (*Zingiberofficinale*) have shown promising results in reducing the duration of clinical recovery, improving the time obtain viral clearance thereby aiding the natural healing process of the body. [Singh H, et al Ashwagandha (*Withaniasomnifera*) and Shunthi (*Zingiberofficinale*) in mild and moderate COVID-19: An open-label randomized controlled exploratory trial. Complement Ther Med. 2023 Jul 22]

The World Health Organization (WHO) now refers to Ayurveda, Yoga and other traditional systems of medicine as Traditional, Complementary and Integrative Medicine (TCIM) WHO. [WHO Global Report on Traditional and Complementary Medicine 2019; World Health Organization: Geneva, Switzerland, 2019.] The term "AYUSH" refers to Ayurveda, Yoga and Naturopathy, Unani Siddha and Homeopathy systems of medicines .

AYURVEDA AND SWASTHYA

Ayurveda has been advocating the principle "Swasthya" rather than absence of illness. Though modern medicine understands health as the "absence of disease". The World Health Organization (WHO) uses a more holistic view of health; "state of complete physical, mental and social well-being and not merely absence of disease or infirmity." [Basht G. Exploring insights towards definition and laws of health in Ayurveda: Global health perspective. Ayu. 2014 Oct-Dec;35(4):351-5. PMID: 26195894; PMCID: PMC4492016]

The concept of 'Swasthya' or wholeness, in other words, optimal health and well-being are based on inner wholeness together with a balance of mind, body, social and physical environments. The approach to health care in the future has undergone a paradigm shift from standardized prevention and treatment to personalized prevention and treatment, from short-term to long-term sustainable intervention, from single molecular targets to an integrated system of networks, and from treatment with side effects to prevention and comprehensive health promotion. [Seetharaman M, Krishnan G, Schneider RH. The Future of Medicine: Frontiers in Integrative Health and Medicine. Medicina. 2021; 57(12):1303.]

The objectives of Ayurveda are to maintenance of health of the healthy person and to treat the disease. Ayurveda generally provides advice on how to prevent illness, promote health, and maintain it through dietary changes, lifestyle modifications, and other interventions. Ayurvedic therapies, which include herbal/herbo mineral medications and detoxification techniques, play a vital role in restoring the health of ailing people. [Dua, Pradeep Kumar; Naik, Raghvendra; Jain, Snehlata. Standardization in AYUSH systems: Bureau of Indian Standards (BIS) and International Organization for Standardization (ISO) perspectives. International Journal of Ayurveda Research 4(1):p 5-14, Jan-Mar 2023]

To maintain “Swasthya” daily regimen, seasonal regimen and a proper diet should be followed. Ayurveda has described various rules and regimens, regarding diet and behavior to get acclimatized to seasonal changes easily. The primary concept of the Ayurvedic medical philosophy is prevention [Jayesh Thakkar, S. Chaudhari, and Prasanta K. Sarkar. *Ritucharya: Answer to the lifestyle disorders*. *Ayu*. 2011 Oct-Dec; 32(4): 466–471]. Many of these preventive concepts have amassed sufficient scientific data to persuade the proposal that they can be implemented across cultures around the world.

AYURVEDA AND EPIGENETICS

The emerging field of epigenetics is bringing attention towards Ayurveda. Epigenetics can control the expression of genes. In other words, it has shown that changes in diet and life style and stress removal have an impact in the struggle to fight against genetic disorders and genes are not the only ones who decides the destiny. A comparison has been given to the software of a computer which decides the programme. Just as Ayurveda suggests, one's psychological state and physical environment affect or sustain gene expression levels and patterns. In contrast, an unhealthy lifestyle may "turn on" the harmful genes via an epigenetic process, leading to an increase in the production of pro-inflammatory cytokines or other disease-causing proteins. [Basisht G. *Exploring insights towards definition and laws of health in Ayurveda: Global health perspective*. *Ayu*. 2014 Oct-Dec; 35(4): 351-5. PMID: 26195894; PMCID: PMC4492016]

The primary causes of epigenetic alterations are Lifestyle and behavior, diet and digestion, stress, and environmental variables. Ayurveda addresses these variables, which influence the Deha (body) Prakriti (psychophysiological constitution), which corresponds to the phenotypic, and the Janma (birth) Prakriti (genotype) indirectly. Thus, epigenetics is seen as a crucial Ayurvedic mechanism. This linkage, insight, and comprehension has resulted in improved communication and comprehension with the allopathic medical system, as well as a greater integration of both sciences in the management of optimal health. Furthermore, research into Ayurvedic modalities that alter gene expression would improve the linkage and comprehension between the existing medical system and Ayurveda. [Hari Sharma and Robert Keith Wallace. *Ayurveda and Epigenetics*. 2020 Dec; 56(12): 687]

The "P4" approach is a new approach in medicine to reducing the burden of chronic diseases that implies predictive, preventive, personalized, and participatory approaches that have great potential to address the underlying mechanisms of chronic diseases by harnessing technology and an increasingly better understanding of environment-biology interactions, evidence-based interventions, and so on. [Sagner M, et al. *The P4 Health Spectrum - A Predictive, Preventive, Personalized and Participatory Continuum for Promoting Healthspan*. 2017 Mar-Apr; 59(5): 506-521.]

Bhushanpatwardhan also advocates that Ayurvedic researchers should develop strategic collaborations with innovative initiatives involving predictive preventive personalized medicine (PPPM). This path leads to exploration of the concept of “Prakriti” as Prakriti-based medicine is speculated to change the scenario of global health wisdom. Ayurvedic treatment modalities are based on ahara (diet), vihara (lifestyle), and aushadhi (medication), which are the three pillars of prakriti-based medicine making it a holistic science. [Bijoya Chatterjee 1, Jigisha Pancholi. *Prakriti-based medicine: A step towards personalized medicine*. 2011 Apr; 32(2): 141-6.]

PRAKRITI, AYURGENOMICS AND AYURNUTRIGENOMICS

Ayurveda classifies the human population as Vata, Pitta and Kapha types based on three major constituents or Prakriti. Prakriti is a manual or guide to personalize the diet and medicine. In Ayurveda, the central concept of health and disease is based on an individual's uniqueness. [Patwardhan B, et al] Ayurvedic Prakriti assessment is based on distinctions in physical, physiological, and psychological traits and is not influenced by racial, ethnic, or geographical factors. [Ghodke Y, et al.] It is speculated that different prakriti's have unique metabolic activities. Kapha is slow, Pitta is fast, while Vata is considered to have variable metabolism. The discovery of genetic variants driving Prakriti's metabolic variability has opened up new paths and approaches to Pharmacogenomics.

Different prakriti may have different drug metabolism rates associated with drug metabolizing enzyme (DME) polymorphism as well. In a study by Y. Ghodke Sharma Vikas, a remarkable association between CYP2C19 genotypes and Prakriti with fast and slow metabolism as main distinguishing and differentiating traits was identified. *Ayurgenomics: A CSIR study establishes links between Ayurveda and Modern Science for Predictive and Personalized Medicine*.

Ayurgenomics presents a personalized approach in the predictive, preventive, and curative aspects of stratified medicine with molecular variability, which includes the study of interindividual variability due to genetic variability in humans for assessing susceptibility, and establishing diagnosis and prognosis, mainly on the basis of the constitution type of a person's Prakriti.

