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Review on New Technology for Ayurvedha Formulations

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Abstract
Ayurveda, one of the world's oldest holistic systems of medicine, emphasizes the balance of body, mind, and spirit through personalized prevention and treatment strategies. Rooted in classical texts, Ayurveda encompasses a vast pharmacopeia of herbal, mineral, and herbo-mineral formulations, traditionally prepared through Panchabidha Kashaya Kalpana and its derived dosage forms such as Churna, Vati, Ghrita, Taila, Asava-Arishta, Avaleha, Bhasma, Pisti, Arka, and Malahara. While these formulations have demonstrated therapeutic potential for centuries, challenges related to standardization, quality control, bioavailability, stability, and safety have limited their global acceptance. The integration of modern technologies—particularly nanotechnology, artificial intelligence (AI), and digital health tools—offers transformative solutions to these challenges. Nanotechnology enhances bioavailability, targeted drug delivery, and shelf life of Ayurvedic medicines, with traditional Bhasmas increasingly recognized as nanoscale materials. AI contributes to drug discovery, formulation optimization, quality control, clinical decision support, and personalized medicine through Prakriti-based assessments. Digital platforms such as TKDL, AYUSH Research Portal, DHARA, and clinical software systems further strengthen research dissemination, standardization, and intellectual property protection. The convergence of traditional Ayurvedic wisdom with advanced scientific technologies promises improved efficacy, safety, and global relevance of Ayurvedic formulations, paving the way for evidence-based, personalized, and integrative healthcare in the future.

Keywords:-Ayurvedha, Ayurvedha formulations,Nano technology, Artificial intelligence, Development of Ayurvedic formulations.

INTRODUCTION
The study of life known as Ayurveda addresses the mental, emotional, and spiritual well-being of each individual as well as those of animals, birds, and plants. Ayurveda is sometimes understood as the science of medicine in a limited sense.(1) Ayurveda is one of the oldest the holistic treatment systems in the world. The origins of Ayurvedic wisdom may be traced back over 5000 years to India, earning it the moniker "Mother of All Healing.The Ashwin twins received the Ayurvedic knowledge from Lord Bramha, which was subsequently transmitted to Daksha Prajapati and Indra. The sage Bharadvaja offered to ascend to heaven in order to acquire ayurvedic knowledge. Its purpose is not to combat illness, but to advance good healthAccording to Ayurveda, being simply free from obvious illnesses and having a strong body are not indicators of health. To be deemed healthy, an individual must possess the discernment of their soul, senses, and mind in addition to the balance of their dosas and dhatus. As a result, Ayurveda treats both the prevention and treatment of diseases, as well as the signs and symptoms of both happy and unhappy lives, as well as medications, diets, drinks, and other regimens that are beneficial or detrimental to

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health.The Ayurvedic formulary is extensive, varied, and in a very good position. As was previously noted, the pharmacopeia of Ayurveda is a rich tradition of herbal practices that describe the medicinal applications of over 600 plants in seventy books that contain eight thousand medicine combination formulations. Ayurvedic medicine literature categorizes medications, food ingredients, and drink constituents into multiple groups. Ayurvedic practitioners likely produced the remedies in their homes up until the 19th century. However, Arya Vaidya Sala of Kottakkal led the way in the 20th century in attempting to industrialize Ayurveda. The use of new technology in Ayurvedic formulation may enable production to increase while requiring fewer raw ingredients.1587 plants are used by Ayurveda in the formulation of numerous well-researched herbal remedies that treat a wide range of illnesses. The primary idea behind Ayurveda is that it customizes the healing experience for each individual.

