



DPT. OF KAUMARABHRTYA
VPSV AYURVEDA COLLEGE
KOTTAKKAL

COLLEGE UNION 2024-2025

CONFERENCE PROCEEDINGS



PUTREEYA

CONFERENCE ON TWO DECADES OF KNOWLEDGE
DEVELOPMENT IN APPLIED PAEDIATRICS AND KAUMARABHRTYA

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PREFACE

In this era where Ayurveda is spreading its roots to the various parts of the globe, with an increasing exigency, the necessity for detailing the core of this science to the world is also growing. Ayurveda speaks of sadadadhyayana or continuing medical education. This might aid in creating major contributions that could meet the rising demands of the world. Puthreeya'24 is a pioneer attempt to this, 'continuing medical education', by the department of Ayurvedic Paediatrics (Kaumarbhrithya). This conference, which included 10 presenters, 100 attendees and almost 30 volunteers, detailed about the recent developments that had happened in the field of Kaumarbhrithya over the last 20 years. This is the documentation of the different sessions of 'Puthreeya '24 - Conference on two decades of knowledge development in Applied Paediatrics and Kaumarabrithya'. The peer reviewed articles, that are compiled here, are the worthy works of the eminent presenters. This compilation is an aggregate of different topics in Paediatrics, which have an increasing concern in today's world. As you delve into the pages, we hope that you will find inspiration, knowledge, and a renewed commitment to improve the health and well-being of children around the world. We express our sincere thanks to all the authors, reviewers and others who have contributed to this work. This is merely a beginning. We expect more updations and productive efforts from the upcoming Ayurveda society, in the future.

FOREWORD



The field of Ayurveda has long been revered for its deep-rooted wisdom and its holistic approach to health and well-being. Among the various branches of Ayurveda, Kaumarabhritya, which focuses on pediatric care, holds a special place as it seeks to ensure the health of our future generations from their earliest days. It is with great pleasure that I introduce this comprehensive compilation, which serves as both a testament to the rich tradition of Ayurvedic pediatrics and a reflection of the remarkable advancements made in this field over the past two decades.

This proceeding is an outcome of the Puthreeya '24 conference, a pioneering initiative by the Department of Kaumarabhritya at VPSV Ayurveda College, Kottakkal. The conference brought together distinguished experts and practitioners, who shared their knowledge and insights on the latest developments in pediatric care, blending the time-tested principles of Ayurveda with modern scientific advancements. The articles compiled here provide an in-depth exploration of various pediatric conditions, from gastroenterology to respiratory disorders, offering valuable perspectives on how Ayurveda continues to evolve and adapt in response to contemporary health challenges.

As you delve into this collection, you will find not only a wealth of information but also inspiration to further the cause of pediatric health through Ayurveda. The dedication of the authors and the collective wisdom contained within these pages make this proceeding an invaluable resource for students, practitioners, and researchers alike.

I extend my heartfelt gratitude to all those who contributed to this work, and I hope that it will serve as a guiding light for future generations of Ayurvedic practitioners. May this proceeding inspire continued learning, innovation, and the application of Ayurvedic principles in the service of children's health.

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INDEX

Sl. No	Author	Title	Page No:
1.	Keynote address – Dr. P. Krishnakumar	An overview of the recent trends neurodevelopmental disorders	1
2.	Dr. Pratibha	Exploring Childhood Emotional and Behavioural Disorders: An Ayurvedic Perspective	9
3.	Dr. Lekshmi M. K.	Recent Advances in the Management of Pediatric Respiratory Disorders	31
4.	Dr. Dinesh K. S.	Autism spectrum disorders- last two decades of updates	38
5.	Dr. Karthik K. P.	Pediatric gastroenterology: recent advances in biomedicine and ayurveda	45
6.	Dr. K. V. Ramankutty	Overview to the ancient practices in common ailments in children	63
7.	Dr. Anand P. K. V.	Role of daivavyapashraya chikitsa among the practitioners of yuktivyapashraya chikitsa	73
8.	Dr. S. Swapna Chitra	Recent updates in attention deficit hyperactive disorder: a review	78
9.	Dr. Shabu	Skin Disorders in Children- Recent Updates	84

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AN OVERVIEW OF THE RECENT TRENDS IN NEURODEVELOPMENTAL DISORDERS

I thank the principal and the organizers for this opportunity. I consider this as an honor to be invited to deliver the keynote address at this CME program at Kottakkal, the traditional home of Ayurveda. I was asked to talk on “developments in the last 20 years in intervention for developmental disorders”. I have only limited knowledge or say, a layman’s knowledge about Ayurveda and my presentation will be largely related to the concepts or developments in modern medicine.

Brain – Historical aspects

Before going into the recent developments in the approach to developmental disorders, it is relevant to see how the concept of brain and brain sciences evolved over the years. As you know, Hippocrates, who is considered as the father of western medicine or Greek medicine, was a proponent of the humoral theory of diseases. Disease occurs when there is an imbalance between the four humors that determine the functioning of the human body. The four humors being yellow bile, black bile, blood and phlegm. Hippocrates lived around 4th or 5th century BC, and this concept was based on the theory, that the human body was formed of four elements- earth, fire, air and water, akin to our concept of five elements constituting the body – (earth, water, air, fire and space) and the “Thridosha theory”. One difference is that blood, bile and phlegm are visible while the vata, pitta and kapha are not visible entities (to my knowledge).

Aristotle, considered to be one of the greatest intellectuals of history, who lived in the 4th century BC, believed that the brain occupies only the front part of the skull cavity, and the occipital part of the skull cavity was empty. He believed that the brain functioned as a cooling agent of the heart and liver and the

heart was the centre for emotions, sensations, feelings etc. This belief was held for nearly five hundred years, since nobody dared to question great men like Hippocrates and Aristotle.

Galen who lived in AD 2nd century (122CE) showed that the brain is the centre for all sensations and cognitive activities. His experiment on recurrent laryngeal nerve is famous where he cut the nerve in a pig and demonstrated that after severing the nerve, the pig could not squeal, proving that the voice is controlled by brain. Galen considered that common sense, cognition, and memory were functions of the brain. Personality and emotion were not generated by the brain, but rather by the body as a whole (or perhaps by the heart and liver). In Galen's view, an imbalance of each humor corresponded with a particular human temperament (blood – sanguine, black bile – melancholic, yellow bile – choleric, and phlegm – phlegmatic). Thus, individuals with sanguine temperaments are extroverted and social; choleric people have energy, passion, and charisma; melancholics are creative, kind, and considerate; and phlegmatic temperaments are characterised by dependability, kindness, and affection.

This bizarre (from the current view) notion about the brain continued till 16th century AD. In 1520, one of the leading scientists postulated that the sutures of the cranium allowed the vapours of the brain to escape periodically. The anatomy of the brain as we know today started taking shape from the 17th century onwards. In 1664, Thomas Willis published his textbook of the anatomy of the brain. Willis argued that the ventricles were not formed as part of God's design to house the spirits as was believed then but formed "accidentally from the complication of the brain." Leonardo DaVinci (1452-1519) dissected the brain and described the structure of brain.

In 1848, American railroad worker Phineas Gage sustained head injury, and an iron rod passed through his left frontal lobe separating it from the rest of the brain. This injury resulted in total change in his personality even though he survived. People said, “he is no more our old Phineas Gage”. This led to the theory that specific areas of brain had specific functions. Studies by Broca and Wernicke in the 1860s and 70s demonstrated specific brain areas related to speech and language. In 1791, Italian physician Luigi Galvani showed that electricity applied to nerves could make the muscles contract, suggesting that electric impulses played a role in the nervous system.

Advent of powerful microscopes and better staining methods resulted in the identification of neurons or nerve cells by the end of 19th century. Junction between two neurons called synapses were identified in the early part of 20th century and later it was demonstrated that neurons communicated using electrical and chemical signalling. In the latter half of the 20th century there was information explosion about the

An overview of the recent trends in neurodevelopmental disorders

functioning of the nervous system aided by advancements in science and technology. The declaration of 1990s as the “decade of brain” by USA, gave a great push to neurosciences research. The human genome project which began 1990 and published the genomic sequence that accounted for 90% of the human genome and paved the way for advanced interdisciplinary research in neurogenetics.

New insights on brain development and relevance to neurodevelopmental disorders

Fundamental changes occurred in our knowledge of human brain and the nervous system in the early part of the 21st century. It was believed in the past that the brain growth reaches a peak by the age of 6 or 7 years and the development of the brain is completed by this age. Now we know that this is not true. The brain growth continues beyond the adolescent age, and it is said that the adolescent brain is not a fully cooked brain but a work in progress.

When the baby is born all the 86 billion neurons are there in place in the brain, and no new neurons are formed after birth. Even though repair of the injured brain is known to occur during the early postnatal period, as per the current evidence, no new neurons are formed in the adult brain. Brain growth occurs because of myelination, formation of glial cells and new synapses. This process continues till the age of 20 or 25 years and the last part of the brain to complete myelination is the frontal lobe, which is concerned with higher order brain functions like decision-making, problem-solving, coping with stress etc.

Functional growth of the brain is linked to formation of new connections or synapses between the existing neurons. A pruning process occurs in the developing brain, whereby wanted connections are retained and unwanted connections are removed. What type of connections are formed or what type of connections are retained or what type of connections are deleted – this is largely determined by the living environment and experiences. The brain grows based on a “use it lose it” principle. The part of the brain which is used remain active with formation of new connections, while there is gradual reduction in the neural connections in the unused parts of the brain. It is like a knife- if remained idle for long periods, it becomes rusted and if put to constant use it remains sharp.

It can be rightly assumed that the developing brain is in a dynamic equilibrium with the environment and the changes in the living environment predispose to functional as well as structural changes in the brain. The question whether nature (the biological substrate) or nurture (how the child is brought up) – which is important has become largely irrelevant. The living environment and lived experiences especially in the early childhood, determine the type of brain and the type of man.

The living environment in this context means the intrauterine environment also. The “first 1000 days” program was initiated by the UNICEF keeping this in mind. The “first 1,000 days” is a period that begins with pregnancy and continues until the second birthday of the child. This is the period when the brain development is rapid compared to any other period in life. Health, nutrition and stress level of the mother during pregnancy influence the brain growth of the foetus. Healthy living environment with adequate nutrition, love and care during the early years lead to healthy brain development and vice versa. Scars formed in the brain due to hunger, malnutrition, infections, stress and abuse during childhood often have lifelong effects and these scars are difficult to heal. (Nalla kalam vannu kaanaan nallathaakki cholledo nee” - poet PP Ramachandran). You may remember the story of Kakkasseri Bhattathiri whose mother was given special care during the antenatal period. Few years back one of our postgraduate students found that mothers of children with autism spectrum disorder experienced more stress during the antenatal period compared to mothers of typically developed children.

The earlier concept was that after a particular age, the brain functions begin to decline with gradual deterioration of neuronal functions. Now we know that this is not true and even the adult brain can remain active and withhold degeneration with appropriate activities. This concept of neuronal plasticity or the malleable brain is perhaps one of the greatest discoveries on brain functioning in the last twenty-five years. Neuronal plasticity reduces as age advances, but the neurons can remain active despite the aging process.

The advances in science and technology resulted in great leaps in our knowledge about brain structure and function. With newer imaging technologies like PET scan, we are now able to study the living brain. Human genome project had contributed significantly to our understanding of neurogenetics, and genetic factors associated with many developmental disorders are now known. Aberrant neural development resulting from a common genetic defect may be involved in the aetiology of neurodevelopmental disorders. The high prevalence of comorbid disorders in children with NDD may be a pointer to a common genetic aetiological factor.

Another important recent discovery is that the genes are subjected to environmental influences through epigenetic mechanisms. Epigenetics refers to molecular pathways that lead to alterations in the gene expression without changes in the genomic sequence. The epigenetic modifications are transmitted from one generation of cells to the next generation. Environmental factors like intrauterine hypoxia, stress in the antenatal period, antenatal exposure to smoking, alcohol, radiations and certain drugs like anti-epileptics and antipsychotics were found to be associated with epigenetic markers. It is postulated that epigenetic factors act as mediators between genes and environment.