Ayurnutrigenomics is an emerging field of interest in which the selection of a suitable dietary, therapeutic, and lifestyle regime is made on the basis of clinical assessment of an individual maintaining one's Prakriti. This concept of personalized nutrition is a new concept of nutrigenomic research for generating individualized functional foods and nutraceuticals suitable for one's genetic makeup with the help of Ayurveda. [Subhadip Banerjee, Parikshit Debnath, and Pratip Kumar Debnath. *Ayurnutrigenomics: Ayurveda-inspired personalized nutrition from inception to evidence*. 2015 Oct; 5(4): 228–233]

Ayurveda combines foods (Pathya or Ahara) and drugs (Aushadha) under the umbrella of therapeutics, to maintain harmonization of the Doshas or physiological factors with respect to Prakriti and other environmental factors. [Debnath PK, et al.]

Research on nutrition based on Prakriti is emerging as a major field, be termed as Ayurnutrigenomics, which presents a huge scope of development toward the understanding of nutrigenomics and molecular nutrition research. It helps in structuring health recommendations and personalized food design. This novel concept of Ayurnutrigenomics is an emerging area of research, which may unfold future possibilities towards safe therapeutics in future. [Banerjee S, et al.] Prakriti-based medicine has the potential to offer remedies to the challenging health issues like adverse drug reactions, drug withdrawals etc.

Fields of genomics, proteomics, metabolomics, and now epigenomics (‘omics’ technology of system biology) study the contribution of genes, proteins, metabolic pathways and non-genetic factors to human physiology and variations in pathways that has vital role in disease susceptibility of an individual. Ayurgenomics is expected to provide explanation regarding the effective administration of current drugs by targeting them on patients of particular Prakriti. It offers a new bridge between traditional medicine

and modern medicine by providing a rigorous scientific understanding of basic concepts, and at the same time incorporating the practical preventative approaches of Ayurveda into modern medicine.

GUT MICROBIOME AND AGNI

Ayurveda has described Agni as an important factor of digestion and metabolism in our body. Ayurveda has given utmost priority to the “Gut health” linking it to the health of an individual. Diet and digestion influence the composition of the gut microbiome. Ayurveda, is perhaps the oldest science which has been focusing on the role of digestion in health and disease for centuries. Wallace, R has presented the connection between the gut microbiome and various prevention and therapeutic approaches of Ayurveda. [[Wallace, R. The Microbiome in Health and Disease from the Perspective of Modern Medicine and Ayurveda. *Medicina* 2020, 56, 462](#)]

Gut microbiota is an organ by itself, with an extensive metabolic capability and functional plasticity. [[Jandhyala SM, et al. Role of the normal gut microbiota. *2015 Aug 7; 21\(29\): 8787–8803*](#)] In a healthy human, the gut microbiota has a symbiotic interaction with the gut mucosa and is associated with metabolic, immunological, and gut protective activities. [Shi N, Li N, and others] The gut microbiota takes nutrients from the host's diet and sheds epithelial cells. [Ramakrishna BS and others] According to emerging data, dietary components can have a direct impact on the composition and metabolic activity of the mammalian gut microbiota, affecting both physical and mental health. Anthocyanins, in particular, increase gut microbial health, reduce inflammation, and reduce the risk of colorectal cancer. [K. Shondelmyer, R. Knight, A. Sanivarapu, and O. Ogino]

A study of the relationship between prakriti--the foundation of customized medicine in Ayurveda--and gut microbiota, a potential indicator of an individual's health--would substantially increase precision therapy. Exercise and a high-fiber diet, including fruits, vegetables, legumes, and whole-wheat grain products, have also been proven to boost microbial diversity. [[Clarke et al. 2014; Flint et al. 2012.](#)]

Interestingly, the key elements that can impact and induce changes in an individual's three doshas, including as age, diet, lifestyle, stress, and environment, are also known to affect the microbiome composition and function. (Lakhota 2014) This reveals a probable link between prakriti constitution and microbiome assemblage, as well as how modest physiological or lifestyle changes can lead to disequilibrium and sickness in otherwise healthy people. The study discovered that the overall species diversity increased with age in people for both the gut and mouth microbiome.

It is worthwhile to recollect that Indian thali, delivers both fiber and other phytochemicals by integrating a variety of plant meals in various colors. Thus, variety aids in the restoration of gut bacterial diversity and has the potential to prevent or treat chronic diseases such as colon cancer and type 2 diabetes. [[Shondelmyer K, Knight R, Sanivarapu A, Ogino S, Vanamala JKP. Ancient Thali Diet: Gut Microbiota, Immunity, and Health. *Yale J Biol Med.* 2018 Jun 28;91\(2\):177-184. PMID: 29955222; PMCID: PMC6020729.](#)]

MILLETS

Ayurvedic treatises mention millets under the umbrella of Trinadhanya and Kshudradhanya. Millets have emerged as an excellent choice of nutritious replacement for refined cereals to fight obesity caused by our sophisticated sedentary lifestyle. One of the dietary modifications to tackle obesity is including millet in the diet. [[Vasavi Totawar: Importance of Millets and Kshudradhanya in Today's Lifestyle - A Review *international Ayurvedic Medical Journal {online} 2023 {cited April 2023}*](#)] The high mineral content, antioxidants, protein and lower fat content as compared to rice and wheat makes it a potential therapeutic food. Year 2023 has been declared by the United Nations General Assembly as the International Year of the Millet at the behest of Indian government.

PANCHAKARMA

Panchakarma treatment is a program for the body, mind, and consciousness that cleanses and rejuvenates. Panchakarma therapies go a long way in maintaining health. Ayurveda employs the “Pancha karma” method in its therapies. Pancha karma therapy applies various processes for the rejuvenation of the body, cleansing and enhancing longevity. The “Pancha karma” approach is used in Ayurvedic remedies. Pancha karma therapy employs a variety of techniques to rejuvenate the body, cleanse it, and increase longevity. The Pancha karma is made up of five karmas (activities) that are utilized to remove poisons from the body's tissues. They are the Virechan (purgation), Vaman (forced therapeutic emesis), Basti (enemas), Rakta moksha (blood detoxification), and Nasya (nasal delivery of medications).

Shirodhara is a traditional and well-established Ayurvedic therapy that involves slowly and consistently dripping therapeutic oil over the patient's center of the forehead as the patient rests quietly on a comfortable bed. Other liquids, such as coconut water, buttermilk, milk, and so on, are often used depending on the patient's unique needs. Studies have indicated that therapies such as Shirodhara have psycho-neuro-immunological effects such as a drop in noradrenaline levels, a sympatholytic impact, activation of peripheral skin circulation, and an increase in the level of natural killer cells. According to Xu et al., the mechanism in their study indicates the physiologic action of Shirodhara by dripping sesame oil on the forehead may trigger somato-autonomic reflex through temperature sensors or pressure sensors in the skin or hair follicles via the trigeminal cranial nerve. This procedure produced a relaxed state that results in the maintenance of psycho-physiological balance. Shirodhara has shown significant improvement in serum biomarkers of stress, which were reduced after Shirodhara in a study by [[Rajan S, et al.](#)]

Yet another study at NIMHANS (National Institute of Mental Health and Neurosciences), Shirodhara coupled with medhyarasayan has been reported in patients of cerebellar ataxia with clinical improvement. [[Sriranjini SJ, Pal PK, Devidas KV, Ganpathy S. Improvement of balance in progressive degenerative cerebellar ataxias after Ayurvedic therapy: A preliminary report. *Neurol India.* 2009;57:166–71.](#)]

Abhyanga massage is the therapeutic intervention of Panchakarma in which the body is treated with simple or medicated oil (full body or on particular body part) according to the need. Abhyanga is promising in reducing subjective stress experience. It has displayed beneficial in lowering HR in all and Blood Pressure in prehypertensive subjects. [[Basler AJ. Pilot study investigating the](#)

MARMA CHIKITSA

MarmaChikitsa is an advanced technique of Ayurveda related to diagnosis, treatment of particular disease and reducing pain. [Arvind Kumar Yadav, RitaMarwaha, NishaBhalerao, Swatantra Kumar Chourasia,Shradhha Sharma. Pain management through MarmaChikitsa. *J Ayurveda Integr Med Sci* 2022;2:69-76.] The ancient Ayurvedic literature classified 107 vital parts of the body as a seat of prana (life force), and collectively referred to them as Marma.