WHAT IS AYURVEDA

The Sanskrit word for "ayurveda" implies "the science or knowledge of life." If we split the word into its two components, ayur signifies life and veda denotes knowledge science. Ayurveda has a long history, dating back to the 2nd century was founded on the ancient Hindu philosophical principles known as Vaisheshika and the school of logic known as Nyaya.. Ayurveda is a traditional medical system indigenous to the Indian subcontinent. Its five elements are earth, fire, water, air, and ether. These five distinct constituents are grouped by Ayurveda into three types of energy and functional principles. The Sanskrit terms for these operational principles are pitta, kapha, and vata. Vata is made up of air and space. Pitta manifests as the fire and water that make up the body's metabolic system. The energy that gives the body its structure is called kapha. A licensed Ayurvedic physician should ideally provide guidance when practicing Ayurveda, as it requires extreme dedication. Ayurveda is a medical approach that looks at a person's emotional state, spiritual viewpoint, and bodily makeup. Ayurveda acknowledges that external organisms such as bacteria and viruses can contribute to the development of diseases; nonetheless, these are seen as "secondary causes," with the underlying reason being a disruption in the balance between dosas and dhatus.Even the most virulent foreign organisms will not be able to thrive or reproduce to the point ofcausing disease if these dosas and dhatus are in their proper state of equilibrium. Ayurvedic treatments not only treat the underlying cause of the illness but also strengthen the body's defenses against pathogenic microbes. Before beginning to function, the ingredients in these treatments become homologous to the tissues and stop behaving as alien substances. As a result, they have multiple positive effects rather than negative (toxic) ones since they make the body resistant to a variety of different types of organisms. Its origins can be found in antiquated vedic literature, and it addresses the body, mind, and spirit as well as every aspect of our lives.(2)

PANCHABIDHA KASAYA KALPANA (Basic formulations)

Swaras (Juice)

The evolution of liquid oral formulations traces back to administering freshly obtained plant juices, known as Swarasa. This process involves crushing green herbs to extract their juice or, in the absence of fresh herbs, soaking dry powdered herbs in water overnight and then squeezing them through a cloth. For instance, ginger juice is obtained through this method. However, for thick leaves and barks where direct squeezing is not feasible, the putapaka swarasa technique is employed. Here, the raw material is formed into a mass, wrapped in leaves, and covered with mud before being heated until it turns into a red-hot ball. After cooling, the processed material is squeezed to obtain the Swarasa.(3) Examples include Vasa putapaka swarasa and Nimba putapaka swarasa. Due to its heaviness, the dose for Swarasa is half pala (approximately 24 ml), while putapaka Swarasa is prescribed at one pala (approximately 48 ml).

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Additionally, Acharya suggests adding certain Prakeshapa dravyas like honey, sugar, jaggery, alkalies, cumin, rock salt, ghee, oil, and powdered herbs to Swarasa. Swarasa obtained through the putapaka method is typically consumed with one Karsa (approximately 12 gm) of honey

Kwatha (Decoction)

Kwatha is known as a decoction, an extraction technique from later ages that involves boiling dried plant material with water to extract active constituents. This process utilizes heat as a catalyst to dissolve extractable compounds, resulting in a potent liquid known as Kwatha. The quantity of water for the preparation of decoction is also specified according to the quantity and constitution of the drug and the volume of the water remains after boiling is also specified in the text. One part of a coarsely powdered medication is boiled with sixteen parts water over a mild fire until the water volume is reduced to one-eighth part. According to the constituents of the drug (soft, mild or hard), the ratio of water is differs to 4:8:16 parts than the drug. The term "Kwatha," rooted in the process of boiling, underscores its role as a vital extraction method in traditional medicine, synonymous with Shritha, Sheetha, Kashaya, and Niruha.[8] The dose of Kwatha is 50ml.

Hima kalpana (Cold infusion)

Hima kalpana, or cold infusion, offers a method of extracting active principles from medicinal herbs with sheeta veerya (cold potency) and volatile constituents, which heat might otherwise compromise. This technique involves soaking dried plant material in cold water for a specified duration, followed by filtration to obtain the infusion. Traditionally, the ratio of one part powdered drug to eight parts cold water is maintained, and the infusion is consumed within 24 hours of preparation. However, preservative technological advancements have extended these infusions' shelf life. Commonly utilized in day-to-day clinical practice, formulations prepared through hima kalpana cater to various diseases and patient conditions. For instance, Dhanyaka hima, derived from coriander, exemplifies the therapeutic potential of cold infusions in Ayurvedic medicine. The dose of hima kalpana is 2 pala i.e100ml(4)

Phanta kalpana (Hot infusion)

Phanta Kalpana, or hot infusion, represents a refinement of traditional techniques by employing boiled water for extraction. This method entails mixing one part powdered drug with four parts hot water, allowing the mixture to steep for a period before filtration through the cloth. This is known as phanta; it keeps the water-soluble active ingredients found in the herbs. Panchakolaphanta is an example of hot infusion and is used in Ayurvedic formulations. This method adds to the wide range of herbal preparations used in traditional medicine by showcasing an improved method of extracting therapeutic qualitiesDose of panchakola phanta is 100ml.