Many new diagnostic techniques and innovative therapeutic interventions have been developed during the last several years making use of the advances in science and technology that have appositive impact on the management of children with neurodevelopmental disorders. Neural implants include one of the promising developments that will improve the quality of life of children with developmental disorders. Cochlear implants for sensorineural hearing impairment became available in the last part of the 20th century. Retinal implants for degenerative disorders of retina and visual pathways is in the experimental stage. Some recent studies have reported that neurogenesis occurs in the adult brain especially in areas like hippocampus and research to identify factors that promote neurogenesis is being undertaken in many centres.

Neurodevelopmental disorders in the 21st century

We will see how the new knowledge about the functioning of the brain and nervous system had influenced our understanding of neurodevelopmental disorders. Recognition of the role of genetic, epigenetic and environmental factors on the aetiology has greatly influenced the diagnosis and treatment of neurodevelopmental disorders.

The reported prevalence of neurodevelopmental disorders has remarkably increased recently, with more children with ASD, ADHD and SLD seeking clinical support. The increased public attention and increased awareness may be contributing to the increase in the reported prevalence. Over the last 25 years, significant changes had occurred in the spectrum of childhood illnesses with better control of many infections like diarrhoea and vaccine preventable diseases and infections in general. In the early 1990s during our postgraduate training days, the paediatric wards were full of cases like polio, rheumatic fever, malnutrition diarrhoea etc which we don't see now. When children were dying of preventable diseases, there was no time and resources to spare for behaviour disorders or learning problems.

Recently the infant mortality rate (IMR) has come down significantly in many states in India. Kerala now have a single digit IMR comparable to that of the developed countries. There is increased survival of problem babies like preterm or IUGR babies and babies with perinatal brain insult. The increased survival of problem babies may be contributing to the increased prevalence of NDDs. We have now reached a stage when we should be more concerned about development rather than survival alone. It is important to provide an optimum environment to promote healthy development to these babies.

Research on developmental disorders have increased and literature search will reveal that published literature on every aspect of NDD has increased in 21st century. Increased public attention and shift in

administrative priorities have resulted in improvement in diagnostic facilities as well as treatment facilities for children with developmental disorders all over the world.

On par with the increased life expectancy in the general population, life expectancy of children with developmental problems also has improved. More and more children with disabilities survive to adulthood due to better living conditions and treatment facilities. The data on diagnostic stability and the nature of developmental disorders in the adults is still scant. As children grow and brain mature many symptoms may disappear or may get modified and there is chance of new clinical manifestations. Care during transition to adulthood is also an area that warrants more attention from clinicians and researchers. Life cycle approach with due attention to prevention, early detection, early intervention, preschool education, school education and vocational rehabilitation is now recommended as the strategy for comprehensive management of children with NDD.

Another issue that needs more attention is the impact of socioeconomic changes and changes in the family dynamics on care of individuals with disability. In the joint family structure family members were often available to provide care to individuals with disability and the society also was accommodative of people with less severe disabilities. In today's highly commercialised and competitive world, even people with mild or borderline intellectual disability may find difficulty to survive.

Accommodating the new insights about the aetiological factors and clinical characteristics, significant changes were introduced in the diagnostic classification of developmental disorders. "Neurodevelopmental disorders" was included as a new category in the DSM5, replacing the older category of "Disorders usually first diagnosed in childhood or adolescence," in DSMIV. The category of NDD include intellectual disability (ID), communication disorders, autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), specific learning disorder and motor disorders, including Tic Disorder. The title of the chapter on psychological disorders is changed to "Mental, behavioural or neurodevelopmental disorders" in ICD11 to stress the importance of neurodevelopmental disorders.

This inclusion of intellectual disability (ID), communication disorders, autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), specific learning disorder (SLD) and motor disorders together as NDD is in recognition of a possible common aetiology for these disorders. DSM5 stresses on a dimensional approach and accepts the spectrum concept of NDDs with severe disease at one end and mild disease at the other end. The severity of the disorder is largely determined by the degree of support needed for daily living.

On interventions for neurodevelopmental disorders

Comprehensive care of children with developmental disorders includes early detection, early intervention, preschool and school-based interventions and vocational rehabilitation with the aim of enabling them to lead an independent adult life. Often a multidisciplinary approach utilizing the services of paediatrician, psychiatrist, clinical psychologist, speech therapist, occupational therapist, physiotherapist and special educator with input from other medical specialties is required for optimum improvement. The focus is now shifted from institution-based care and institution-based rehabilitation to community-based education, training and rehabilitation. Beginning from the latter quarter of the 20th century, there was a paradigm shift in our approach to individuals with disability. It is now universally accepted that education and support to children and adults with disability should be based on the four basic principles, which include rights -based approach (not based on charity), inclusiveness (inclusive education and training with zero discrimination and segregation), individualized education and training (to enable mainstreaming) and social responsibility.

In the beginning of this century, facilities for comprehensive care of children with developmental disorders were scant in the state. The developmental paediatric clinic which we started at IMCH in 1998, later developed into the child development services (CDS) of the Institute of Mental Health and Neurosciences. In 2007 we could engage a multidisciplinary team with the above-mentioned professionals at the CDS and those days, it was one of the very few centres in the state to provide comprehensive care to children with developmental disorders. There were many constraints in the functioning of the CDS with scarcity of trained professionals and financial crunch. During the last several years many changes occurred and now there are many centres both in Govt sector and private sector to provide multi-disciplinary care to children with developmental disorders. Most of these centres are in cities and children from rural areas often drop out from regular therapy due to affordability and accessibility issues. Kerala Government established the State Initiative on Disabilities (SID) in 2014 for prevention, detection, early intervention, education, employment and rehabilitation of persons with disabilities through Social Justice Department with the joint support of Education and Health Departments. District Early Intervention Centres (DEIC) attached to district hospitals and Regional Early Intervention Centres (REIC) attached to Govt Medical Colleges were started as part of this initiative.

A mobile intervention unit for disability and special anganwadi project for angawadi based intervention also function under the SID. All these initiatives on the part of the Govt are indicative of the gaining public attention on disabilities, but still the facilities are grossly inadequate considering the burden of disability.

An overview of the recent trends in neurodevelopmental disorders

We need more funding for disability and measures to tackle the shortage of trained manpower so that block level or panchayath level centres for identification and treatment of children with developmental disorders could be established.

EXPLORING CHILDHOOD EMOTIONAL AND BEHAVIOURAL DISORDERS: AN AYURVEDIC PERSPECTIVE

1. Background

1.1 Understanding Emotional and Behavioural Disorders [EBDs] in Children

Mental health concerns in children are a significant public health issue, affecting an estimated 10-20% of all children [1]. These concerns can manifest in various symptoms and severity levels. Emotional and behavioural issues are common challenges among young children [2,3]. Emotional problems in young children refer to difficulties in experiencing, expressing, and regulating emotions appropriately for their age and developmental stage [4,5]. Behavioural problems include internalizing and externalizing challenges in regulating behaviours according to social norms, encompassing externalizing problems such as aggression, defiance, and hyperactivity, as well as difficulties with attention and impulse control, which can adversely affect others in the child's surroundings. Emotional and behavioural issues are highly prevalent in children with disruptive behaviour, depression, anxiety, pervasive developmental disorders (autism spectrum disorders), attention deficit hyperactivity disorder, intellectual disabilities, and developmental language disorder, significantly impacting their daily lives and development [6].

Additionally, children with developmental disabilities, who are deaf and hard of hearing exhibit more behavioural problems than their typically developing peers [8,9,10,11]. This association may be more pronounced in children who have additional disabilities. Furthermore, higher levels of emotional and behavioural problems in childhood are linked to future mental health concerns and relational difficulties, substance abuse, poor academic performance, unemployment, and criminal behaviour [12-16]. Therefore, early interventions may positively impact children's mental well-being during their formative years, enhancing their engagement in school, families, and society [17,18].

Emotional Behavioural and Impulse Control disorders taxon encompasses several disorders affecting the emotional quotient behaviours, responses, conduct and learning in children. Reactive Attachment Disorder (RAD) is characterized by persistent social and behavioural difficulties that inhibit communication and can pose challenges for teachers. Oppositional Defiant Disorder (ODD) involves consistent disruptive behaviour and frequent temper outbursts, typically beginning before age eight. Conduct Disorder (CD) encompasses persistently negative and emotional behaviours, including aggressive actions and struggles with respecting others' rights and social norms. Disruptive Mood Dysregulation Disorder

(DMDD) is characterized by chronic irritability between episodes of anger or temper tantrums. Attention-Deficit/Hyperactivity Disorder (ADHD) leads to impulsivity, excessive energy, and difficulties with focusing, often resulting in academic challenges. Autistic Spectrum Disorders (ASD) affect how children interact, communicate, learn, and behave. Misinterpreting a child's behaviours may result in unmet underlying needs, potentially exacerbating social and behavioural challenges and fostering reliance on self-centred and aggressive behaviours in social interactions [19,20]

1.2 How can parents and educators provide support to children with EBDs in home and educational ecosystem respectively?

Children with EBDs often face a range of adverse developmental outcomes, including academic difficulties, conflicts with their parents, peer rejection, involvement in delinquent behaviour, and long-term challenges with adjustment [21]. Acknowledging that children may exhibit behavioural challenges due to unique skills not aligning with conventional standards is also essential. Each child is distinct, requiring individual consideration to enable parents and educators to offer appropriate encouragement and assistance throughout their developmental stages.

Parents must assume their role as caregivers rather than adopt a strictly didactic approach,

while teachers should prioritize their responsibilities as educators. Reflective learning is imperative, and education should be customized to suit the unique needs of each child in a stimulating environment. Teaching methodologies should not impede a child's ability to observe and learn from their immediate natural surroundings.

1.4 The suggested treatment options for EBDs in children

Identifying appropriate treatment strategies requires a comprehensive assessment of the prevailing symptoms, the influence of family and caregivers, the broader socioeconomic context, the child's developmental stage, and physical health. This necessitates an interdisciplinary approach with comprehensive management strategies encompassing various combinations of interventions, including child- and family-focused psychological strategies such as cognitive behavioural therapy (CBT), behavioural modification, social communication enhancement techniques, parenting skills training, and psychopharmacology.

Prior studies and a recent Cochrane review have shown that Parent-Child Interaction Therapy (PCIT) demonstrated larger benefits in reducing hostile parent and child behaviours compared to most Positive Parenting Programmes (PPP) forms [22]. Behavioural modification techniques and interventions are designed to reduce

undesirable behaviours and teach alternative functional strategies based on fundamental principles of behaviour change.

In addressing childhood EBDs, medications are prescribed with other therapies. The most substantial evidence for the use of drugs in managing childhood emotional and behavioural disorders pertains to childhood and adolescent ADHD. However, there is less significant evidence supporting the efficacy of medications in managing other EBDs, such as ODD and CD. Pharmacological treatments for symptoms of ASD are commonly employed, albeit with challenges, given that no medications directly address the social and language impairments associated with ASD.

Commonly used medications include antipsychotics (e.g., Risperidone) and Selective Serotonin Reuptake Inhibitors (SSRI) to address mood and repetitive behaviour issues, as well as stimulants and other medications for treating symptoms related to ADHD. Naltrexone, an opioid antagonist, has shown considerable improvement in symptoms of self-injury, irritability, restlessness, and hyperactivity in autistic children, with minimal side effects and generally good tolerance. However, there is a lack of long-term data.

The use of medication in preschool children to manage ASD and ADHD symptoms remains a topic of controversy.

Stimulant medications for treating ADHD in preschoolers do not have consistent approval, as there is limited research evidence supporting their efficacy and safety. Additionally, research suggests that parenting interventions in this age group yield results comparable to the use of stimulant drugs in older children and young people.

Psychostimulants have been found to have a moderate-to-large effect on oppositional behaviour, conduct problems, and aggression in youths with ADHD, with or without ODD or CD. The most used antidepressants in children are SSRIs and Serotonin-Norepinephrine Reuptake Inhibitors (SNRIs). [20]

1.5 The scope of Complementary and Alternative Medicine (CAM) strategies in EBDs.

Children who receive antipsychotic treatment may face a higher risk of experiencing cardio-metabolic and endocrine disturbances, such as weight gain or type 2 diabetes mellitus, as well as neurological complications like somnolence, as compared to adults. The perceived seriousness of adverse drug reactions and their impact on daily life in paediatric patients may differ from that in adults. There is a potential risk of suicidal thoughts and behaviours in childhood and adolescence when initiating SSRIs, which has led to safety warnings from regulatory agencies [23-

29]. So, research and evidence-based practices concerning the role of Traditional Medicine (TMs) and other Complementary and Alternative medicine systems (CAM therapies) such as the Ayurvedic Sciences as mainstream stand-alone or adjuvant therapeutic approaches in the comprehensive treatment of EBDs is necessary.