In present scenario MarmaChikitsa is quite popular in various parts of India due to its quick, permanent, natural, and non-invasive method of therapy. It has developed as new aspects in Ayurvedic non-pharmacological treatment. MarmaChikitsa, when correctly stimulated, aids in the maintenance of the body's vitality and the treatment of disease/pain through natural healing agents such as prostaglandin. [Pain management through MarmaChikitsa -Arvind Kumar Yadav et al.]

Marma therapy's goal is to provide instant pain relief. Marma stimulation can provide analgesia by secreting a variety of prostaglandin inhibitors, endorphins, interferon, and other opioid-like chemicals that are 100 times more effective than opium. MarmaChikitsa can help with traumatic neurological or neurosurgical lesions, paraplegia, hemiplegia, monoplegia, intervertebral disc, and other conditions. It can assist to relieve pain in the nerves, muscles, ligaments, bones, and joints. It can also help improve the function of body organs and achieve equilibrium. MarmaChikitsa is a neuro-endocrine system practitioner. Actually, when pressure or stimulation is applied to certain areas, specific chemical substances and neurotransmitters such as endorphins and enkephalin are released, which convey nerve impulses to the brain, resulting in the desired effect. Another theory states that the very minor electrical changes that occur at Marma points are capable of producing effect for in charge of initiating the desired effect.

HEALTH TOURISM

It is pertinent to mention that national as well as international acceptance of Ayurvedic healing has undoubtedly expanded the boundaries and prospects of Ayurveda tourism. Ayurvedic treatments and rejuvenation therapies are becoming increasingly popular in wellness tourism. India is an important hub for Ayurvedic tourism as it involves low medical cost in comparison to other countries.

The amount of tourists flocking to Ayurveda is expanding at a rate of roughly 20-25 percent per year. The Indian Ayurvedic market is worth Rs 50 billion and is growing at a rate of 10-15% per year, with the similar rate of growth expected for the next ten years. [Muralidhar and Karthikeyan (2016)]. Ayush Wellness Centres under the National Ayush Mission has received a budget of Rs. 3,400 crore (US\$ 464.68 million) for the next five years towards the development.

High-quality health-care service delivery in conventional as well as Ayush systems, low cost, and proximity to some potential countries have made India one of the most popular destinations for medical value travel. Publication of an Indian standard IS 17942: 2022 – "Tourism and Related Services – Medical Tourism – Service Requirements" as a modified adoption of ISO 22525: 2020 with inclusion of Ayush-related provisions is also poised to boost the medical value travel related to Ayush sector.

The Indian government recognizes the potential of Ayurveda in health tourism and has been taking steps to promote it. The future scope of health tourism in Ayurveda is promising and has the potential for significant growth. It is important to maintain high-quality standards, conduct research to validate treatment efficacy, ensure proper regulation, and promote authentic practices to build trust and credibility in the industry.

A further significant development in the Indian Ayurveda business is the increased use of digital platforms for marketing and distribution, as well as Ayurveda-based digital health platforms. Online platforms have assisted in leveraging digital media to reach a larger audience. The advent of new Ayurveda-inspired brands has resulted in the evolution of breakthrough technology to offer tailored Ayurvedic treatments and products, as well as the launch of their own digital health platforms to give consumers with online consultations, personalized treatments, and wellness plans.[<https://www.indiaretailing.com/2023/05/27/ayurveda-market-in-india-trends-and-growth-outlook/>]

India is the second largest exporter of AYUSH(Ayurveda, Yoga, Unani, Siddha& Homeopathy) drugs as per Pharmaceutical Export Promotion Council of India (Pharmaexil). There is a global renaissance in traditional and alternative health care systems, resulting in a global herbal commerce worth US\$ 120 billion, which is anticipated to grow to US\$ 7 trillion by 2050. [A.Ganeshan et al 2016.]

DRUG DISCOVERY AND NEW FORMS OF DRUG DELIVERY

Several medications have been produced and practiced as 'tradition to trend' from Ayurveda to current therapy. For better therapeutic leads, the potential of Ayurvedic medicine should be investigated further using modern scientific validation methodologies. Several lead compounds have been created from Ayurvedic plants that have a variety of notable medicinal properties. [Mukherjee PK, Harwansh RK, Bahadur S, Banerjee S, Kar A, Chanda J, Biswas S, Ahmmed SM, Katiyar CK. Development of Ayurveda - Tradition to trend. *J Ethnopharmacol.* 2017 Feb 2;197:10-24. doi: 10.1016/j.jep.2016.09.024. Epub 2016 Sep 12. PMID: 27633405.]

In a comprehensive review and meta-analysis of Ayurvedic-based herbal remedies for hypercholesterolemia by [Gyawali et al. (2021)] three Ayurvedic herbs-garlic, guggul, and black cumin-were identified as safe and beneficial in lowering cholesterol biomarkers. In addition to drug discovery using Ayurvedic medicine, novel techniques of medication delivery can be investigated. For example, a drug delivered through the nasal mucus membrane has a systemic effect, and one notable research demonstrated that using Devadali juice (*Luffaechinata*) as Nasya (Ayurvedic treatment in which medicine is infused through nostrils) resulted in a significant

reduction in the elevated serum bilirubin level in the case of viral hepatitis. [Nishteswar K. et al.31. modes of action Nishteswar K. Science of Marma (in Ayurvedic diagnosis and treatment). Ayu. 2015 Jan-Mar;36(1):113-4. PMID: PMC4687231.]

Fumigation therapy is one of numerous Ayurvedic therapeutic modalities in which patients breath fumes produced by specific medicine formulations. This medicinal technique provides interesting study potential from a phytochemical and ethnopharmacological standpoint, but it goes unnoticed. Fumigation is recommended by Ayurveda as a sterilizing and curative process for a variety of human ailments, including microbiological infections and psychiatric disorders. [Vishnuprasad CN, Pradeep NS, Cho YW, Gangadharan GG, Han SS. Fumigation in Ayurveda: potential strategy for drug discovery and drug delivery. J Ethnopharmacol. 2013 Sep 16;149(2):409-15. doi: 10.1016/j.jep.2013.07.028. Epub 2013 Jul 29. PMID: 23906781.] Dhupana is treated with bacteriostatic medications such as Guggulu (Commiphoramukul), Vacha (Acoruscalamus), Haridra (Curcuma longa), and others. It reveals that Ayurveda was presumably aware of the role of microorganisms and knowledge of epidemics. [ShubhashreeIJCAM]

VRUKSHAYURVEDA

Cultivation of medicinal plants has become an urgent necessity in order to meet the growing demand for herbal drugs in the field of medicine.[Shubhashree MN, Matapathi S, Dixit AK. Conservation and preservation of medicinal plants-leads from Ayurveda and Vrikshayurveda. Int J Complement Alt Med. 2018.]. The ancient Indian science of plant life known as Vrukshayurveda works with a variety of tree and plant species and promotes healthy growth and productivity. To ensure quality of medicinal plants, in futuristic context, Vrukshayurveda is quintessential. Chemical fertilizers and pesticide are petroleum derivatives. The world's oil reserves will run out within the next 20 to 25 years, making this agricultural system unsustainable. Alternate cultivation methods are to be developed and Vrukshayurveda is a best option for future.