Upakalpana (Derived Preparation)

Upakalpana(derived preparation) is a medication that is made specifically to meet each patient's needs and be as successful as possible. It is predicated on the Panchabidha Kasaya Kalpana, or five fundamental formulations, from which other dosage forms are derived. This approach aims to increase the efficacy of medications, ensure the stability of the formulation, facilitate simple distribution, and enhance aesthetic appeal. Practitioners can alter dosage forms using these derived forms to meet each patient's individual needs. Patients' preferences and medical situations can be considered while optimizing therapy outcomes by adjusting elements such as formulation type, dosage strength, and administration method. Preparations made from Panchabidha Kasaya Kalpana increase the medication's potency and durability while maximizing bioavailability and efficacy. Additionally, Upakalpana's variety of dose forms, like tablets, capsules, powders, syrups, etc., ensures patient and healthcare provider convenience of use,

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fostering medication adherence and therapeutic efficacy.

Churnas (Powders)

Among the different derived formulations, churn is the oldest solid dosage form and has been used for a long time. In this dosage form, ingredients are dried and pulverized into a fine powder of different sizes. To achieve optimal fineness, the powder is often sifted through a fine cloth, a process known as Vastragalana. In compound churn formulations, each ingredient in complex Churna preparations is individually washed, dried, ground, and sieved before being blended in predetermined ratios. Each one of them (power) is weighed separately and mixed well. Triphala Churna, Sitopaladi Churna, and Maha Sudarshan churnas Narasingha Churna Sringyadi Churna, Avipatti Churnaare well-known formulations used for treatment.

Vati (Tablet/ Pills)

The term "vati" refers to medications that are prepared in tablets or pills. Vati represents a more stabilized and compact form of churnas, culminating in the creation of pills or tablets. The process of vati preparation typically involves three main methods for achieving compactness. Firstly, the drugs are cleaned and dried, and then they fine powder. These are triturated by adding the recommended fluids until they form a soft paste. When indicated, multiple liquids are used one after the other for grinding. After proper trituration, pills will be made manually or by making machine. The characteristics of the final stage of preparation of pills are that they should not adhere to the fingers on rolled. During the preparation of pills, two technical processes have been applied, i.e., Bhavana and mardana, involving trituration with herbal extracts or juices, resulting in a fine dough with excellent binding properties, which is then shaped into pills. Examples of vati formulations include Chandraprabha vati, Yogaraja guggulu, and Kanchanara Guggulu, each tailored to specific therapeutic needs and incorporating diverse herbal constituents to enhance efficacy and stability. In case of Tablet preparation, the ingredients of the formulations were made into granules form ,then these granules were made into tablets using a single-punch tablet machine that had the appropriate punch and die depending on the formulation.(5)

Ghruta (Medicated Ghee)

The importance of lipid-based formulations for medication administration is recognized by contemporary pharmaceutical science, a concept that has long been recognized in Ayurveda. Tailapaka, and Ghruta paka also known as snehapaka. Three fundamental ingredients are used in the preparation of therapeutic oil /ghee in Ayurveda: (i) Drava (prescribed liquid.), (ii) Kalka (prescribed paste), and (iii) Taila/Ghee. To prepare medicated ghee, add four parts of water to the kalka (paste) of the ingredients. Boil it over medium fire until all the water is out of the ghee.-Drava dravya like kwatha,hima, phanta and swarasa were added one after other with the ghee and boiled it till the liquid part were completely evaporated.tirring is required regularly. Then, it is filtered Depending on the foundation utilized; formulations are Dhanwantara ghruta, Dadimadya ghruta, and etc.