2. Ayurvedic understanding of EBDs (non-specific yet pertinent to childhood)

2.1 The concept of Triguna, Prakruti and Manovega

As per Ayurvedic literature, mental inclination and subsequent behaviour traits are causally associated with a dynamic tripartite psychological phenomenon (Triguna) existing in individuals, viz. the domain of knowledge and wisdom (satva), ferocity and initiation (rajas), and inhibition and ignorance (tamas). The relative functioning of the satva trait over the latter two suggests an evolved behaviour with appropriate coping and cognitive skills along with the pursuit of constant learning. The relative dominance of rajasika and tamiska traits renders cognitive, emotional and behavioural errors and, in that sense, are generally acknowledged as defective or abnormal. A sheer balance among these traits or relative prominence of the satvika trait is suggested for normal cognitive and behavioural functioning. Rajasika traits favour excessive activity, often prompted by anger and other emotions. Tamasa trait is dominated by

inactivity, leading to delusions, confusion, and errors in reasoning and judgment.

Nevertheless, Ayurveda recognizes 16 types of manasa prakriti (exclusive behaviours exhibited by individuals suggesting their emotional and behavioural framework). Manasa prakṛti has been classified based on the dominance of one or the other attribute in the aforecited tripartite structure. In Ashtanga sangraha, manasa prakruti is classified into seven types: Satvika, Rajasika, Tamasika, Satvaraja, Rajatama, Satvatama, and Samaguna Prakṛti. [30] Caraka Samhita and Susruta Samhita are classified into sixteen types based on the predominance of triguna. [31,32]. In Kashyapa Samhita, two more types are added to make it 18 in number. [33]. Maladaptation to circumstances and situations may arise due to these traits, especially the latter (rajas and tamasa).

If they are not addressed appropriately, these may lead to various chronic mental disorders like cognitive and perceptive distress (mano vibhrama, buddhi vibhrama, smṛti vibhrama) and subsequent abnormal behaviours (sheela-chesta-achara vibhrama). This finally precipitates as distinct emotional, behavioural and cognitive disorders

There are different sets of grossly maladapted emotional and behavioural defences stemming from phenotypic and psychological inclinations termed mano vega viz. kama (overt

desires/lust in pursuit of materialistic gains), krodha (anger, aggression), lobha (greed), moha (delusion, confusion), mada (bouts of disorientation, falsifying memory concerns), matsarya (pathological competition), mana (overt pride), bhaya (irrational fears), chinta (unwarranted thinking), shoka (overt sorrow) etc [34-35]. Table 01 depicts a correlation between selected manasa prakruti traits and traits in specific EBDs.

The phenotypic variants of functioning as per Ayurveda classifies seven basic functioning levels called ‘Prakruti’ (Vatottara, Pittottara and Kaphottara and their permutations). The psychological tripartite phenomenon expresses itself as traits of specific prakruti itself. The prakruti determines the corresponding psychological attributes in a person or vice versa as both are interdependent. Table 02 depicts a co-relation on vulnerable prakruti traits recognizable in EBDs.

2.2 The role of sensory perceptions (Indreeya-indreeya dharmata) in EBDs

The relationship between humans and their environment has evolved significantly throughout human history, influencing our physical and cultural landscapes and sensory and perceptual experiences, shaping our interactions with the world around us. The human senses, vital for processing information about the environment, undergo a significant

transformation as we adapt to the constructed environment. This transition, from natural to constructed environments, is a complex process that alters our ecological niche and fundamentally changes the way our senses function. The environment we currently inhabit is markedly different from the one our senses were originally attuned to. The newly constructed environment with all sophisticated equipment poses a risk to our senses, and this risk is not evenly distributed. Sensory inequities result in emotional and behavioural dysfunctions. Children are naïve and overtly curious to varied sensory interactions and are relatively vulnerable to these sorts of deviated emotional and behavioural aftermath.

Ayurvedic Sciences immensely emphasise sense organs and sensory perception (indreeya-indreeyartha-mana pravrutti/nivrutti). According to Ayurveda, these elements are causally linked to learning and memory and play a fundamental role in psycho-somatic manifestation. Dysfunction in sensory integration (atiyoga, ayoga, and mithya yoga of samanska indreeyapravrutti) can impair intellect, reasoning, and judgment (buddhi). The Charaka Samhita proposes specific behavioural guidelines (Sadvrutta and Achara Rasayana) for general conduct, hygiene, and moral codes to train sensory faculties and the mind (Ch. Sam Soo 8). This process involves reflective learning through addressing dysfunctional behavioural

patterns, training the senses, enforcing ideal behaviours, correcting perception and cognition, and reinforcing desired ideal behaviours.

2.3 Sadvrutta and Achara Rasayana (Instilling Ideal Behaviour through instructions, and training)

The Ayurvedic Sciences emphasise Sadvrutta, encompassing good personal, religious, social, and ethical conduct, which is crucial in maintaining mental and social well-being. In addition, the principles of Achara Rasayana in Ayurveda and Yama-Niyama in yoga align with the concept of Sadvrutta. These principles denote codes of conduct, self-discipline, and self-directed goals that warrant consideration for application in the current era. It is proposed that these guidelines be incorporated into selected training programs for children with Emotional and Behavioral Disorders (EBDs) in a detailed implementation plan, focusing on good conduct, realistic and wholesome integration of seasonal factors (kala), personal attributes (buddhi and indreeya), and adherence to a prescribed diet and exercise routine. Table 03 depicts a correlation table on symptomologies linked with EBDs and Ayurvedic clinical symptomatology cited in different contexts.

2.4 Preventive regimes in newborns

Jata karma samskaras involved implementing sensory stimulations and specific medications

within 28 days of a newborn's life. This traditional practice is rooted in the belief that it shields the infant from malevolent forces and illnesses. The first 28 days is deemed critical for averting potentially life-threatening complications in newborns.

Uramarunnu was a traditional practice prevalent in the southern regions of India. This practice involved administering a variety of drugs to infants through rubbing. The drugs used in Uramarunnu were primarily believed to promote digestion and enhance strength and intellect. This traditional therapeutic approach of modified Lehana/Praasana involved rubbing specific drugs on a flat stone with substances such as honey, breast milk, cow's milk, or butter. The resulting paste was then applied to the infant's tongue or the mother's nipple, allowing the infant to feed. The time gap between two doses was typically one week, but it could be adjusted based on the infant's health condition. Uramarunnu was usually administered 28 days after birth until one to two years old.

The dosage started with a pinch or the equivalent of one Vidangaphala (*Embelia ribes* Burm.), which was then increased gradually up to the size of an Amalaki (*Emblica officinalis* Gaertn.) based on the infant's age. The drugs used in Uramarunnu were characterized by their bitter (tikta-medhya) tastes [36].

2.5 Potential Ayurvedic therapeutics and their plausible mode of action in EBDs

Shodhana karma (Panchakarma therapy) in Ayurveda is associated with positive outcomes such as improved mental well-being, heightened perception, and enhanced emotional resilience. With extensive textual references supporting its efficacy in treating various clinical conditions, Panchakarma has become integral to Ayurvedic clinical practice. It is considered more effective than internal medicaments (shamana chikitsa) due to its potential to reduce the likelihood of recurrences. Shodhana procedures are comprehensive and intricate medical practices primarily based on age (vaya), clinical dosha assessment (dosha avastha), disease staging (vyadhi avastha), bodily tissue constructs involved in the diseased condition (dhathu-srotas), seasonal variations (kala), mental toughness (satva), metabolic typing (agni-koshta), and phenotypy (prakruti).

Vata dosha is the most crucial factor in mental well-being (niyanta, praneta cha manasa) (Ch Sam Soo 12/ 7–8). The prana vata serves the function of controlling higher cognitive functions and perception, udaana vata controls energy, speech, and memory (Asht Hru Soo 12/ 5; Su Sam Ni 1/V14–15), samaana and apana vata together constitute gastrointestinal functions (Asht Hru Soo 12/ 8-9). Pitta dosha is causal to emotional and

behavioural regulation. Panchakarma procedures such as Virechana and Basti (in eligible age and appropriate physical endurance) targeting the gut homeostasis and ending with neuroception via the autonomic control (parasympathetic vagal innervations) are promising interventions in mood regulation and improved cognition, regulated emotional expression, resilience, and social engagement mimicking the poly vagal mechanisms.

Apana vata and samaana vata interact due to their respective involvement at different levels of koshta. The conversion of ahara rasa to rasa dhatu at koshta and its subsequent transportation to the hrudaya and other body parts by vyana vata (Asht Sam Ni 20/ 2) establishes a direct link between vata dosha functioning at the level of koshta and the digestion-related processes. Consequently, maintaining gut homeostasis and overall nutrient status relies on the integrity of koshta and pakwashaya (Asht Hru Soo 12/1).

During apana vaigunya, an inappropriate upward movement in pakwashaya can decrease gastrointestinal motility (udavarta). Notably, Udavarta can cause disorders due to poor gastrointestinal motility (aruchi, gulma, grahani, pravahika), psychological (manovikara), and brain (shiro-abhitapa) disorders. Udavarta is treated by

methods which restore homeostasis of apana vata (virechana and basti) (Ch Sam Chi 26/5-10)

Curiously, children with EBDs often exhibit distinctive gastrointestinal symptoms. Consequently, Ayurvedic treatment in its first phase typically involves medications that are carminatives (deepana), digestives (pachana), laxatives (anulomana), and anthelmintic (krimihara).

Sensory stimulation produces positive outcomes in children with cognitive and behavioural issues. External therapies such as abhyanga (body/head massage with therapeutic oils), and udwartana/udgharshana techniques ensure regulated sensory stimulation through touch and pressure receptors. The Moordhni taila (different modes of therapeutic oil application over head or bregma) has distinct anxiolytic, and tranquilizing effects. Specific therapeutic procedures often prescribed in aggressive/destructive behaviour, and anhedonia are Takradhara (regulated pouring of medicated buttermilk), Talapothichil (fastening herbal paste over scalp) and shiro-pichu (a cotton swab soaked in medicated oil applied over bregma).

2.6 Ayurvedic Evidence based practices in EBDs

An increasing body of research establishes the role of Ayurvedic therapeutics in child psychiatry [37,38,39]. Single drugs such as the

roots of Vacha (*Acorus calamus* Linn.) have proven nootropic benefits [40,41,42,43]. Vacha is a classic drug that is specifically used both externally and internally in children. Similarly, Yashtimadhu (*Glycyrrhiza glabra* Linn.) have proven effects on enhancing intellectual quotient and regulating emotions [44]. Ashwagandha (*Withania somnifera* Dunal.) [45], Brahmi (*Centella asiatica* Linn (Urb.)) [46], and Shankhpushpi (*Convolvulus prostrates* Forsk.) [47,48] have proven calming, anxiolytic, adaptogenic, anti-inflammatory, nootropic benefits. Formulations such as Kooshmanda Ghrutha, Saraswatha ghrutha, Saraswatharishta, Dhanwantaram Kashaya, Ashwagandharishta, Brahmi ghrutha, Kalyanaka ghrutha, Manasamitra vataka which are usually prescribed in EBDs have proven effects in neuro-cognitive domains and behavioural despair [49-57].

2.6.1 Rasayana vis-à-vis Nootropics

Nootropics are commonly called cognitive enhancers or brain tonics. Information processing, applying knowledge, reasoning, judgement and adapting or coping to situational stress are the main components of cognition. It broadly incorporates memory, attention, executive functions, perception, language, emotional constructs, and psychomotor behaviours. Nootropics are usually considered as good choice for management of cognitive deficits commonly found in patients suffering

from Alzheimer's disease (AD), schizophrenia, stroke, ADHD, and EBDs [58]. Charaka mentions 'Poorve vayase madhyame va' as the ideal age for starting rasayana administration. Research has shown that stress during prenatal and childhood period triggers long-term changes in children, adolescents and adults, resulting in impaired cognitive function and an increased risk of behavioural and other psychiatric disorders.

Neuron cells expend a lot of energy for repair, maintenance, electrical, and neurotransmitter purposes. Natural nootropics increase blood circulation to the brain and supply essential nutrients and thereby increase energy and oxygen flow to the brain. These drugs also minimize chronic neuro-inflammation [59,60].