Vrukshayurveda emphasizes the identification, cultivation, and research of medicinal plants. With the advancement of technology, such as genetic engineering and biotechnology, Vrukshayurveda can contribute to the development of new plant-based medicines and therapies. It can help identify specific compounds and their therapeutic properties, leading to the discovery of novel remedies for various ailments. [Dr. S. A. Meshram, Dr. A. A. Meshram. Vrikshayurveda - A Boon. J Ayurveda Integr Med Sci 2019;6:186-189.]

As concerns about environmental sustainability grow, Vrukshayurveda can promote organic and sustainable farming practices. It can provide guidance on natural fertilizers, pest control methods, and optimal cultivation techniques, reducing the dependence on harmful chemicals and promoting eco-friendly agriculture. Pacagavyam, kuapajala (natural organic liquid manure made from animal and plant products), and other techniques can be investigated further for efficacy and, if proven to be suitable, can be used for the various processes required in developing an organic nursery protocol for medicinal plants. [Shubhashree MN, et al.]This approach aligns with the increasing global demand for natural and environmentally friendly solutions. Health hazards caused by rampant use of chemical fertilizers and pesticides can be cut down. Health hazards in human beings like Digestive ailments, Cancer, Physical and Mental ailments, Reproductive abnormalities, Immune suppression, Hormone disruption etc are due to the haphazard use of chemical fertilizers and pesticides, so if these methods are incorporated as mentioned in Vrukshayurveda(Bio fertilizers, various cultivation techniques, Pest control like fumigation with Sarshapa-Brassica juncea,Hingu-Ferula asafoetidaetc) in agriculture the incidence of deadly diseases in future can be reduced. [AshwiniJeerankalagi, Shivanand T Biradar, Shashidhar P Naik, D N Dhari, Vidyalaxmi S Pujari. The relevance of Vrukshayurveda for organic cultivation of medicinal plants. J Ayurveda Integr Med Sci 2022;1:329-333.]

Phytochemistry and Pharmacology in Vrukshayurveda can contribute to the exploration of plant-based compounds and their interactions with the human body. By conducting in-depth phytochemical and pharmacological studies, it can provide a scientific basis for the efficacy and safety of Ayurvedic medicines. By studying the individual characteristics and genetic makeup of patients, it can help identify the most suitable medicinal plants and formulations for their specific health conditions. This research can lead to the development of standardized plant extracts, ensuring consistent quality and potency in Ayurvedicformulations. Vrukshayurveda and modern biotechnology can be amalgamated for the benefit of society in future.Vrukshayurveda can help Ayurveda evolve into a more robust and effective healthcare system in the future.

Hence, there is great scope to integrate traditional approaches for increased production of high-quality planting materials. Ayurvedic literatures acknowledged the relevance of multidisciplinary approaches and emphasized the integration of multiple domains as a viable tool for medical science progress.

PASHU AYURVEDA(VETERINARY SCIENCE)

Central Council for Research in Ayurvedic Sciences (CCRAS), under Ministry of Ayush, Government of India, has actively undertaken numerous endeavors to establish veterinary Ayurveda as an evidence-based science. In this regard, “The Ayurvedic Formulary of India, Part-IV (Veterinary)” was published by the Ministry of Ayush in October 2022, comprising 50 selected formulations to facilitate the manufacture and use of Ayurveda Veterinary Drugs. The ministry has taken steps to explore and revive local health traditions in veterinary Ayurveda. CCRAS is in collaboration with different Veterinary Universities regardingthe uses of medicinal plants in veterinary practices. Trans-Disciplinary University (TDU), Bengaluru, is working on developing practical and farmer-friendly ethnoveterinary practices. The National Dairy Development Boards (NDDB) is promoting these practices throughout the country in regional languages. Undoubtedly, these initiatives will open new avenues to the practitioners, manufacturers, researchers, academicians, and enthusiasts in the field of veterinary Ayurveda in future.[Acharya R. Research in PashuAyurveda:Future prospect. J Drug Res AyurvedicSci 2023;8:95-6]

NANO MEDICINE

“Rasashastra,” is an integral part of Ayurveda, which deals with medications of mineral origin and comprehensively covers their variety, features, processing procedures, qualities, therapeutic purposes, and management of adverse effects. Metal-based remedies, known as bhasmas in Ayurveda, are used to treat a variety of ailments. Bhasmas are a type of Ayurvedic metallic/mineral

preparation that is combined with herbal juice or decoction. A Bhasma is an incinerator ash; the beginning material goes through an elaborate purification process, which is followed by the reaction phase, which involves the incorporation of various minerals and/or herbal extract. Particle size (1-2) is greatly reduced, facilitating medication absorption and assimilation into the human system. [Pal D, Sahu CK, Haldar A. Bhasma : The ancient Indian nanomedicine. *J Adv Pharm Technol Res.* 2014 Jan;5(1):4-12. doi: 10.4103/2231-4040.126980. PMID: 24696811; PMCID: PMC3960793.]The end product would be a nontoxic material. Examples are SwarnaBhasma, ShankhaBhasma, TamraBhasma etc. Gold in tradition Indian Ayurvedic medicine as SwarnaBhasma (gold ash) has been characterized as globular particles of gold (56-57 nm).Gold nanoparticles have been detected in Swarnabhasma and the formulation was found effective asantiarthritic agent in rats [Brown C. L., et al.](#) Bhasma-inspired new drug discovery approach could emerge in future where in several metals based nanomedicines could be developed. [Chaudhary A. et al.]

Bhavana is a unique traditional method of transformation of raw material/substances into pharmaceuticals through levigation or wet grinding of powdered drugs with juice/decoction/solution of plant, animal, or mineral origin. This approach provides the unique power of influencing a drug's physicochemical and biological properties, making the drug act faster, stronger, and longer with a with minimal dose. [Chaudhary A, et al.]

Thus, the Bhasmas as nanomedicines may offer a huge potential for designing new drugs employing the concept of nanotechnology.

MANAGEMENT OF NONCOMMUNICABLE DISEASES

With the successful conquest of communicable infectious diseases in the majority of the world, noncommunicable disease (NCD) has emerged as the greatest health threat of the modern era. [Saklayen MG. *The Global Epidemic of the Metabolic Syndrome. CurrHypertens Rep.* 2018 Feb 26;20(2):12. doi: 10.1007/s11906-018-0812-z. PMID: 29480368; PMCID: PMC5866840.]

MoreoverNoncommunicable diseases impose a large financial burden on the economies of many countries. NCDs are chronic and long-lasting diseases that pose one of the most serious health issues today. In this quest, Ayurveda provides solutions to NCD prevention and the development of long-term habits for a healthy lifestyle. Ayurveda is a comprehensive lifestyle that improves general well-being, balances the mind and body, and guides humanity toward a healthy future.

According to the ICMR India State-Level Disease Burden Study report "India: Health of the Nation's States," the estimated proportion of all fatalities caused by NCDs has risen from 37.09% in 1990 to 61.8% in 2016.

The main risk factors for noninsulin-dependent diabetes are physical inactivity, poor diet, sedentary lifestyle choices, and stress. Ayurveda emphasizes the management of Prameha (Diabetes) by diet and lifestyle changes (which can be correlated to diabetes). [Guddoye G, Vyas M. *Role of diet and lifestyle in the management of Madhumeha. Ayu J.* 2013;34:167–73.] Studies have also shown the effectiveness of Ayurveda intervention in the management of type 2 diabetes. [Panda AK, Ratha KK, Rao MM. *Efficacy of ayurveda formulation ayush-82 (IME-9) in newly diagnosed type 2 diabetics: Retrospective analysis of individual data. J Tradit Med ClinNatur.* 2017;6:250.]