Taila (Medicated Oil)

Taila preparations are the formulations where the tail is boiled with prescribed decoction and paste of drugs accordingto the formulae. The method of preparation is the same as medicated ghee... Examples such as Nirgundi Taila and Saindhavadi Taila Mahamasa Taila, Visagarbha Taila, Pinda Taila etc.

Sandhana Kalpana (Fermentative Formulation)

Asavas and Aristas are medical preparations manufactured by immersing the drugs either in powder form or as a decoction, known as Kasaya, and sugar or jaggery solution for a predetermined amount of time. During this time, a fermentation

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process produces alcohol. The medication specified in the texts is ground into a coarse powder to prepare the arista formulations, and a decoction is made. This decoction is taken in the fermentation pot and sugar honey, or jaggery based on the formulation were added, and then boiled. The pot lid is placed over the mouth, and seven layers of cloth smeared with clay are used to seal the edges. The container is stored in a designated area, an underground basement, or a pile of pady to try and maintain a steady temperature throughout the fermentation process, as fluctuations in temperature can slow down or speed up the process. The cover is taken off, and the liquid is decanted before being strained after the predetermined amount of time (35–45 days) and then strained after two or three days. When the fine suspension particle settles down, it is again strained and packed in the bottle. Without making decoction, Asava is prepared as like as Arista etc. The mportants Asaba and Arista formulations are Balarista.Dasamularista, Ashokarista Chandana sava etc.

Avaleha (Medicated Jam)

Avaleha is a drug preparation that is semi-solid, and for the preparation of Avaleha, the prescribed decoction is condensed by boiling with either jaggery sugar or candy sugar, powder, or pulp of certain drugs, resulting in a concentrated base. The concentrated mass is prepared by continuing the procedure until it becomes thread when squeezed between two fingers or settles in water without dissolving readily. Subsequently, praise drugs, often including flavouring agents, ghee, oil, and honey, are incorporated into the mixture. Exemplary instances of Avalehas include Chyawanprash Awaleha and Vasawaleha. This preparation method enhances the shelf-life and stability of the formulation and ensures precise dosing and ease of administration, making Avalehas a preferred choice in Ayurvedic therapeutics. Formulations are Chyavan Prash, Agastya rasayan etc.

Satwa (Water soluble extract)

Satwa, denoting a water extract, represents a solid substance extracted exclusively from plants rich in starch or carbohydrates. The process of obtaining Satwa involves several steps. The fresh plant material is initially prepared by cutting it into small pieces and crushing it to facilitate extraction. Subsequently, the crushed material undergoes maceration in water and is kept overnight. The mixture is filtrated following maceration to separate the liquid from the crushing materials. The filtrate liquid is again kept for sedimentation. The sediment, enriched with the desired constituents, undergoes further processing. It is repeatedly putapaka technique or a furnace. Purified metals, minerals, marine and animal products are used to make bhasma.In Ayurveda, sodhana means purification, and it eliminates harmful matters, distinct characteristics, including nischindritwa (no metallic luster), Rekha purna (fine texture enabling easy adherence to finger lines), Varitara (It should float on the surface when submerged in cold, steady water.), and apurnabhava (irreversibility to the original state). Examples of bhasma include swarna bhasma and sukti bhasma[24]. From the bhasma different rasa

washed with water to remove impurities, and the process of decantation aids in separating the sediment from the liquid phase. The resulting sediment is then allowed to dry, culminating in the formation of Satwa. Guduchi Satwa serves as a prime example of this extracted solid substance.

Bhasma (incinerated ash)

Bhasma is the powder form of a material that is obtained through calcination. This ancient method involves subjecting minerals, metals, marine and animal products to a purification process before incinerating them in a closed crucible using the

modifies undesirable physical properties, and enhances therapeutic action. The resultant bhasma exhibits

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preparations (metallic preparations) are formulated with the bhasma such as Pottali rasayana Khalwi rasayan etc.