Although a lot of phytocompounds have been reported to show good nootropic potential, establishing their clinical usage is a challenging job, as optimum dose must pass blood brain barrier to reach target sites in CNS. Interestingly, most of the medhya rasayana combination in Ayurveda are polyherbal ghee formulations or are administered along with milk, as lipophilic drug can easily cross the blood-brain barrier [61]. Formulation like Brahma rasayana has been reported to significantly improve cognition and memory. The activity is attributed due to the antioxidant, anti-inflammatory, neuroprotective, pro-cholinergic and anti-acetylcholinesterase

properties of different ingredients in Brahma Rasayana [62].

Medhya rasayana powder containing Mandukaparni (*Centella asiatica* L.), Guduchi (*Tinospora cordifolia* (Willd.) Miers ex Hook. f. and Thoms.), Yastimadhu (*Glycyrrhiza galbra* L.) and *Sankhapushpi* (*Convolvulus pluricaulis* Choisy) administered 2 gm twice daily with milk could significantly improve short-term memory and attention span of school-going children [63]. Ingredients of this combination like *C. asiatica* leaf extract has been found to be useful in improving memory, and in controlling erratic behaviour as it possesses neuronal dendritic growth stimulation property when administered in growth spurt (neonatal) period. Increased dendritic arborization property is hypothesized as the major neuronal basis by which *C. asiatica* exhibits nootropic effects [64].

G. glabra roots were also reported to possess cerebro-protective (i.e. resolving chronic neuro-inflammation) effect mediated by its antioxidant activity [65]. Most of the medhya rasayana mentioned in Ayurveda act by modulating the psycho-neuro-immune (PNI) axis. These drugs/combinations possess adaptogen, antioxidant and immunomodulatory potential too by which they modify the PNI axis. Cognition is greatly influenced by immunomodulation as immune system can

effectively modify or influence the learning, memory and psychomotor behaviour [66].

Swarna prashana (one of the jata karma samskaras by Kashyapa) has been specially mentioned to have rasayana property and is advised for usage in neonates and children as an immunity booster and to improve memory intelligence and appetite. The molecular ingredients like sugar, amino acid, protein, lipids etc. present in ghee and honey help in retaining high stability, low toxicity, and immunogenicity conjugation of gold particles. This colloid of Swarna bhasma is hypothesized to interact with the membrane receptor of antigen-presenting cells (APCs) such as dendritic cells and regulate immune responses [67]

3 Current limitations in addressing EBDs

In developing countries such as India, particularly within semi-urban and rural locales, healthcare facilities are often underequipped to deliver comprehensive mental health services for children and adolescents. Furthermore, parents and educators frequently need more experience and exposure to discern how a child's observable behaviours reflect their underlying social and emotional requirements, consequently impeding their ability to respond effectively.

4 The way ahead.

Managing EBDs requires formulating interdisciplinary practices incorporating the roles of parents, educators, extended family members, therapists and healthcare practitioners). Their collective efforts are instrumental in the success of these treatments. The following domains need special attention in their respective ranking.

1. Creating a natural environment conducive to effective sensory learning (creative and reflective): A school focused on nurturing every child's individual value, honesty, integrity, and skills could prioritize imparting life lessons and supporting students in pursuing their aspirations. Instead of using traditional evaluation methods, the school could aim to recognize and foster each student's ambitions. After completing their education, students could have a clear sense of direction and be empowered to plan their life's path. The school's primary objective could be to help students lead fulfilling lives, with their career choices contributing to this fundamental goal. Is this feasible? It is often said that dreams envisioned with open eyes can materialize.

2. Parental behaviour viz. visual and verbal monitoring, encouraging and prompting sensory-cognitive exercises, speaking, praising, and instructing (modelling) [68]

3. Family support assuring a sense of safety and security.

4. Therapeutic behavioural corrections (setting desired behaviours and effortfully eliminating the unwanted ones through behavioural therapies).

5. Medication and other non-pharmacological interventions like yoga.

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Table 01 Legend: Co-relation of selected manasa prakruti traits and traits in specific EBDs.

Selected Manasa Prakruti Traits	Psychological inclinations	Corelatable EBD traits in specific clinical conditions
Aṭana sheelata (R)	Roaming or wandering in nature. Fluctuation in action and thought	CD
Adhṛti (R)	Lack of self-command and firmness in decisions	ADHD, CD, other ICDs
Ahankara (R)	Self-conceited or over-proud about self	ODD
Anṛīkatva (R)	Untruthful or not genuine in words of self	CD, ODD
Akaruṇya (R)	Lacking compassion toward fellow beings	CD
Dambha (R)	Deceiving in nature or intend to injure others	CD
Mana (R)	Self-conceit	CD, ODD
Harsha (R)	Exaltation	ADHD
Kama: (R)	Addictive behaviours, Desire for sensual enjoyments	CD, other ICDs
Krodha (R)	The state of anger or wrath, intentional harming	CD, ODD, other ICDs
Durupacara: (R)	Lack of courtesy, deceit	CD
Anaryam: (R)	No respect to societal norms/conduct	CD
Souryam (R)	Devoid of fear, ferocious traits, may indulge in life threatening acts/adventure seeking	CD, ADHD, ASD, ODD, other ICDs
Matsaryam: (R and T)	Jealous and intolerant to other gains	CD
Amitabhashita: (R)	Excess/ unwarranted speech	ADHD, ICDs
Nastikyam (T)	Not believing in religious social and societal codes of conduct	CD
Adharmasheelata (T)	Lack of Virtues or moral codes of conduct	CD

Exploring childhood emotional and behavioural disorders: An Ayurvedic perspective

Buddhernirodha (T)	Restraint from seeking comprehensive knowledge, reasoning and judgment	CD, ODD
Ajnanam (T)	Lack of proficiency acquired through training, ignorance	CD, ODD other ICDs
Durmedhastvam (T)	Crookedness, foolishness, loss of pursuit in learning	CD, ODD
Akarmasheelata (T)	Lack of interest in doing activities, Lassitude	ODD
Pramada (T)	Inattentiveness, Lack of discipline in self-directed activities	CD, ADHD, ODD, other ICDs
Kshut trushna abhyadhiko (T)	Absurd eating habits, unwarranted cravings	EBDs in general
Vipratipatti (T)	Delusional beliefs, obsessions	CD, ODD
Paratisandhana (T)	Oppositional defiance.	CD, ODD

Table 02 Legend: Co-relation on selected vulnerable prakruti traits potentially identifiable in EBDs.

Selected Prakruti traits	Psychological inclinations	Corelatable traits in specific EBDs
Shoora (P)	Devoid of fear, ferocious traits, may indulge in life threatening acts/adventure seeking	CD, ADHD, ASD, ODD, other ICDs
Mana (P)	Self-conceit	CD, ODD
Krodhapa Nashana (P)	Aggression, destructive mindset	CD, ODD, other ICDs
Irshyalu (P)	Jealousy	CD
Doshatmaka, Abhavya (V)	Impugnation	ODD
Nastika (V)	Not believing in religious social and societal codes of conduct	CD, ODD

Exploring childhood emotional and behavioural disorders: An Ayurvedic perspective

Na dhurdha, Na jitendriya (V)	Inattentiveness, ill disciplined	ADHD, CD other ICDs
Anarya (V)	Not following moral codes of conduct, indulgence in unlawful acts	CD, ODD
Matsaradhmata (V)	Unreasonable jealousy	CD
Stena (V)	Stealing tendencies	CD

Table 03 Legend: Correlation on symptomologies linked with EBDs and Ayurvedic clinical symptomatology cited in different contexts

EBD Symptomatology	Perception errors	Psychological state	Behavioural Symptoms	Dosha status	Clinical Diagnosis
Marked anhedonia abnormal behaviours that violate other's rights, societal norms etc. Symptoms ranging from Aggression, Destruction of properties, deceitfulness, to theft. Aggression, Argumentative and defiant behaviour, vindictiveness Recurrent behavioural	Indreeya vaikalyam/Indreeya dourbalyam, (A.H.Soo 4/7) Vyakulendreeya (A.H Ni 7/45)	Mana santapa (Ch Ch.3/36), Asahishnutvam (Su Utt 39/86) Amarsham (Ch Ch 9/12) Akshamatvam (Ch Sh 4/38) Vyagra chittata (Ma Ni 68/25) Outsukyam (Ch Chi 21/38)	Arati (Su Chi 34/6), Ashtanga Hrudyaa Soo 2/24 Nirbhaya (A H U 4/16) Hitopadesheshu Akshanti (A H Ni 2/8) Hree kshaya/ Nairlajja (A H Ni 2/42) Aakroshanam (Su.Sa.1/12)	Prana avruta vyana (Ch Chi 28/202) Pitta kopa	Brahma rakshasa graha (Ch Ch 9/20; A HU 4/25) Rakshasa graha (A H U 4/27) Pisacha graha (Su U 60/15) Paittika unmada (Ch Ch

Exploring childhood emotional and behavioural disorders: An Ayurvedic perspective

outburst, verbal and physical), destruction of property, physical assault, pyromania.		Krodha (Ch Soo 7/27)	Aprashantha(M.NI .18/8)		7.7/2; A HU 6/10)
		Chitta bhranti (Su U 61/8)	Kalaha echa (Ch. Soo.24/31, Asht Sam.Ni.6/26, Asht H.Ni.6/27)		Bala graha (Su Sh 10/51; Ma Ni 68/17)
		Chitta viplavam (A HU 5/51; AH Ni 6/2)	Samprahara echa (Ch Soo 24/31)		
		Mnao vibhrama (Ch Ni 7/4)	Himsa echa (Ch Ni.7/11)		
		Chitta pariplavam (Ch Ch 9/6)	Abihananam (Ch Chi/A H Utt)		
		Vaichityam (Ch Chi 3/36)	Chesta vibrama (Ch Sam Ni 7/5)		
			Doshana vak ,parusha vaak (Su.Utt.60/9, Ma Ni .20/19)		
			Ugra vaak (A H U 4/39)		
			Achintita arambham (A.H U 6/6)		
			Abhidravana, Parinudhanam, Peedanam,		
			Praharanam, Hananam (Ch Ch 7.7/2; A HU 6/10)		

			Asuchi (Su U 60/15)		
			Aasphalanam bhoomim (Ch Ni 8.8.2)		
			Ghrunitvam (A H Ni 5/10)		
			Bheebhatsa cheshta (A HU 7/3)		

RECENT ADVANCES IN THE MANAGEMENT OF PEDIATRIC RESPIRATORY DISORDERS

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Introduction

Pediatric respiratory disorders encompass a wide range of conditions, from common illnesses like asthma and bronchiolitis to rare and complex diseases such as cystic fibrosis and interstitial lung disease. Recent advancements in medical science and technology have significantly transformed the management of these disorders, improving both the quality of life and clinical outcomes for affected children. This article explores some of the most notable advancements in the management of pediatric respiratory disorders, focusing on new treatment modalities, diagnostic tools, and innovative approaches that are shaping pediatric respiratory care.

Advances in respiratory system physiology and disease in the last two decades

1. The Gut Microbiome and Pediatric Respiratory Health

The intersection between the gut microbiome and respiratory health is an area of growing research interest, especially in the context of pediatric respiratory conditions¹. Emerging evidence suggests that the gut microbiome, the complex community of microorganisms residing in the gastrointestinal tract can have profound effects on respiratory health, influencing both the development and management of various pediatric respiratory disorders. The gut microbiome plays a crucial role in shaping the immune system, which in turn affects various aspects of health, including respiratory health. Recent research has shed light on several mechanisms through which the gut microbiome can impact pediatric respiratory conditions.

The lungs may affect kidney function through intestinal mediation. Communication is believed to exist between the gut and lung microbiota across long physiological distances. Following the inhalation of various pathogenic factors (e.g., particulate matter 2.5 µm or less in diameter, pathogen) in the air through the mouth and nose, considering the anatomical connection between the nasopharynx and lungs, gut microbiome regulates oxidative stress and inflammatory states in the lungs and kidneys. Meanwhile, the intestine participates in the differentiation of T cells and promotes the migration of various immune cells to specific organs. From birth throughout the entire life span, a close correlation between the composition of the gut and lung microbiota exists, suggesting a host-wide network (Grier et al., 2018). The gut microbiota constantly communicates with vital organ systems of the host, such as the brain, bone marrow, vasculature, kidney, immune system and autonomic nervous system. This communication contributes to the homeostasis and health of the host.