Keeping in view the strength of AYUSH systems for the prevention and management of NCDs by promoting healthy lifestyle, a project aimed for “Integration of AYUSH (Ayurveda) with National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)” was conceived in 2015 by the Ministry of AYUSH and Central Council for Research in Ayurvedic Sciences (CCRAS) in collaboration with Directorate General of Health Services, Ministry of Health and Family Welfare (MoHFW), for imparting health services on pilot basis in the three districts of three states, namely Bhilwara (Rajasthan), Gaya (Bihar) and Surendranagar (Gujarat) and promising results were observed [Sharma R, Shahi VK, Khanduri S, Goyal A, Chaudhary S, Rana RK, Singhal R, Srikanth N, Dhiman KS. *Effect of Ayurveda intervention, lifestyle modification and Yoga in prediabetic and type 2 diabetes under the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)-AYUSH integration project. Ayu.* 2019 Jan-Mar;40(1):8-15. PMID: 31831963; PMCID: PMC6892000].

GERIATRICS

Future systems are characterized by sophisticated technology with a community responsibility for health and well being and a new approach to ageing. Enhancing wellness scores over curing disease.Ten years from now, more patients will be living longer. [Garson A et al.](#)Many countries are experiencing an aging population, with a larger proportion of elderly individuals. One-fifth of the world's population will be over the age of 65 by 2050.[[Ingle GK, Nath A \(2008\) Geriatric health in India: concerns and solutions. Indian J Community Med 33: 214-218.](#)]

According to the most recent forecasts, the number of persons aged 80 and more will triple in the next 30 years. Many regions' 65-year-old population will double by 2050, while worldwide life expectancy beyond 65 will rise by 19 years. [<https://www.un.org/development/desa/en/news/population/our-world-is-growing-older.html>].This demographic shift emphasizes the need for specialized healthcare services and geriatric care. Advancement of age usually creates physical, psychological, emotional, and social problems.

Geriatric care needs to tackle two-fold problems: first, fundamental anti-ageing care that reduces the rate of physiological ageing, and second, medical management of disorders that emerge exclusively in old age.Although the quality of life may not be as important, conventional contemporary medicine appears to be strong in the management of old age-related health conditions. Ayurveda, on the other hand, has the potential for disease prevention through health promotion as well as disease management in old age. [Rai, Amit et al.]

Ayurveda helps in managing chronic conditions commonly associated with aging, such as joint pain, arthritis, digestive issues, cognitive decline, and stress-related disorders. In functional and degenerative disorders that have a chronic or long standing nature Rasayana therapy is the only solution for effective management in any system of medicine. Vayasthapana are specialized Rasayana drugs that arrest degenerative changes, increase life span with quality health.[[Tripathi B \(2008\) ChikitsaSthan 1/7, CharakSamhita Part 2, ChaukhambhaSurbhartiPrakasan, Varanasi, India. Pg no: 5.](#)]Ayurvedic treatments often include natural

remedies, herbal medicines, lifestyle modifications, dietary changes, which are generally well-tolerated by the elderly population compared to invasive procedures or strong pharmaceutical drugs. [Stratton RJ, Green CJ, Elia M (2003) Disease-related malnutrition: an evidence-based approach to treatment. CABI Publishing, Wallingford, UK.] Ayurvedic Geriatric care (Jarachikitsa) and Rasayana methodologically delay ageing which begins at 60-70 years and reduce geriatric degeneration.

Ashwagandha (*Withaniasomnifera*), Amalaki (*Phyllanthusemblicus*) are some of the Rasayana drugs which are used in old age. The integration of Ayurveda with modern medicine can provide a comprehensive approach to geriatric care, combining the strengths of both systems to improve health outcomes for the elderly. Geriatric care in Ayurveda is gaining recognition and importance, and it is likely to continue to do so in the future.

RASAYANA

Rasayana is a special branch of Ayurveda, which deals with methods of rejuvenation methods such as food recipes and regimens, herbal and mineral supplements, and health-promoting lifestyle choices that are thought to improve quality of life and delay aging. [Udapa MH, Et al.] In fact the ideal time for treating the geriatric problems is youth. It is interesting to know the exemplary effects of the fruits of pomegranate (*Punicagranatum L.*), which has shown the life-span and health-span enhancing action, when tested on *Drosophila melanogaster* (fruitfly) model. In the study conducted by [Balasubramani SP, Et al] there was a two fold increase in fecundity, improved resistance to oxidative stress (H_2O_2 and paraquat induced) and to *Candida albicans* infection in pomegranate fed flies which demonstrate the rasayana action. [Pathak P, Prasad BR, Murthy NA, Hegde SN. The effect of *Emblica officinalis* diet on lifespan, sexual behavior, and fitness characters in *Drosophila melanogaster*. *Ayu*. 2011 Apr;32(2):279-84. doi: 10.4103/0974-8520.92544. PMID: 22408317; PMCID: PMC3296355.]

Exploring innovative ways to ensure healthy aging of populations is a pre-requisite to contain rising healthcare costs. Scientific investigation and research into the principles and practices of traditional remedies can yield new insights and simple answers for living a healthy lifestyle.

Ayurveda considers ageing as the Swabhavajavyadhi i.e. it is inherent nature of the living being to get old. Ancient text Sarangadhara Samhita presents an interesting scheme of loss of different biological factors during different decades of life as a function of ageing. This is especially significant as it can provide a guideline for selection of age-specific organ-protective Rasayana to retard aging.

TABLE 1: AGE RELATED DEGENERATIONS AND PREVENTABLE RASAYANAS

Sl.No	Decades	Age related bio-losses	Restorative Rasayanas
1	0-10 yrs	Loss of Corpulence (Balya)	Vacha(<i>Acorus calamus</i>), Gambhari(<i>Gmelina arborea</i>), Swarna(gold)
2	11-20	Loss of Growth (Vridhi)	Gambhari(<i>Gmelina arborea</i>), Bala(<i>Sidacordifolia</i>), Ashwagandha(<i>Withaniasomnifera</i>)
	21-30	Loss of Lusture (Chhavi)	Haridra(<i>Curcuma longa</i>), Kumari(<i>Aloe vera</i>), Louha
4	31-40	Loss of Intellect (Medha)	Shankhapushpi(<i>Convulvulus prostratus</i>), Brahmi(<i>Bacopamonnieri</i>), Jyotishmati(<i>Celastrus paniculatus</i>)
5	41-50	Loss of Skin glow	Jyotishmati(<i>Celastrus paniculatus</i>), Chironji(<i>Buchanania lanzan</i>), Bhrinjaraja(<i>Eclipta alba</i>)
6	51-60	Loss of Vision (Drishti)	Triphala, Jyotishmati(<i>Celastrus paniculatus</i>), Shatavari(<i>Asparagus racemosus</i>), Saptamrita Lauha
7	61-70	Loss of Virility (Shukra)	Kapikachu(<i>Mucunapruriens</i>), Ashwagandha(<i>Withaniasomnifera</i>)
8	71-80	Loss of Strength (Vikram)	Bala(<i>Sidacordifolia</i>), Shilajeet, Ashwagandha(<i>Withaniasomnifera</i>)
9	81-90	Loss of Cognitive power	Brahmi(<i>Bacopamonnieri</i>), Mandukaparni(<i>Centella asiatica</i>)
10	91-100	Loss of Locomotive ability	Bala(<i>Sidacordifolia</i>), Ashwagandha(<i>Withaniasomnifera</i>)

Certain recent studies on popular rasayana remedies like Amalaki(*Emblica officinalis*), Ashwagandha(*Withaniasomnifera*), Guduchi(*Tinospora cordifolia*), Brahmi(*Bacopamonnieri*) and Chyavanprasha have shown evidence to suggest their efficacy as anti-aging remedies.