Pisti

Pisties are made by grounding the medication (marine and mineral) in the prescribed liquids and then exposing it to the moon or sunlight. After being purified, the medicine is left to triturate for a day (unless otherwise indicated) in rose water, and then it is left to dry in the sun for an additional day. This cyclic process typically extends over a period of seven days or more, ensuring the attainment of a finely powdered pisti. Formulations are Pravala pisti, Mukta Pisti, etc.(6)

Sarkara (Syrup)

Medicinal liquids, derived from various traditional preparations such as arka (distilled essence), hima (cold infusion), Fanta (hot infusion), or kwatha (decoction), into Sarkara form(syrups), represent a fusion of ancient methodologies with modern pharmaceutical standards. This transformational process begins with blending the medicinal liquids with twice their volume in sugar, a step essential for preservation and palatability. Subsequently, the mixture undergoes gentle heating at low temperatures until it reaches the desired stage, where the syrup attains optimal consistency and medicinal efficacy. Once this stage is achieved, the mixture is carefully removed from heat, filtered to remove impurities, and meticulously packed into bottles. Formulations are Vanaspa Sharkara, Parusaka Sarklara etc(8).

Arka (Distilled medicinal essences)

A liquid preparation called "Arka" is made by employing a device called an "Arkayantra" to distill specific liquids or medications that have been soaked in water. The prescribed medications are washed and coarsely ground to prepare Arka. The medications are soaked in water and left overnight. Then, it is distilled.

Malahar (Ointments)

Mallahar (ointment) is the term for medications that are applied externally as a paste. In the Ayurveda classical text Sidha Yoga Sangraha. Variants like Sweta Mallahar and Jibantyadi Mallahar have been formulated. The medications are ground into a fine powder. It is combined with the liquid or other media specified in each preparation to form a soft paste. The ointments, which are soft, semisolid formulations for external use on skin or mucous membranes, contain medications that have been dissolved, suspended, or emulsified in the base. They serve for emollient and protective actions on the skin, besides acting as vehicles or bases for topical medicinal applications.(9)

NEW TECHNOLOGY FOR AYURVEDHA FORMULATIONS

Nanotechnology for ayurvedic formulations

The convergence of traditional medicine and modern technology has sparked innovation in healthcare, particularly in the field of Ayurveda. Ayurveda, an ancient Indian system of medicine, emphasizes holistic healing and natural remedies.

Rasa Shastra is a prominent branch of ayurveda, where nanoparticles in form of Bhasmas have been used therapeutically since ages. But the concerns regarding their safety have been unanswered due to insufficient evidences. Nanotechnology offers a promising future of ayurvedic medicine by enhancing its effectiveness and accessibility by addressing challenges such as bioavailability, targeted delivery and stability.(10)

Enhanced Bioavailability and Efficacy

One of the key challenges in Ayurvedic medicine has been achieving consistent bioavailability and efficacy of herbal formulations. This issue is adressed by reducing the particle size of herbal extracts to nanoscale dimensions. This process, known as nanonization, increases the surface area of the particles, allowing for better absorption and improved therapeutic outcomes. Ayurvedic formulations can more efficiently cross biological

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barriers and precisely reach their target areas by encasing active ingredients into nanoparticles. (11)

Targeted Drug Delivery

In Ayurveda, herbs are often prescribed to restore balance to particular organs or systems. Rasa Shastra describes use of Bhasmas which have been described as alpamatra upyogitvat meaning these drugs shows maximum therapeutic efficacy in small doses. Nanoparticle-based delivery systems can be engineered to release drugs at the desired location, enhancing their therapeutic effect. This targeted approach not only improves efficiency butalso conserves resources by minimizing the amount of medication required.

Enhanced Stability and Shelf Life

Potency and efficacy can be lost over time in many traditional Ayurvedic medicines due to deterioration. Nanotechnology offers solutions to this challenge by enhancing the stability and shelf life of herbal remedies. Encapsulating herbal extracts within nanoparticles protects them from environmental factors such as light, heat, and moisture, prolonging their viability and ensuring consistent quality. This increased stability allows for the development of standardized Ayurvedic formulations with reliable therapeutic effects.