Immune System Modulation

One of the primary ways the gut microbiome influences respiratory health is through immune system modulation. The gut microbiota contributes to the development and function of the immune system by interacting with gut-associated lymphoid tissue (GALT)³. This interaction can influence systemic immune responses, including those related to respiratory health. Recent studies have shown that an imbalance in the gut microbiome—dysbiosis—can lead to increased susceptibility to respiratory infections and inflammation. For instance, dysbiosis has been associated with an increased risk of asthma and other allergic respiratory conditions in children². This relationship highlights the importance of a balanced gut microbiome in maintaining respiratory health and suggests potential therapeutic avenues for managing pediatric respiratory disorders.

2. The prominent role of muscles of respiration

The muscles of respiration play a fundamental role in maintaining adequate ventilation and oxygenation, essential for healthy respiratory function. In pediatric patients, the effective functioning of these muscles is crucial due to their high metabolic demands and rapid growth. Understanding how respiratory muscles contribute to various pediatric respiratory disorders can provide insights into diagnosis and management strategies⁴. The primary muscles of respiration include the diaphragm, intercostal muscles, and accessory muscles. Each plays a distinct role in facilitating the mechanics of breathing.

In children with asthma, the intercostal muscles and accessory muscles may become overused due to increased airway resistance and impaired airflow⁵. Cystic fibrosis (CF) affects the lungs and digestive system, often leading to respiratory muscle weakness and dysfunction. The thick mucus in CF can cause frequent infections and inflammation, placing additional strain on the respiratory muscles⁶. RSV bronchiolitis can lead to respiratory muscle fatigue due to increased work of breathing and airway obstruction. Conditions such as spinal muscular atrophy (SMA) and muscular dystrophies can impair respiratory muscles, leading to significant respiratory challenges. These disorders affect muscle strength and coordination, including those necessary for effective breathing⁷.

Recent innovations in diagnostic techniques

3. Genetic and Molecular Diagnostics

Advances in genetic and molecular diagnostics have revolutionized the diagnosis of genetic disorders such as cystic fibrosis (CF)⁸. The development of next-generation sequencing (NGS) technologies has enabled comprehensive genetic testing, allowing for the identification of mutations in the CFTR gene with high precision. This has not only facilitated early diagnosis but also

personalized treatment plans based on specific genetic mutations⁹.

4. Improved Imaging Techniques

High-resolution imaging technologies, such as advanced computed tomography (CT) and magnetic resonance imaging (MRI), have improved our ability to visualize and understand complex respiratory conditions¹⁰. These imaging modalities provide detailed anatomical and functional insights that are crucial for diagnosing conditions like interstitial lung disease and congenital anomalies of the respiratory tract.

5. Enhanced Pulmonary Function Testing

Innovations in pulmonary function testing, including the development of portable spirometers and more sophisticated techniques for measuring lung volumes and airflow, have made it easier to monitor respiratory function in children¹¹. These tools are particularly useful for managing asthma and chronic obstructive pulmonary disease (COPD) in pediatric patients.

Advances in Therapeutic Approaches

6. Targeted Therapies

In the realm of cystic fibrosis, the introduction of CFTR modulator therapies has been a game-changer. Drugs such as ivacaftor and lumacaftor/ivacaftor target specific CFTR mutations, improving chloride channel function and reducing symptoms. These targeted therapies have significantly improved lung function and quality of life for CF patients¹².

7. Biologic Therapies

For asthma management, biologic therapies have emerged as a promising option for children with severe, uncontrolled asthma. Monoclonal antibodies targeting specific inflammatory pathways, such as omalizumab (an anti-IgE antibody) and mepolizumab (an anti-IL-5 antibody), have shown efficacy in reducing asthma

exacerbations and improving control in patients with eosinophilic asthma¹³.

8. Non-Invasive Ventilation

The use of non-invasive ventilation (NIV) techniques, such as bilevel positive airway pressure (BiPAP) and continuous positive airway pressure (CPAP), has expanded in the management of pediatric respiratory failure. NIV can provide respiratory support without the need for invasive intubation, reducing complications and improving comfort in conditions like acute respiratory distress syndrome (ARDS) and neuromuscular disorders affecting respiratory function¹⁴.

9. Probiotic and Prebiotic Interventions

Probiotics—live beneficial bacteria—and prebiotics—compounds that promote the growth of beneficial bacteria—have been studied for their potential to positively influence the gut microbiome and, by extension, respiratory health. Clinical trials have investigated the effects of specific probiotic strains on asthma and respiratory infections in children. For example, some studies have shown that probiotics may help reduce the frequency of asthma exacerbations and improve asthma symptoms in children with mild to moderate asthma¹⁵. Similarly, prebiotic supplementation has been explored as a means to enhance gut microbiome diversity and potentially improve immune responses related to respiratory health.

10. Fecal Microbiota Transplantation (FMT)

Fecal microbiota transplantation (FMT) involves transferring fecal matter from a healthy donor to a patient with a dysbiotic gut microbiome. While FMT is primarily used to treat conditions such as *Clostridium difficile* infection, recent research has explored its potential for modulating the gut microbiome in the context of pediatric respiratory conditions. Early studies suggest that FMT may have beneficial effects on immune regulation and respiratory health. However, this approach is still

in the experimental stage, and more research is needed to establish its safety and efficacy for managing pediatric respiratory disorders¹⁶.

11. Dietary Interventions

Dietary interventions that influence the gut microbiome are another area of interest. Diets rich in fiber, fruits, and vegetables can promote a healthy gut microbiome, which may, in turn, support respiratory health. Recent research has highlighted the importance of early-life nutrition in shaping the gut microbiome and its potential impact on respiratory health¹⁷.

12. Respiratory Muscle Training

Techniques such as inspiratory muscle training can help improve respiratory muscle strength and endurance, benefiting children with chronic respiratory conditions. Mechanical Ventilation Support: For severe cases where respiratory muscle dysfunction is profound, mechanical ventilation may be necessary to support breathing and reduce muscle fatigue. Medications to manage inflammation, infection, or muscle weakness can be tailored to address specific aspects of respiratory muscle involvement in various disorders¹⁸.

13. Innovations in Care Delivery

The way respiratory care is delivered has also evolved, with new models and technologies enhancing patient management and outcomes.

a. **Telemedicine** has become an invaluable tool in pediatric respiratory care, particularly for patients in remote or underserved areas. Virtual consultations allow for regular monitoring and management of chronic respiratory conditions, enabling timely adjustments to treatment plans and reducing the need for frequent in-person visits. This approach has proven effective in managing asthma and other chronic respiratory disorders¹⁹.

b. **Digital Health Tools** - The proliferation of digital health tools, including smartphone apps and wearable devices, has empowered patients and

caregivers with real-time data on respiratory health. Apps for asthma management, such as those that track symptoms, medication use, and peak flow measurements, help in maintaining better control of the condition and improving adherence to treatment plans²⁰.

c. Multidisciplinary Care Teams - The integration of multidisciplinary care teams, including pulmonologists, allergists, nutritionists, and respiratory therapists, has improved the management of complex respiratory conditions. This holistic approach ensures comprehensive care that addresses all aspects of a child's health, from disease management to supportive therapies and psychosocial support²¹.

Ayurveda provides a unique perspective on managing respiratory conditions, focusing on restoring balance and enhancing the body's natural healing processes. In Ayurveda, respiratory health is closely linked to the dosha system. Respiratory issues are often associated with imbalances in these doshas, particularly Kapha dosha, which governs mucus production and respiratory function. An excess of Pitta dosha can lead to inflammation and irritation in the respiratory tract, contributing to conditions like asthma and bronchitis. Imbalances in Vata dosha may lead to dryness and irritation in the respiratory passages, which can exacerbate conditions like chronic bronchitis and lead to cough and breathlessness.

1. The concept of doosheevisha in allergic respiratory conditions

The treatment of respiratory conditions followed the principles of kasa, swasa and pratisyaya chikitsa from very olden days. The concepts of *kaphavrita vata* with *agnimandya* was taken as the baseline. But with the advancements of the laboratory investigations available for detecting allergic conditions like Absolute eosinophil count (AEC), IgE etc, the use of internal medicines in the *doosheevisha* context have increased. The explanation of *dhooma*, *rajas*, *anila* and *himambu* in the etiology of swasa points towards this. Use of

Haridrakhanda, Rajanyadi choorna and doosheevishari gulika in managing allergic respiratory conditions have increased in the recent years²².

2. Wide use of rasa preparations

The use of rasa preparations in the management of respiratory conditions have increased in the last decades due to the increase in the availability of such drugs owing to the industrialisation of their preparation. The systematic use of such rasa preparations like Swasanandam gulika, Lekshmivilasa rasa, Sidhamakaradwaja etc have helped a lot to manage the acute respiratory conditions, particularly in children. These rasa preparations can be given to children with breastmilk as anupana in breastfeeding children and with honey or sugar in older children. The dose of the rasa preparations varies according to the age, weight and prakriti of the child and severity of the condition. The rasa preparations can be used during the acute phase and should not be continued for more than one week, unless the condition demands.

3. Use of arkakalpana

The use of arkakalpana preparations as internal medicines has increased a lot in the last decade. As most of the medicines used in swasa-kasa contexts are rich in volatile components, the effect is not compensated. Also the palatability of the preparation is highly appreciated in children. Various research works are also carried out in the use of different arkas like *parnayavani*, *thulasi*, *bharngi* and *vasa* in respiratory diseases.

4. Ayurvedic nebulisation

The process of Nebulization involves a suspension of fine vaporized liquid droplets otherwise known as aerosol to administer fluids, oxygen and liquid medication directly to the respiratory system. The Ayurvedic nebulisation drugs are made by continuous hot percolation process known as Soxhlet process. Studies have been done on Ayurvedic drug formulations like Sirishadi and

Bharngyadi in comparison with contemporary nebulisation drugs which showed vary promising results²⁴.

5. Urolepam with upanahadravyas

Another recent advancement in Ayurvedic management is the use of external application of paste of *teekshna* drugs like *Jatyadi ilaneer lepa* mentioned in *Arogyarkshakalpadruma*. This is a type of upanahasweda which helps to alleviate the *sopha* in the *urapradesha*, reduce the muscle spasm and also may help to reduce bronchospasm ultimately²⁵.

6. Mukhalepa in URTI

The application of mukhalepa like triphala choorna, kachooradi choorna etc in conditions like adenoiditis, tonsillitis, nasal turbinate hypertrophy etc have evolved as a treatment modality in children. This method is a cheap and easier method of management of the above conditions.

7. Nasal drops

A variety of Ayurvedic nasal drops are available which are mostly prepared in the *arka* form following the principle of *nasya*. Thulasi, parnayavani, yashtimadhu, are the drugs used to prepare these arka. Use of such nasal drops have replaced *nasya* with *swarasa* and *choorna*, which were not so patient friendly.

8. Chest physiotherapy

The inclusion of chest physiotherapy in the management of lower respiratory infections and asthma along with Ayurvedic management have improved the respiratory disease outcome²⁶. The use of *sneha-sweda* like *patasweda* or *nadi sweda* in the *uras* along with chest physiotherapy helps a lot in the expectoration of the exudates and the sputum.

9. Yoga and respiratory exercise

Training of yoga and pranayama techniques during the remission stage of asthma and recurrent

respiratory infections helps to increase the lung capacity and pulmonary functions of the child. Different exercise equipment and various toys are available, which are now prescribed for children to improve their pulmonary functions²⁷.

10. Diet and regimen

The prescription of *laghu*, *ushna* and *anabhisyadi* diet was part of the Ayurvedic treatment from centuries. Addition of Vitamin D supplements in patients having deficiency is the new advancement in the management of respiratory diseases. Vitamin D appears capable of inhibiting pulmonary inflammatory responses while enhancing innate defence mechanisms against respiratory pathogens²⁸. So, focus on diet containing vitamin D and sunlight exposure are also included in the present *pathya* prescriptions.

Conclusion

Ayurveda can play an inevitable role in managing respiratory conditions in children.

❖ Allergic rhinitis and recurrent upper respiratory infections can be successfully managed through Ayurveda following the treatment principles of *agnimandya*, *doosheevisha*, *pratisyaya* and *kasa*.