NAIMITTIKA RASAYANA

According to the disease condition, specific Rasayana drug known as naimittikarasayana are administered such as Pippali Rasayana, Bhallataka Rasayana in Kustha (skin diseases). [Vashistha N, Sharma P. Inside review of Naimittika Rasayana. *International Journal of Research and Review*. 2021; 8(3): 102-106.] It improves immunity, exhibits multidimensional activities like antioxidant, tissue protective, immune stimulant and improves quality of life. Rasayana play a vital role as they provide curative and health promoting effects during recuperation too.

ACHARA RASAYANA

Achararasayana is a unique concept in Ayurveda which refers to specific code of conduct, lifestyle and behavior and plays an important role in the prevention and management of psychosomatic disorders in future. It is a cognitive behavioral therapy that focuses on changing automatic negative thoughts that can exacerbate and contribute to emotional difficulties, depression, and anxiety. It is a cost-effective technique for reducing the global illness burden. [Shivani S. Dhurgude et al: *The Importance of AcharRasayana in Chittodvega (Mental Disorders)*. *International Ayurvedic Medical Journal* {online} 2022 {cited July 2022}]

MENTAL HEALTH

The coronavirus pandemic has created a psychological havoc across nations. The classical texts of Ayurveda advocate certain principles to be followed in life for ensuring good physical and mental health, overall well-being, and optimum quality of life. [Chandhok S, Shubhashree M N, Chandrasekharan C. *Relevance of Charaka's principles for psychological well-being during the COVID pandemic*. *J Appl Conscious Stud* 2022;10:140-7]. In Ayurveda, psychological and mental well-being is considered equally important as any other physical ailment. The principles of Ayurveda suggest the regime that individuals should follow to maintain optimum psychological well-being. For optimum, significant and long-term outcomes, knowledge and principles of Ayurveda are to be combined with modern-day psychotherapy to expand reservoir of coping resources. There are many herbal tranquilisers which are found safe and effective for long term use . Ex- Brahmi (*Bacopamonneiri*)

WOMEN'S HEALTH

Polycystic Ovarian Syndrome (PCOS) is a common endocrinopathy faced by the women today. It is frequently associated with the reproductive system, resulting in menstruation abnormalities, infertility, obesity, depression, sleep apnea, insulin resistance, and, in time, diabetes mellitus, endometrial cancer, cardiovascular disease, and other complications. Ayurvedic therapies aid in reduction of the weight and also reduce the symptoms of PCOS. It aids in the reduction of insulin resistance by promoting ovulation, which is one of the most important aspects in the preservation of fertility. [ShahinaMole.S, et al.]

GarbhiniParicharya(Antenatal care), which contains dietetic and other regimens advocated in Samhitas for pregnant women, is of great significance for future. Ayurveda give importance to antenatal care (GarbhiniParicharya) and postnatal care (SutikaParicharya) which are well described in ancient classical texts. Now a days due to changes in life style, culture, food habits, hectic schedule, elective Caesarian Section has become a common phenomenon. Adopting good antenatal care practices helps normal delivery with good and effective uterine contractions during labor and also leads to proper contraction of uterus after labor preventing post partum complications.[Dr. Sachin Mittal,Dr. Rajesh Gupta. *Effect of anuvasanabasti and yoni pichu in sukhrasava& reducing postpartum complications*.]Treatment like Balasidhatailamatrabasti(enema with medicated oil) and Yonipichu(vaginal tampon)in 9th month of pregnancy helps in increasing tone, smoothening of pelvic region and related organs. Yoni pichu brings contractility of uterine muscle and helps in cervical ripening by altering the cervical matrix and helps in releasing prostaglandins. [Swati Malsariya, K. Bharathi, B. Pushpalatha. *Effect of Bala Siddha TailaMatraBasti and Yoni Pichu in Achieving Sukhrasava: A Case Study*. *International Journal of Ayurveda and Pharma Research*. 2020;8(Suppl 2):83-87. Sutikaparicharya (puerperium care) maintains maternal and infant health by preventing complication and establishing infant feeding. Abhyanga(Oil massage) during puerperal period causes toning up of muscles of pelvic floor, abdomen, back and vagina and prevents thrombosis [sthaVerma, Sonalika, Hiremath, SheelaMallikarjuna, SrideviSwamy. *SutikaParicharya - Post Natal Care in Ayurveda*. *J Ayurveda Integr Med Sci* 2017;3:175-180.]Ayurveda can also be of great use in menopausal phase and as a substitute to hormonal therapy.

AYURVEDA AND TECHNOLOGY

Artificial Intelligence (AI) and Machine Learning (ML) has emerged as tools that hold potential to revolutionize the field of healthcare, including the practice of Ayurveda. AI and ML can assist in the diagnosis of diseases, suggest personalized treatment plans and optimize patient outcomes. By developing language models and algorithms that are specifically trained to understand and process Indian languages, researchers and practitioners can effectively leverage AI and ML techniques to extract valuable insights from Ayurvedic texts, medical literature, and patient records written in regional languages. This advancement facilitates better communication, knowledge sharing, and innovation within the Ayurvedic community, promoting the preservation and dissemination of traditional medical knowledge across diverse linguistic and cultural contexts. Natural Language Processing (NLP) can assist in the digitization and organization of Ayurvedic texts and ancient manuscripts, making them more accessible and searchable for researchers, practitioners, and enthusiasts. By extracting valuable information from these texts, NLP can aid in the discovery of new insights, formulations, and treatment approaches. Additionally, NLP can enhance the accuracy and efficiency of patient consultations by facilitating intelligent chat bots or virtual assistants. These AI-powered tools can understand patients' queries, symptoms, and medical histories in natural language, enabling personalized recommendations and advice. NLP algorithms can also analyze patient feedback and reviews, helping to identify patterns and improve the efficacy of Ayurvedic treatments.

Furthermore, NLP can assist in cross-linguistic research and knowledge sharing in Ayurveda. By enabling translation capabilities and language understanding, NLP can bridge the gap between different languages and cultures, allowing practitioners and researchers from diverse backgrounds to collaborate and exchange information effectively.[Khurana, D., Koli, A., Khatter, K. et al. *Natural language processing: state of the art, current trends and challenges*. *Multimed Tools Appl* 82, 3713–3744 (2023).]

Classification and regression are machine learning techniques that can be used in Ayurveda to make sense of patient data and improve treatment outcomes. Ayurveda, has also started embracing these technological advancements to enhance its reach and effectiveness. The integration of digital health and telemedicine in Ayurveda has the potential to expand the reach of this traditional healing system, facilitate personalized care, and improve patient outcomes.[Vodička, S., &Zelko, E. (2022, September 28). *Remote consultations in general practice – A systematic review*. *Slovenian Journal of Public Health; De Gruyter Open*.]

TECHNOLOGICAL ADVANCEMENT

The digitization of Ayurvedic healthcare facilitates the collection and analysis of vast amounts of patient data. This aggregated information can be anonymized and used for research purposes, leading to insights on the effectiveness of Ayurvedic treatments, identifying patterns in diseases, and supporting evidence-based practices. The application of data analytics and machine learning can further enhance the understanding of Ayurvedic concepts and refine treatment protocols.