ARTIFICIAL INTELLIGENCE

It is currently trending. We are building brains with AI, which is a technology that allows machines to think, act and become intelligent like humans. It is a combination of a human cognitive abilities and the intelligence of machine's and programs(12).AI is being created by studying how the human brains think, how it learns, how it makes decisions, how it works, solves real-world problems and verifies the results. To save the cost optimization process; many industries are benefiting from AI. The AI can be of various types (4 main types) and can be implemented as most desired as per requirement.

Expert system

It is a behavioral concept that mimics human behavior for making decisions, reasoning, and solving complex problems.

Fuzzy logic

It is defined as the concept of human thinking to make decisions in every situation. He makes decisions logically according to yes/no or true /false possibilities.(13)

Neural network /ANN (Artificial neural network)

Simulates a real human network by following the working of the human brain.In ANN, neurons behave as biological neurons, and those nodes are connected to each other through links for communication or interaction. They accept node data and perform different operations and produces output as node value.

Robotics

An important part of AI where an artificial agent works in the real-world environment and interacts with surrounding environment it is a man-made machine that mimics human thought processes; simply put, it is a machine of human intelligence.(14) AI has many benefits, including reducing errors, increasing power, and increasing worker efficiency and helping to solve new problems, Improved interfaces as well as better handle information.

AI in Rasa-shastra

To combat the problems of quality control, safety and efficacy it is possible to create standard study protocols where the use of new machinery will help us to understand the complex processes. In the light of new developments regarding bio-inorganicals, Rasashastra can give inspiration to new leads. Quality Control and standardization have always been issues regarding Bhasmas and Rasaushdhis owing to lack of standard protocols. However, during last couple of decades Rasaushadhis have been targeted on safety issues. A big number of

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articles on Rasaushadhis, including Bhasmas in indexed journals, are available. These papers cover a wide range of topics, with this characterization, toxicity studies, clinical studies, physico-chemical evaluation, development of standard operating procedures for validation, free radical scavenging activities, other antioxidant activities, disease-specific pharmacological activities, and a few comparative studies with modern medicines.(15) It is waste to highlight that the Rasashastra bhasmikaran procedure converts solid visible form into the solid form nano size, whereas modern chemical techniques use metal in ionic form to obtain metal nano particles. Bioavailability research on around 50 inorganic materials were included in WHO study issued in 2000, which helped in development of the mostly recent studies on Bio-Inorganics.

AI in Bhaishajya Kalpana

The various aspects related to drug formulation, preparation, storage etc., are all dealt in this sub-division.It is equally important to evaluate the medicinal characterization, dosage, clinical trials, disease specific mode of action, development of standard operating procedures for validation, preservation and packaging the final products for public use as per modern parlance.(16)

Drug discovery in Ayurveda and its Components

It is anticipated that machine learning and other technologies will make the search for novel medications in Ayurveda more inexpensive, efficient, effective, and timely.Artificial intelligence (AI) and machine learning will bring in this new era of efficient, rational, and skilled drug discovery.Using AI to find patterns hidden in massive amounts of data is crucial for drug discovery because these patterns can be utilized for:

1. Identifying traditional medications using their Sanskrit names and the several forms of the same plant family that are available.

2 .

A thorough explanation of medications, encompassing botanical data and details on Rasa, Guna, Virya, Vipaka, and Prabhava, as well as their global standardization.

3. Once the medications have been identified and described, we can utilize them directly to treat the illness.

4. Regarding the drug discovery side of things, information gathered from publications, patents, clinical trials, patient files, and Samhitas will be fed into an artificial intelligence platform that will yield drugs that are already well-known and documented in classical literature in addition to practical applications.As a result, a cloud-based depiction of more than one billion known and disrupted relationships between biological components—such as genes, tissues, organisms, illness symptoms, and potential medications—is produced. Similar to a search engine, this may be queried to create knowledge graphs.

As a result, this engine might offer a variety of choices, including stronger alternative medications, to treat the same illness when requested for information about it.This way, it will all come down to advanced pattern recognition when we construct them and evaluate them in clinical trials. The groundbreaking finding of monoamines in Rauwolfia serpentina ushered in a new era of Ayurvedic pharmacology. Up until that point, the benefits of Ayurveda in natural product research and medicine were mostly overlooked, understudied, and unacknowledged.(17) Reverse pharmacology, a strategy inspired by classical knowledge that contributed to the discovery of reserpine, is currently being used with success.