❖ Severity and frequency of bronchial asthma in children can be reduced and the quality of life can be improved through Ayurveda by *swasa* treatment protocols and assisted therapies like yoga and respiratory exercise.

❖ Lower respiratory tract infections including mild pneumonia without clinical features of respiratory distress like nasal flaring, chest in drawing and grunting can be managed through the principles of *swasa* and *kasa* with the judicious use of *rasa* drugs.

Respiratory tract infections are a major cause of morbidity and mortality in children. Therefore, it is imperative that research studies be conducted to determine the pattern and management of respiratory diseases in the pediatric age group.

Researches in the new fields like lung microbiome, lung-brain axis and Ayurvedic management need to be highlighted in the near future.

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AUTISM SPECTRUM DISORDERS- LAST TWO DECADES OF UPDATES

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Rising Prevalence of Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is increasingly recognized as a significant public health concern. Recent data indicates a notable rise in ASD prevalence among children under 18, with rates ranging from 1.5 to 2 per cent of the general population[1]. This upward trend is consistently observed across various data sources, including national surveys, epidemiological studies, and special education records.

A closer examination of the data reveals a concerning disparity in diagnosis. While there is evidence of a diagnostic shift from Intellectual Disability (ID) to ASD in the general population, it's clear that ASD identification is more prevalent among middle- and high-income children. Low-income children appear to be underdiagnosed,

potentially leading to an underestimation of ASD prevalence in this population[2].

This discrepancy is alarming. It suggests that socioeconomic factors may influence the early detection and diagnosis of ASD. To address this issue, increased awareness, early intervention programs, and accessible diagnostic services are crucial, especially for children from low-income backgrounds[3].

Key Findings:

- A consistent increase in ASD prevalence across different data sources.
- Evidence of diagnostic substitution between ASD and ID.
- Underdiagnosis of ASD in low-income children.

These findings underscore the need for further research and targeted interventions to ensure equitable access to diagnosis and treatment for all children with ASD, regardless of socioeconomic status.

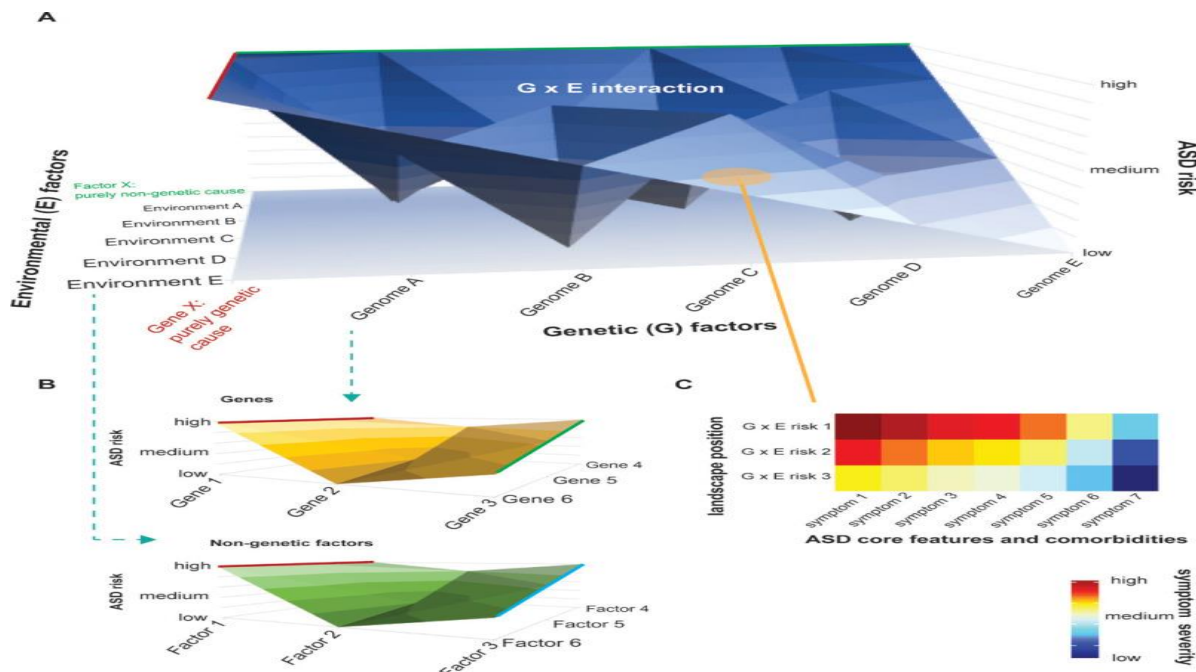


Figure 1: A model for the etiology of ASD (Reprinted from [4])

Causes- Recent updates

A. ASD is caused by genetic or environmental factors or a combination of these. For some individuals, ASD is solely caused by the presence of the genetic mutation(s) (red line). Exposure to a certain environment may cause ASD independent of the genetic background in some individuals (green line). In most cases, the genetic setup of an individual will, in combination with exposure to environmental factors, determine the risk for ASD. For example, while a person with genome A may be at low risk in environment A, the same person may have high risk in environment E.

B. Each genome and each environment are a combination of many genetic factors (upper panel) and non-genetic factors (lower panel), respectively. Whether a genome confers a high risk of developing ASD may be determined by a single mutation, i.e., as seen in many syndromic forms of ASD (red line), or a combination of gene variants, where ASD-associated variants may act in a simple additive way (green line) or are in a more complex relationship. For example, ASD-associated gene 3 may result in low risk if in combination with gene 6, but the risk increases in the presence of gene 5. Thus, multiple variants will increase ASD risk, but specific gene variants may also decrease the overall risk. Similarly, the presence of one particular environmental factor may be such a strong trigger that it acts independently of other environmental factors (red line). In many cases, however, a combination of environmental factors will determine the overall risk contributed through non-genetic factors in an additive or more complex relationship.

C. In case the risk of developing ASD surpasses a threshold, the genetic factors, environmental factors, and their interplay will determine the severity of ASD symptoms and the presence and severity of comorbidities. This results in considerable heterogeneity among ASD.

Autism: A Complex Puzzle

Autism is a complex condition influenced by a combination of genetic and environmental factors. Imagine autism as baking a cake. The recipe (genes) provides the foundation, but the ingredients (environmental factors) and how they interact during baking determine the outcome. Just as a cake can be influenced by a single unique ingredient or a combination of factors, autism can be caused by a single gene mutation or a complex interplay of multiple genes.

Key Factors:

- **Genetic Factors**[5]:
 - **Single-gene mutations:** In some cases, a single altered gene can directly contribute to autism.
 - **Multiple genes:** More commonly, autism is associated with a combination of genes working together in intricate ways.
- **Environmental Factors**[6]:
 - **Prenatal influences:** Factors affecting the developing foetus, such as infections or exposure to certain substances.
 - **Postnatal influences:** Factors after birth, including diet, pollution, or early childhood experiences.

The Complex Interaction

Understanding autism requires recognizing the intricate relationship between genetic and environmental factors. While research has made significant strides, the exact mechanisms are still being explored. It's essential to remember that autism affects individuals differently, and there's no one-size-fits-all explanation.

Pathophysiology recent updates

For years, researchers have focused on how the brain develops and works in autism. Studies on

brain tissue have found problems with brain structure and cell function in people with autism. This suggests that autism involves brain abnormalities. However, recent research on the immune system and the gut-brain connection has shown that problems outside the brain might also be involved in autism.

Many studies have found differences in brain size and shape in young children who later developed autism. While some studies found specific brain areas were different in adults with autism, larger studies have not confirmed these findings. This suggests that early brain overgrowth might be followed by slower or even reduced brain growth later on.

Brain connections also seem to be different in people with autism. While some studies found reduced connections between distant brain areas and increased connections within smaller brain areas, other studies haven't confirmed this.

There are also problems with the structure of brain cells in autism. For example, there are fewer Purkinje cells in the cerebellum. But the most clear problem in autism is with connections between brain cells called synapses. Many genes linked to autism affect proteins important for synapse function. These genes include SHANK, neurexin, and neuroligin. Studies have shown that many autism-related genes are involved in processes that control synapse health and learning. So, autism is also called a "synaptopathy." Two important signalling pathways in synapses, mTOR/PI3K and NRXN-NLGN-SHANK, seem to be involved in autism. These pathways help build new synapses, but they mostly affect excitatory synapses, which might lead to an imbalance between excitatory and inhibitory brain signals.

Beyond the brain, researchers have started to look at other body parts involved in autism. The digestive system is one area of focus, as many people with autism have digestive problems. These problems seem to be more common and severe in

people with more severe autism, suggesting a link between gut health and autism. Common digestive symptoms include stomach pain, bloating, diarrhoea, constipation, and acid reflux.

The gut in people with autism seems to be more leaky, allowing substances to pass through that microbiome composition in ASD patients [7]. Studies have shown that Ayurvedic gut therapy protocols, including poly-herbal formulations and lifestyle guidelines, can significantly increase the abundance of beneficial Bifidobacterium in autistic children [8]. The gut-brain axis plays a crucial role in ASD pathogenesis, with gastrointestinal problems and dysbiosis commonly observed normally wouldn't. This can lead to inflammation, which may affect the brain. Interestingly, this leaky gut is also seen in other conditions like Crohn's disease and celiac disease. Some genetic forms of autism even affect the nerves in the gut, leading to digestive problems.

The balance of bacteria in the gut called the microbiome, is different in people with autism.

This imbalance can worsen digestive problems and inflammation. While studies have found different results, many show changes in the types of bacteria in the gut of people with autism. These changes in gut bacteria and the leaky gut can lead to inflammation that affects the brain and contributes to autism.

Ayurvedic Perspectives on Autism

Autism spectrum disorder (ASD) requires a comprehensive understanding involving both metaphysical and biological domains for optimal management.

Metaphysical Understanding: ASD is viewed as a pervasive developmental disorder arising from imbalances in the interplay between the self (Atma), mind (Manas), and intellect (Buddhi) with the environment. While Atma transcends the realm of medicine, addressing imbalances in Manas and Buddhi necessitates a multidisciplinary approach

encompassing lifestyle interventions (Achara Rasayana), spiritual practices (Daivavyapashraya chikitsa), and supportive therapies like speech and behaviour therapy. This metaphysical perspective constitutes a significant aspect of ASD management.

Biological Understanding: The biological underpinnings of ASD encompass disturbances in the body, mind, and intellect. Ayurvedic medicine offers therapeutic interventions to address these imbalances. Effective management of biological factors can significantly ameliorate ASD symptoms.

Integrated Management: A holistic approach integrating metaphysical and biological principles can enhance the quality of life for individuals with ASD and provide solace to their families. While the judicious use of Ayurvedic therapies is emphasized, the role of conventional medications like risperidone and antiepileptic drugs cannot be entirely dismissed in cases of severe seizures or comorbidities.

Biological Manifestations and Management:

- **Gastrointestinal (GI) Disorders:** Dysbiosis, characterized by an imbalance of gut microbiota, is prevalent in ASD. Associated symptoms include altered bowel habits, digestive issues, feeding difficulties, irritability, and abdominal discomfort. Other GI disorders like inflammatory bowel disease, mesenteric lymphadenopathy, and leaky gut syndrome may coexist. These conditions correlate with the Ayurvedic concept of "Ama" (undigested residue).

- **Pitta-predominant Ama:** Characterized by abdominal tenderness, diarrhoea, oral ulcers, increased appetite, and urinary tract infections.

- **Kapha-Vata predominant Ama:** Manifests as abdominal pain, vomiting, constipation, bloating, regurgitation, gastroesophageal reflux disease (GERD),

decreased appetite, and altered bowel and urinary patterns.

- **Metabolic Derangements:** Metabolic imbalances, particularly those related to carbohydrate and protein metabolism, contribute to toxin accumulation (Ama) in the body, affecting brain function.

- **Toxins:** Both endogenous (internally produced) and exogenous (environmentally sourced) toxins play a role in ASD pathogenesis. Leaky gut syndrome exacerbates toxin absorption.

- **Brain Pathologies:** ASD is associated with various brain abnormalities such as macrogyria, micro-columnar pathology, polymicrogyria, gliosis, and neurotransmitter imbalances. Ayurvedic procedures and therapies targeting respiratory conditions (Kshaya and Shwasa) can be beneficial.