The globalization of Ayush necessitates standardization, both at the national and international levels, in terms of terminology, clinical examination, diagnosis, health record maintenance, interventions in the form of herbs, herbal/herbo-mineral formulations, diet and lifestyle, drugs, and pharmacovigilance specific to these systems. [Dua, Pradeep Kumaret al Standardization in AYUSH systems: Bureau of Indian Standards (BIS) and International Organization for Standardization (ISO) perspectives. *International Journal of Ayurveda Research* 4(1):p 5-14, Jan–Mar 2023]. Ministry of AYUSH is actively engaging with WHO for development of Standardized Terminologies of Ayurveda, Siddha and Unani systems of Medicine .For ex- Namaste portal

A. NAMASTE Portal

Namaste Portal is the comprehensive web-portal for Standardised Terminologies and National Morbidity Codes of Ayurveda, Siddha and Unani Systems of Medicine and WHO-ICD-10 and ICD-11.[Sheshagiri, Srihari. "NAMASTE Portal: A standard reference repository for Ayurveda terminologies." *Journal of Indian System of Medicine*, vol. 9, no. 1, Jan.-Mar. 2021, p. 1. *Gale OneFile: Health and Medicine*.]The objective is to provide a single window access to the information and services being provided by Indian government for citizens and stake holders. It is being maintained successfully for the collection of Morbidity statistics through National Ayurveda, Siddha and Unani Morbidity codes.

B. AYUSH Grid

The Ministry of AYUSH has initiated steps to set up a nationwide digital platform called “AYUSH GRID” which aims to bring onboard all AYUSH facilities including hospitals and laboratories and to promote traditional systems of healthcare.

C. The AYUSH Research Portal

The AYUSH Research Portal is meant for disseminating the information related to the AYUSH and the current research updates purely meant for academic purpose.

AYUSH STARTUP

Government of India is extending its support for emerging startups in Ayurveda. All India Institute of Ayurveda (AIIA) under Ministry of Ayush has launched “Ayushstart ups challenge” to encourage early start ups to work on innovation in Ayurveda and aims to recognize and endorse inventive startups operating in the Ayush domains while leveraging the potential of emerging technologies.For instance, Food Innovations in Ayush Sector – Ready to Eat Nutritious Ayurveda Ahara (Food), Ayush Bio-instrumentation (Hardware Solutions) and Innovations in healthcare enabling breakthrough performance in terms of better outcomes are some of the examples. [<https://www.startupindia.gov.in/content/sih/en/ams>]In order to recognize India’s age old principles of Ayurveda and the Aahara prepared as per ancient texts, Food Safety and Standards Authority of India (FSSAI) has formulated Food Safety and Standards (Ayurveda Aahara) Regulations, 2022 in consultation with the Ministry of Ayush and notified the regulations in the official gazette on 5th May, 2022.The regulations define “Ayurveda Aahara” a food prepared in accordance with the recipes or ingredients or processes as per method described in the authoritative books of Ayurveda listed under ‘Schedule A’ of these regulations. [<https://pib.gov.in/PressReleasePage.aspx?PRID=1846185>]

PHARMACOVIGILANCE

Medical pluralism is a growing trend and people are exploring various options including modern, traditional, complementary and alternative medicine. Global concern on drug safety paved way to pharmacovigilance. People are unaware of the need to be vigilant during use of herbal medicines alone or in combination with other medicines. People are of the notion that Ayurveda medicines cause no harm and self medicatethemselves. Drug herb interactions and medical pluralism are very common during these years. Many diabetes patients are known to take herbal remedies with anti-diabetic qualities in addition to their conventional therapies, which may provide both a benefit and a potential risk due to drug interactions. For instance Methi(Fenugreek) and Metformin are consumed by diabetic patients with out knowing the probable drug interactions. Similarly,drug interactions between allopathictranquilizers and Ayurvedic drugs (Brahmi and Alprazalam) for sleeplessness,Nonsteroidal anti-inflammatory drugs and Ayurvedic drug Guggulu(*Commiphoramukul*) for pain management are yet to be explored. [Way ahead for excecution of pharmacovigilanceprogramme. Dr. Shubhashree M N.]Due to intrinsic pharmacokinetic and dynamic interactions, variability in herbal product compositions, unsupervised self-administration and lack of adequate knowledge about the ingredients and their pharmacological properties, there is a serious risk of potentially adverse herb-drug interactions. [RajarshiBhadraKeyvanRavakhah and Raktim K GhoshHerb-drug interaction: The importance of communicating with primary care physicians]

Scientific validation and documentation of Ayurvedic medications are critical for quality assessment and global acceptance. Ayurvedic herbs' therapeutic efficacy can be boosted by excellent quality, which can be attained through identification, purity, safety, drug content, physical and biological qualities. Ayurvedic remedies must be investigated using current scientific methodologies in order to be validated.

The Bureau of Indian Standards (BIS) is the National Standards Body of India which is involved in developing National Standards on products, processes, and services which are called as “Indian Standards.” At present Ayush department in BIS is involved in creating standards for herbs and AYUSH related materials (equipment, instruments, Yoga accessories, etc.) corresponding to the International Standards.

AYUSH-GLOBAL SCENARIO

“AYUSH” refers to traditional and unconventional health care and healing systems like as Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy. Traditional medical systems, including Ayush systems, are significant and frequently underutilized health resources with numerous uses, particularly in the prevention and management of lifestyle-related chronic diseases and in satisfying the health demands of the aging population. Owing to the Health challenges of the 21st century, interest in Ayush Systems is undergoing a revival. The Declaration of Astana of the WHO, adopted at the Global Conference on Primary Health Care in October 2018, made clear that the success of primary health care will be driven by applying scientific as well as traditional knowledge, and extending access to a range of health care services, which include traditional medicines. It is reported that 88% member states have acknowledged use of traditional medicines, which corresponds to 170 member states in WHO. [Pradeep dua et al]

The WHO has also stated in the “WHO Traditional Medicine Strategy 2014–2023” that “for many millions of people, herbal medicines, traditional treatments, and traditional practitioners are the main source of health care, and sometimes the only source of care which is available close to homes, accessible and affordable. It is also culturally acceptable and trusted by large numbers of people. The affordability of most traditional medicines makes them more attractive at a time of soaring health-care costs and nearly universal austerity.”

Appreciating the role of traditional medicines in health care, the WHO has set up a Global Centre for Traditional Medicine in Gujarat, India. It is noteworthy that Ayush experts are formulating ISO standards in collaboration with the BIS to augment the Ayush exports in the global market.

INTERNATIONAL TRADE

In the recent past, there has been a huge international demand for Ayush products and services. In view of the huge potential for growth and export of Ayush systems, the Government of India has set up the Shellac and Forest Products Export Promotion Council with the mandate of export promotion of Herbal extracts. The Pharmaceuticals Export Promotion Council has been tasked with promoting the export of certain herbal products. The Export Development Authority for Agricultural and Processed Food Products encourages the export of Medicinal Plants. Recently, a dedicated Ayush Export Promotion Council has been established to facilitate all aspects of exports pertaining to the Ayush sector. [pradeepdua et al]

The important sectors are Healthy Eating, Nutrition, and Weight Loss (\$946 billion); Physical Activity (\$738 billion); Wellness Tourism (\$436 billion); Traditional and Complementary medicine (\$413 billion); Public Health, Prevention, and Personalized Medicine (\$375 billion). Ayush products are being traded into more than 100 countries either as medicine or as food supplements.