Prakriti:

One of the distinctive ideas presented in Ayurveda is called Prakriti. Every Dosha, or a mixture of two

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or all three, determines it. A person's predominant Dosha or Doshas can be ascertained with the help of a pakriti study.Given that sickness results from an imbalance in Dosha, a more thorough comprehension of Prakriti facilitates the development of a personalized treatment plan. By developing a clinical decision support system with Prakriti as its main instrument to achieve higher acceptability, this function can be enhanced. Ayurvedic digitization trends are being actively set by a variety of governmental and nongovernmental organizations. Information must be gathered, arranged, and distributed with economy and efficiency, taking into account the knowledge and abilities of the portal or program manager. Ayurvedic doctors can use a variety of computer-based methods that are intended to help research findings in the field of AYUSH researchers and affiliated faculties.Content for the portal is provided by all AYUSH Research councils, National Institutes, and Drug Standardization Laboratories. It is structured to

DHARA

which stands for "Digital Helpline for Ayurveda Research Articles," is Sanskrit for "flow." It is an extensive online indexing service for research articles on Ayurveda.[78] It is the first and only all-inclusive online indexing service devoted only to papers about Ayurvedic research.[79] The Central Council for Research in Ayurvedic Science (CCRAS) in New Delhi, The Ayurveda Trust in Coimbatore, and the Swiss Medical Academy (SAMA) in Switzerland collaborated to produce it. and Family Welfare collaborated to produce the TKDL initiative. The CSIR is where this project is being worked on. Using information technology tools and an inventive classification system called Traditional Knowledge Resource Classification, the Traditional Knowledge Digital Library has overcome barriers related to language and format by methodically and scientifically converting and organizing the available contents of ancient texts on Indian Systems of Medicines, such as Ayurveda, Siddha, Unani, and Sowa Rigpa, as well as Yoga, into five international languages: English, Japanese, French, German, and Spanish. them identify, communicate, and evaluate data in order to provide proper diagnosis and treatment. There are numerous programs available on the market that provide digital Ayurvedic supported systems, such as Aushadhakosh, Dosha evaluation, Prakriti assessment, RASEX, RUDRA, etc. On the internet, the system is aided by numerous dot coms and bloggers (Technoayurveda, Ayurhelp, Ayurvedic treatment, Chakrapani, etc.), as well as e-Journals, e-books, and indexing units (DHARA, AYUSH Research portal, TKDL).

AYUSH Research portal

The Central Council for Research in Ayurveda and Siddha (CCRAS) established the AYUSH Research Portal, which is intended to disseminate support interdisciplinary research and attempts to make the study findings accessible.of the 5605 items in the portal's entire collection, 10751 are related to Ayurveda.

This partnership aims to assess research related to Ayurveda. DHARA contains 7619 items at a glance, with full text available for 2588 of them.

TKDL

It stands for **Traditional Knowledge Digital Library** The Council of Scientific and Industrial Research (CSIR), the Ministry of Science and Technology, and the Department of AYUSH in the Ministry of Health

(TKRC).As of the time of writing, the TKDL database had transcriptions of more than 3.6 lakh formulas and practices. Furthermore, global definitions and standards for the development of TK databases based on TKDL specifications have been created by the TKDL.The WIPO Intergovernmental Committee (IGC) on Intellectual Property and Genetic Resources, Traditional Knowledge, and Folklore Expression reached a consensus on this during its fifth session

The Ayurvedic Formulary of India (AFI)

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is a singular attempt in that it compiles the fragmented data on different formulations found in traditional Ayurvedic books in a way that is appropriate for developing pharmacopoeia standards and also satisfies the requirements of the Drugs and Cosmetics Act.According to the original reference book, a list of therapeutic indications has also been provided for the different formulations. The original Shlokas of reference form, from which the formulations were generated, have been appended to the formulations for convenient reference.Other plant parts have been recommended for the various formulations due to the unavailability of roots and barks as well as the nation's regulatory laws. Consequently, there's no chance of adulteration. The second redesigned edition of AFI is now more international quality, user-friendly, and informative for users worldwide. Scientists and Ayurvedic practitioners can now use this book.