- **Sensory Integration Issues:** Sensory processing difficulties, common in ASD, can be addressed through Ayurvedic therapies, music therapy, and vestibular stimulation.

- **Immune Dysfunction:** Hypersensitivity or immune deficiency often accompanies ASD. Allergic manifestations and recurrent infections are common. Ayurvedic approaches to detoxification and immune modulation are relevant.

Advances in Ayurveda

Recent research suggests a strong link between gut dysbiosis and ASD, with the potential for Ayurvedic interventions to improve gut in affected individuals. Factors such as early colonization, mode of delivery, and antibiotic usage can influence gut microbiome composition and ASD onset. Emerging therapeutic approaches targeting the gut microbiome, including probiotics and fecal microbiota transplantation, show promise in managing ASD symptoms [9]. These findings highlight the potential of Ayurvedic and microbiome-based interventions in ASD management.

Therapy updates

Treatment Options for ASD: Pharmacological interventions for ASD primarily target comorbid conditions like Attention Deficit Hyperactivity Disorder (ADHD), aggression, and irritability. This overview focuses on common drug classes, their efficacy, and safety.

Psychostimulants: While effective for ADHD, psychostimulants like methylphenidate and amphetamines have limited benefits for core ASD symptoms. They primarily address hyperactivity and impulsivity but may worsen other symptoms.

Atypical Antipsychotics: Risperidone and aripiprazole are Food and Drug Administration (FDA) approved medications for irritability in ASD. They effectively reduce aggression, irritability, and repetitive behaviours. However, they often cause weight gain, sedation, and other metabolic side effects. Quetiapine, ziprasidone, and olanzapine have shown mixed results and carry significant side effect risks.

Antidepressants: Selective Serotonin Reuptake Inhibitors (SSRIs) like fluoxetine, sertraline, citalopram, escitalopram, and fluvoxamine are commonly prescribed for ASD, though evidence for their efficacy on core symptoms is limited. Fluoxetine has shown some benefit in reducing repetitive behaviours, but overall results are inconsistent.

Alpha-2 Adrenergic Receptor Agonists: Clonidine and guanfacine can reduce hyperarousal, irritability, and sleep disturbances in ASD. However, they often cause sedation, fatigue, and decreased appetite.

Summary of Non-Pharmacological Therapies for ASD

Complementary and Integrative Health (CIH): With the limited efficacy of current pharmacologic treatments for ASD, there's growing interest in

CIH, including sensory integration therapies, acupuncture, and especially music therapy, which shows promising results in improving core ASD symptoms.

Music Therapy: Music therapy is notably effective due to its potential to alter brain structure and connectivity, improving sensory integration and emotional attunement in ASD patients. The neuromodulatory effects of music suggest significant benefits, especially in enhancing speech and communication through music-based interventions.

Cognitive-Behavioral Therapy (CBT): CBT is highly structured and beneficial for ASD, particularly in managing anxiety, depression, and core symptoms. While effective in young patients, its benefits in adults are less clear.

Social Behavioral Therapy (SBT): SBT, including Applied Behavioral Analysis (ABA) and other developmental models, focuses on improving social skills, communication, and functional independence, with early intensive interventions showing substantial benefits in young children.

Oxytocin and Vasopressin: Oxytocin has shown potential in improving social behaviours in ASD, though results are mixed and administration challenges exist. Vasopressin antagonists are also being explored for their pro-social benefits, with promising early results.

Omega-3, Vitamins, and Herbal Medicine: Omega-3 fatty acids are being investigated for their neurodevelopmental benefits in ASD, though the evidence remains inconclusive, with some trials showing no significant effects

Speech-Language Therapy (SLT)

Implementation:

- SLT is recognized as the most commonly implemented special education program for children with autism.

- Given that SLT is an umbrella term for various therapies conducted by speech-language pathologists (SLPs), it is essential to consider the diversity of targeted skill areas and intervention models.

- The developmental-naturalistic model and ABA are highlighted as extensively studied approaches in SLT for individuals with autism.

Sensory Integration Therapy:

- Sensory-based interventions, including activities like wearing weighted vests or swinging, are commonly used to enhance arousal levels and behavioural control in children with autism.

- While these interventions are often employed to address core symptoms of autism, current evidence supporting their efficacy remains limited. Further investigation and evidence are necessary to validate their effectiveness.

Developmental Approaches:

- Developmental approaches that focus on child-led spontaneous play and joint attention with adults are acknowledged for enhancing communication skills in young children with autism.

- Programs such as Developmental, Individual-differences, Relationship-based (DIR/Floor Time) and Hanen's More than Words have been introduced in Korea however, the scientific evidence supporting the effectiveness of these programs is not yet consistent or sufficient. Continued research and evaluation are recommended to establish their efficacy.

Promising New Interventions[10]:

Several new promising interventions have been introduced for children with autism like the Program for the Education and Enrichment of Relational Skills (PEERS), Paediatric Autism Communication Therapy (PACT), Research Units in Behavioral Intervention (RUBI), and Unstuck and On-target interventions. While these interventions show potential, further research is required to establish their evidence base and long-term efficacy.

1. PEERS Program:

- The PEERS program, targeting teenage adolescents, has been recognized for its potential to improve social competence and skills. It is noted for enhancements in social skills, knowledge, social responsiveness, and overall social communication and cognition.

2. PACT:

- PACT, which utilizes specific video feedback techniques to help recognize, respond to, and enhance parent-child communication, was identified as a promising intervention and further studies need to be conducted to establish a stronger evidence base for this approach.

3. RUBI:

- The RUBI program, designed as a parent training program to decrease challenging behaviours in children with ASD, was highlighted as a significant area for future research and needs continued research to confirm its effectiveness and scalability.

4. Unstuck and On-target:

- This classroom-based intervention for high-functioning students aims to promote cognitive and behavioural flexibility in everyday situations. It is noted as an innovative approach worth further exploration and necessitates additional research to better understand its impact and to consider implementation in educational settings if proven effective.

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**PEDIATRIC GASTROENTEROLOGY:
RECENT ADVANCES IN BIOMEDICINE
AND AYURVEDA**

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I. INTRODUCTION

Pediatric gastroenterology, a subspecialty within gastroenterology emerged in the mid-20th century, with significant advancements marking its evolution. This subspecialty addresses conditions such as gastroesophageal reflux, celiac disease, and inflammatory bowel diseases (IBD) like Crohn's disease and ulcerative colitis, which have shown varying prevalence rates globally. Recent advancements in biomedicine have revolutionized pediatric gastroenterology, including the development of biologic therapies for IBD, advancements in genetic research for personalized medicine, and the introduction of non-invasive diagnostic tools. Additionally, the integration of probiotics and dietary management strategies has significantly improved patient outcomes.^[1] Complementing these biomedical advancements, Ayurveda offers a unique, time-tested approach to pediatric GIT disorders. Ayurvedic treatments, including dietary recommendations, herbal supplements, and lifestyle modifications, provide

an alternative or adjunctive therapeutic option, emphasizing the balance of body and mind.^[2] This chapter explores the latest updates in pediatric gastroenterology from both biomedical and Ayurvedic perspectives, highlighting the convergence of modern medicine and traditional practices in enhancing pediatric GIT healthcare.

II. MATERIALS AND METHODS

Research articles on pediatric gastroenterology in both biomedicine and Ayurveda were collected and analyzed for data of all kinds. PubMed alone was considered for biomedicine articles whereas both PubMed and Google Scholar were searched for inputs from Ayurveda (due to the paucity of Ayurveda publications in the former). All types of scientific communications (Meta-analyses, systematic reviews, clinical trials, experimental studies, observational studies, other original articles, and selected relevant reviews) were included. The keywords were pediatric, gut, GIT, gastroenterology, microbiota, and Ayurveda. Appropriate Boolean operators were added. The timeline of the search was set from 2005 to 2024 to curate the most recent data. The obtained data were visualized in VOS viewer 1.6.20 to identify the frequently researched areas and their interactions. Generative AI was also used for assistance in data synthesis.

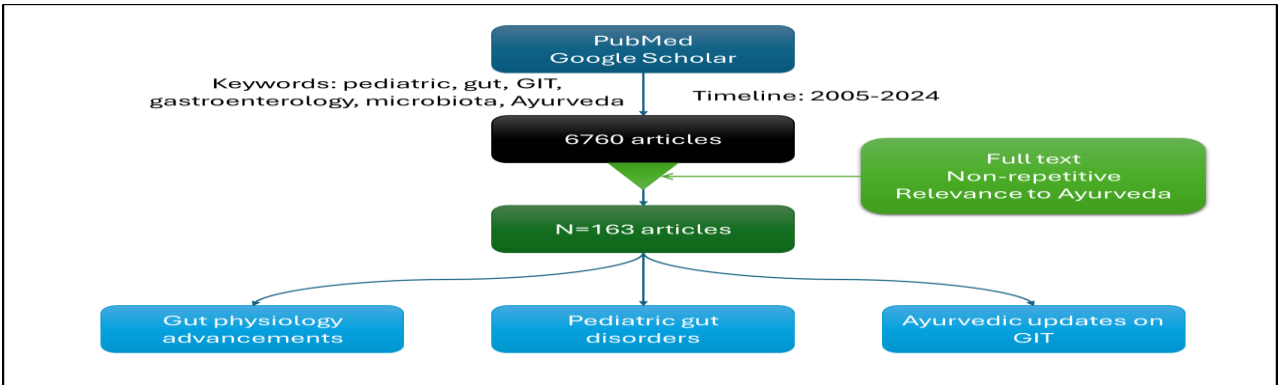


Figure 1: Materials and Methods

III. RESULTS

The literature search in PubMed yielded 6,760 relevant articles from biomedicine and Ayurveda combined. Its visualization is as follows:

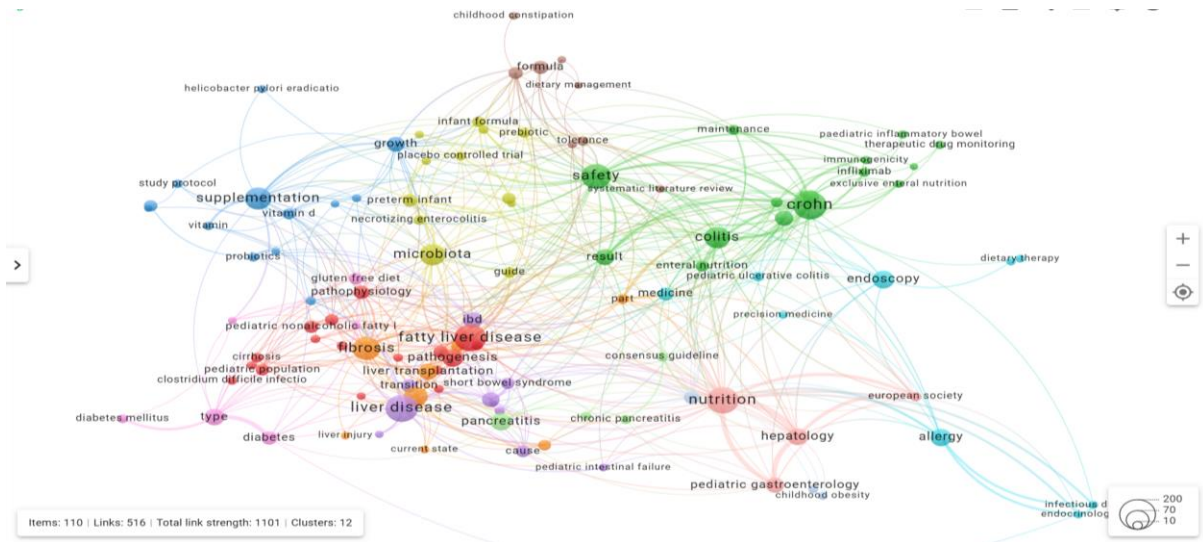


Figure 2: Pediatric Gastroenterology Research: Links and Gaps (VOS viewer)

Advancements closely related to the scope of Ayurveda were: Gut microbiota, Gut-related axes, ages and stages of gut maturation, gastroenteric modulation of immunity, novel receptors of the gut, “gut” genomics, and specific diseases and their management. The results have been divided into three: Knowing the gut (gut physiology advancements), Pediatric Gut Disorders (Diagnostic and therapeutic advancements), and Ayurveda Updates.