It is also the need of the hour to move toward the United Nations Sustainable Development Goal 3 (UN SDG 3) – Ensuring healthy lives and promoting well-being for all at all ages – By achieving Universal Health Coverage (UHC), addressing health emergencies and promoting healthier populations. Ayush systems can make a significant contribution to the goal of UHC by being included in the provision of essential health services.

High-quality health-care service delivery in conventional as well as Ayush systems, low cost, and proximity to some potential countries have made India one of the most popular destinations for medical value travel. Publication of an Indian standard IS 17942: 2022 – “Tourism and Related Services – Medical Tourism – Service Requirements” as a modified adoption of ISO 22525: 2020 with inclusion of Ayush-related provisions is also poised to boost the Ayush sector.

COSMETOLOGY

Consumers are going green globally specially in cosmetics market. Recently the growth of beauty products are driven by products that are natural or herbal and it has been increasing gradually. Ayurvedic Cosmetics are in demand as they are safe the focus is more on translating ancient ayurvedic formulas into the products of the modern world. Extracts taken from plants and other natural substances are formulated into cosmetic products like moisturizers, to provide a comprehensive beauty range serving mankind.

INTEGRATIVE MEDICINE

Integrative Medicine is a relatively new area that is widely recognized as a cost-effective problem-solving strategy that simplifies the management of incurable and complex conditions for which current medicine has nothing to offer. The creation of an integrated medicine health incubator is critical to the creation of a multidisciplinary program that offers to minimize healthcare costs, out-of-pocket spending, and stresses preventative healthcare as a means of achieving a healthy population in a developing country like India.[Anand A, Tyagi R, Kaur P. *Incubating Integrative Medicine in India through PMO's Atal Incubator Scheme of NitiAayog. Ann Neurosci.* 2017 Jul;24(3):131-133. doi: 10.1159/000477149. Epub 2017 Jul 24. PMID: 28867893; PMCID: PMC5566680.] Integrative healthcare centers are functioning at prestigious institutes like All India Institute of Medical Sciences (New Delhi), National Institute of Mental Health And Neuro-Sciences (Bangalore).

Affordability, accessibility, and availability of health care, as well as disproportionate growth and illness burden, have emerged as key challenges in India. Emphasizes the need for a shift in thinking from illness-disease-drug-centric curative techniques to person-health-wellness-centric preventive and promotive approaches. [Patwardhan B, Mutalik G. *Search of novel model for integrative medicine. Chin J Integr Med.* 2014 Mar;20(3):170-8. doi: 10.1007/s11655-014-1745-2. Epub 2014 Mar 4. PMID:

24615209.]NITI Ayog the apex public policy think tank of Government of India is also developing action plan for states to include AYUSH in addressing health and nutrition issues. It is closely working under cooperative federalism to look at gaps to integrate with AYUSH. Integrative treatment protocol is developed by conducting robust integrative research studies. NITI Ayog is working towards making AYUSH part of child development program, early childhood program and school health program.

The novel idea of the integration of health care with modern and traditional medicine, helps the patients with curable and incurable disease through a more scientific approach. For example considering the incurable nature of muscle dystrophy patient the main focus could be on complementary and alternative approach, which includes Ayurveda, known to improve the health of incurable muscle dystrophy patients. Treatment with the yoga and physiotherapy could also be provided which may improve their health at greater level. [Anand A, Tyagi R, Kaur P. Incubating Integrative Medicine in India through PMO's Atal Incubator Scheme of NitiAayog. *Ann Neurosci.* 2017 Jul;24(3):131-133. doi: 10.1159/000477149. Epub 2017 Jul 24. PMID: 28867893; PMCID: PMC5566680]

COLLABORATIVE RESEARCH

Collaborative research efforts can help enhance the understanding, credibility, and acceptance of Ayurveda both within and outside of traditional Ayurvedic communities. Collaborative research brings together experts from various fields such as Ayurveda, modern medicine, pharmacology, biochemistry, and other relevant disciplines. By conducting rigorous scientific studies, researchers can validate the efficacy and safety of Ayurvedic treatments and medicines. This scientific validation is crucial for gaining wider acceptance, integrating Ayurveda into mainstream healthcare systems, and promoting evidence-based practices. Ministry of Ayush is conducting the world's first multicenter Phase - III clinical trial examining the efficacy of Ayurveda in the treatment of Rheumatoid Arthritis. The clinical trial is conducted in accordance with stringent International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use – Good Clinical Practice (ICH- GCP) guidelines. Such Collaborative Projects can propel Ayurveda system of medicine on a global scale into the future.

The Ayush Information cell helps in global promotion and propagation of AYUSH systems of medicine which would lead to signing of Memorandums of Understanding (MoUs) with foreign Governments/ Universities/Institutes, for Country to Country cooperation in the field of traditional systems of medicine, setting up of AYUSH Academic Chairs and undertaking collaborative researches.[<https://hcikl.gov.in/pages>]

Ministry of AYUSH has signed 23 MoUs for undertaking collaborative research with various foreign universities in countries namely Austria Germany, Brazil, United Kingdom, Canada, WHO Geneva, United States, Argentina, Israel, Australia, Tajikistan and Ecuador and signed 13 MoUs for setting up of AYUSH academic Chairs with foreign institutes/ universities in countries like Mauritius, Russia, Argentina, Malaysia, Bangladesh, Latvia, Trinidad & Tobago, etc.[Pib]

The All India Institute of Ayurveda (AIIA), the apex institute of Ayurveda in India under the Ministry of AYUSH, and the National Institute of Advanced Industrial Science and Technology (AIST), Japan has signed an MoU for academic establishment. AIST is a reputed and one of the largest public research organizations in Japan, focusing on technologies and on “bridging” the gap between innovative technological seeds and commercialization.[<https://pib.gov.in/PressReleasePage.aspx?PRID=1865904>]. The MoU will enable both countries to promote research collaboration and building capacities in the field of the Indian Ayurvedic system of traditional medicines. All these activities will be executed in support of the Ministry of Ayush.

In January 2020, Indian Institute of Technology Delhi and the All India Institute of Ayurveda signed a MoU to study the therapeutic benefits of herbal formulations and wellness. Seven collaborations focusing on various Ayurvedic formulations and practices have been planned for the next two years. It includes

- A) Examine the effect of six Ayurvedic juices on gastrointestinal secretions
- B) Develop herbal formulations to reduce harmful effects of reusing cooking oil
- C) Develop a biodegradable herbal wound dressing
- D) Develop ‘DhoopanYantra’—a fumigation device for aiding wound healing
- E) Examine the impact of ashes on proteins implicated in neurodegenerative diseases
- F) Study the effects of ‘Brahmari Pranayama’ on the nervous system
- G) Gauge if Ayurvedic drugs help in early detection of cancer and assess response to these drugs in treating breast cancer

CONCLUSION

Ancient treatise CharakaSamhitha mentions that new ideas are to be incorporated from the world around and learnt .There is something new to learn and imbibe .Ayurveda is a dynamic science and a constant learning process. Sushruta also supports the idea with his quote “Ekamshastramadhyanonavidyatshastranischayam, tasmatbahushrutahshastramvijaniyatchikitsakah” which implies without having the knowledge of other branches of science ,one cannot conclude that it is the best , therefore a physician should study many scriptures.

The concepts of Ayurveda conveyed thousands of years back are relevant now and will continue to do so in the future. The heightened awareness about the efficacy of herbal and traditional medicines as well as surge in research and developmental activities, management of chronic diseases have expanded the scope of Ayurveda.

Ayurveda has gained popularity outside of India, and its recognition as a valid healthcare system may continue to grow in the future.It is hoped that ancient wisdom coupled with modern technology would benefit the mankind in future.