BENEFITS OF NEW TECHNOLOGY

Enhanced Standerdization And Quality Control

The compositions and potencies of Ayurvedic formulations varied from batch to batch as a result of the traditional preparation methods' frequent lack of uniformity. Utilizing contemporary analytical methods like mass spectrometry, spectroscopy, and chromatography makes it feasible to pinpoint and measure the active ingredients found in Ayurvedic formulations and botanicals.This makes it possible for producers to set uniform production procedures and quality assurance standards, guaranteeing the reliability and security of Ayurvedic medications.

During COVID -19 Treatment

The employment of technology in conventional practice has evolved into the new normal during COVID-19. Consultation and telecommunication have grown in importance as communication methods.Various audio-visual platforms are also crucial in these situations and offer effective means of keeping an eye on people's daily stress levels and general health while they are alone. All things considered, these technologies can significantly contribute to the emerging field of telemedicine, whether it is for disease prevention or public health monitoring, paramedic staff, or symptomatic and asymptomatic COVID positive patients during a pandemic. Other technologies, such as the internet, drones, and robots with Bluetooth assistance, can be extremely important in reducing the impact of the COVID-19 pandemic in some situations.(18)

Increased Efficacy And Therapeutic Potential

Opportunities exist to improve the therapeutic potential and effectiveness of Ayurvedic medicines thanks to new technologies. For example, bioinformatics allows researchers to examine big datasets and spot possible synergistic relationships between various components. Ayurvedic medications may now be delivered precisely thanks to nanotechnology, which also increases their bioavailability and guarantees that they reach their designated site of action.

Improved Safety

Adding new technology to Ayurveda can help enhance the safety profiles of Ayurvedic medications. Safety is an important consideration in the development of any medication. The quality and safety of Ayurvedic medicines can be guaranteed by identifying and quantifying any possible impurities or harmful compounds present in raw materials using sophisticated analytical techniques. Artificial intelligence and other technologies can help anticipate potentially harmful decisions regarding Ayurvedic medications

FUTURE PERSPECTIVE AND OPPRTUNITIES

Personalized Medicine In Ayurveda

Using customized medical techniques into Ayurvedic formulation is one of the most promising directions for the future. Ayurveda acknowledges that every person is different and that their needs should be catered to in their treatment plans. This tailored approach can maximize the therapeutic effects of Ayurvedic

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formulations by making them more focused and potent.(19)

Integration Of Traditional And Modern Knowledge

the rich tradition of knowledge and practices found in Ayurveda. partnerships between contemporary scientific discoveries and traditional Ayurvedic practitioners.(20)

Collaboration And Interdisciplinary Research

Innovation and cooperative methods can be promoted by bringing together specialists from a variety of disciplines, including pharmacology, chemistry, biotechnology, nanotechnology, and data science.This partnership may result in the creation of cutting-edge methods, compounds, and distribution strategies that improve the effectiveness, security, and uniformity of Ayurvedic treatments. The difficulties and constraints encountered in Ayurvedic formulation can also be addressed by interdisciplinary research, creating new opportunities for investigation and learning.(21)

CONCLUSION

Ayurveda, as a time-tested holistic system of medicine, possesses a rich foundation of classical formulations and therapeutic principles aimed at promoting health and preventing disease. The integration of modern technologies such as nanotechnology, artificial intelligence, and digital platforms has significantly strengthened Ayurvedic formulations by improving standardization, safety, bioavailability, stability, and therapeutic efficacy. Advances in AI-driven drug discovery, quality control, personalized medicine through Prakriti assessment, and digital knowledge repositories have enhanced research, clinical practice, and global acceptance of Ayurveda. Overall, the harmonious blending of traditional Ayurvedic wisdom with contemporary scientific and technological innovations offers a promising future for the development of safe, effective, and personalized Ayurvedic healthcare systems.

The successful fusion of conventional knowledge with cutting-edge scientific understanding will determine the direction of Ayurvedic formulation in the future. Evidence-based research can complement and improve

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