1. KNOWING THE GUT

1.1. Gut microbiota

The gut microbiome comprises a diverse array of microorganisms, including bacteria, fungi, viruses, and archaea, that play a pivotal role in maintaining gut health and influencing various physiological parameters. Key bacterial phyla such as Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria dominate the gut ecosystem. **Firmicutes** and **Bacteroidetes** are particularly abundant, often representing over 90% of the gut

microbiota.^[3] The Firmicutes/Bacteroidetes (F/B) ratio is commonly used as an indicator of gut health, with a higher ratio being associated with obesity and a lower ratio linked to inflammatory bowel disease (IBD) and other metabolic disorders. **Lactobacillus** and **Bifidobacterium** (Actinobacteria) are beneficial microbes known for their role in fermenting dietary fibres into short-chain fatty acids (SCFAs) like butyrate, which are crucial for maintaining gut barrier integrity, modulating immune responses, and providing energy to colonocytes. Conversely, an overgrowth of **Proteobacteria**, which includes potentially pathogenic bacteria such as **Escherichia coli** and **Salmonella**, is often associated with dysbiosis, inflammation, and disease states. The diversity of the gut microbiota, along with the presence of specific beneficial strains, is essential for maintaining overall health. Reduced microbial diversity is commonly observed in various diseases, including IBD, colorectal cancer, and metabolic syndrome.^[4] Hence, the composition and balance of gut microbiota are critical not only for digestive health but also for metabolic,

immune, and even neurological functions, highlighting the importance of a healthy, balanced gut microbiome for overall well-being.^[5-7]

Table 1: Common Gut Microbes and Their Implications on Health

Microorganism	Phylum	Role/Implication on Health
Firmicutes	Firmicutes	Dominant in gut; high levels linked to obesity
Bacteroidetes	Bacteroidetes	Helps in digesting complex molecules; low levels linked to IBD
Lactobacillus	Firmicutes	Produces lactic acid; enhances gut barrier function
Bifidobacterium	Actinobacteria	Produces SCFAs; modulates immune response
Escherichia coli	Proteobacteria	Pathogenic strains cause infections; overgrowth indicates dysbiosis
Salmonella	Proteobacteria	Pathogenic; causes gastrointestinal infections
Clostridium difficile	Firmicutes	Pathogenic; causes severe diarrhea and colitis
Bacteroides	Bacteroidetes	Ferments complex carbohydrates; supports gut health
Faecalibacterium prausnitzii	Firmicutes	Produces butyrate; anti-inflammatory properties
Akkermansia muciniphila	Verrucomicrobia	Degrades mucin; promotes gut barrier integrity

In Ayurveda, Gut microbiome composition significantly varied among three predominant Prakriti types: Vata, Pitta, and Kapha. Research found using 16S rRNA gene-based microbial community profiling, that while Bacteroidetes and Firmicutes are the major gut microbial components, specific taxa were differentially abundant among the *Prakriti* groups.^[8] The study revealed that *Pitta* individuals had a higher abundance of butyrate-producing bacteria, which are beneficial for gut health, whereas Kapha individuals had a higher prevalence of *Prevotella copri*, associated with pro-inflammatory conditions.^[8] Gut microbiota has been valuable in elucidating novel explanations of Ayurvedic

concepts like *Agni* and *Koshtha*. Further research in understanding how Ayurvedic interventions affect the microbiome, and how individuals with different sets of flora respond to Ayurvedic interventions would unravel newer possibilities.

1.2. Gut and Surrounding Axes

1. **Brain (Gut-Brain Axis):** The gut-brain axis is mediated through neuroactive compounds produced by gut microbes, such as short-chain fatty acids (SCFAs), which can cross the blood-brain barrier. These metabolites influence the central nervous system by modulating neural pathways

and neurotransmitter systems. Dysbiosis in the gut microbiota has been implicated in the development of neuropsychiatric disorders such as anxiety and depression through mechanisms that include the modulation of systemic inflammatory cytokines, alteration of the stress response, and direct signalling to the brain via the vagus nerve.

2. **Liver (Gut-Liver Axis):** The liver is significantly affected by the gut microbiota through the portal vein, where metabolites, bacterial products, and endotoxins such as

lipopolysaccharides (LPS) are transported, influencing liver function and health. Gut-derived microbial metabolites like SCFAs and secondary bile acids play roles in modulating liver immune responses, metabolic flux, and hepatic steatosis. Perturbations in the gut microbiota can lead to conditions such as non-alcoholic fatty liver disease (NAFLD) and cirrhosis through mechanisms involving increased intestinal permeability and systemic inflammation.

3. **Skin (Gut-Skin Axis):** The connection between gut and skin health is exemplified by the influence of gut microbes on systemic immune responses that affect skin barrier function and inflammatory status. For instance, certain gut bacteria influence the production of inflammatory mediators that can exacerbate or mitigate dermatological conditions like eczema, psoriasis, and acne. *Lactobacillus rhamnosus* has been shown to enhance skin barrier function and reduce the severity of atopic dermatitis by modulating immune responses. *Bifidobacterium breve* can improve the skin's barrier and reduce inflammation in conditions like eczema. *Akkermansia muciniphila* is another microbe associated with maintaining the gut barrier, which in turn influences skin health and has implications for diseases like psoriasis. Dysbiosis has been linked to acne, with *Cutibacterium acnes* playing a

significant role in the development of this condition.

4. **Heart (Gut-Heart Axis):** Cardiovascular health is impacted by metabolites such as TMAO (trimethylamine N-oxide), produced by gut flora from dietary choline and carnitine. Elevated TMAO levels have been associated with atherosclerosis and other cardiovascular diseases by promoting cholesterol accumulation in arterial walls and enhancing platelet responsiveness, leading to thrombosis.

5. **Lung (Gut-Lung Axis):** The gut-lung axis is less direct but significant, where gut microbiota modulates immune homeostasis, which affects respiratory health. Changes in gut microbiota composition can influence the immune system's response to respiratory pathogens and are linked to conditions such as asthma and COPD.

6. **Kidney (Gut-Kidney Axis):** The kidneys are affected by gut-derived uremic toxins like indoxyl sulfate and p-cresyl sulfate, which are products of protein fermentation by gut bacteria. These compounds can accumulate in chronic kidney disease (CKD), exacerbating renal damage through oxidative stress and inflammation.

7. **Bone (Gut-Bone Axis):** Gut microbiota influences bone density and health via calcium absorption and the modulation of the immune system. SCFAs produced by gut bacteria can enhance the differentiation of osteoclasts and are vital in maintaining bone homeostasis.

8. **Endocrine (Gut-Endocrine Axis):** Gut microbes directly affect the host's endocrine system by modulating hormone levels, including insulin, which plays a crucial role in metabolism and diabetes. For instance, certain gut bacteria can influence the secretion of incretins and other hormones involved in glucose homeostasis,

impacting insulin sensitivity and metabolic outcomes.

The potential for microbiota-targeted therapies offers a promising avenue for the prevention and

management of these conditions, emphasizing the need for further research into these complex biological interactions.^[9]

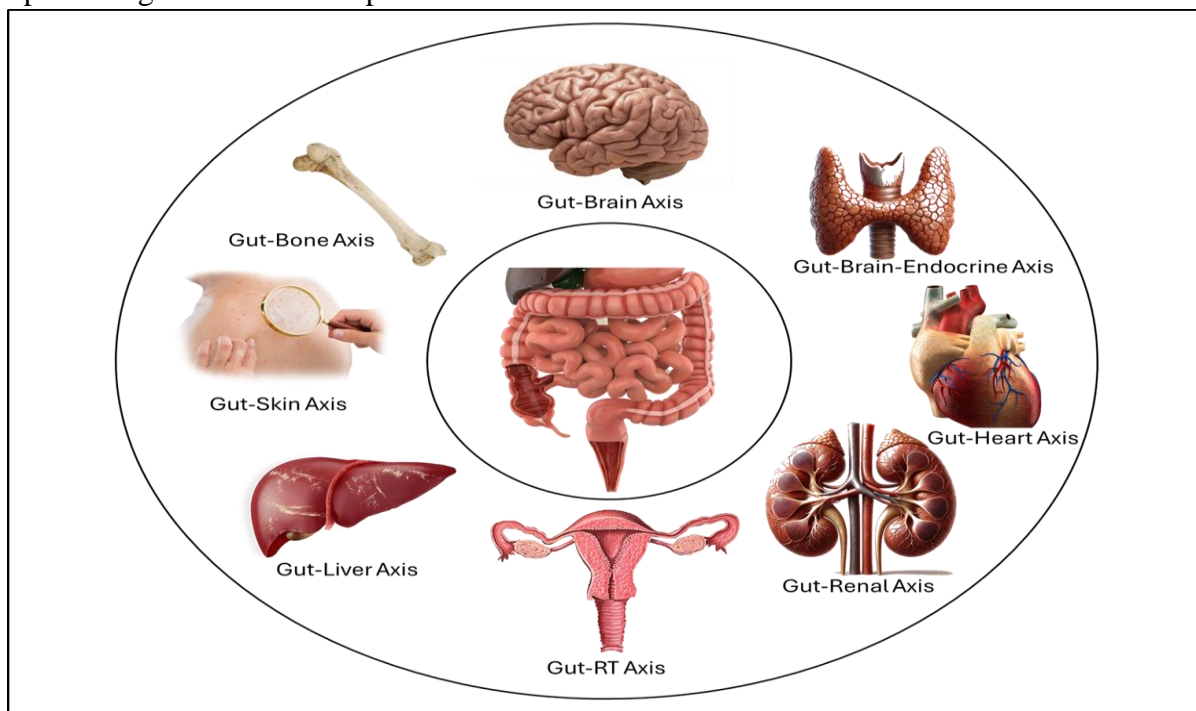


Figure 3: Gut and related axes

1.3. Prebiotics, Probiotics, and Synbiotics

Prebiotics (non-digestible food components that selectively stimulate the growth or activity of beneficial microorganisms in the gut), probiotics (live microorganisms that, when administered in adequate amounts, confer a health benefit on the host), and synbiotics (a combination of prebiotics and probiotics that enhance the survival and activity of beneficial microorganisms in the gut) are rapidly expanding sectors with significant implications. Their internal use during pregnancy, lactation, and after childbirth has been shown to affect both maternal and neonatal gut microbiota, thereby enhancing outcomes for both mother and baby. Various studies have investigated the prebiotic properties of Ayurvedic herbs. Herbs such as *Glycyrrhiza glabra* and *Triphala* have been

found to encourage the growth of beneficial bacteria while reducing harmful ones. They also affected different bacterial groups; *Triphala* boosted the relative numbers of butyrate-producing bacteria, while *G. glabra* increased those of propionate-producing bacteria.^[10–12] *Takrarishta* (Ayurvedic fermented preparation) demonstrated the presence of potent probiotics such as

Lactobacillus sp. and *Kluyveromyces* spp.^[13] *Woodfordia fruticosa* (L.) Kurz. flowers used broadly in fermented preparations, regulate the gut microbiome by restoring beneficial bacteria like *Bifidobacterium*, *Akkermansia*, and *Lactobacillus*, and reducing harmful bacteria such as *Bacteroides*, *Parabacteroides*, and *Alistipes*.^[14]

1.4. Novel receptors in the gut

Recent discoveries have highlighted the critical role of multiple receptors in pediatric gut health

and disease management. Taste receptors, primarily known for their role in the oral cavity, have been identified in the gut, where they play a pivotal role in detecting nutrients and regulating digestive processes. These receptors, particularly those sensitive to sweet, umami, and bitter compounds, are involved in modulating hormone release, gut motility, and appetite. For instance, sweet taste receptors in the gut can stimulate the release of incretin hormones, which enhance insulin secretion and glucose metabolism, thereby influencing energy balance and metabolic health in children.^[15] Ayurveda identifies *rasa* (taste) as a fundamental parameter having a pervasive role in determining the pharmacological action of drugs,

that even applies to external application and rectal drug administration. The discovery of extraoral taste receptors ascertains the relevance of the same.^[16] *Vasti* (enema) of bitter-sweet tasting drugs and *seka* (washing/medicine streaming) with sour medicines can probably be appreciated better by their interaction with these receptors.

Opioid receptors in the gut, which respond to endogenous and exogenous opioids, significantly impact gastrointestinal motility and pain perception. Activation of these receptors can lead to alterations in bowel movements, ranging from constipation to diarrhea, depending on the type of opioid and its receptor affinity. In pediatric patients, dysregulation of opioid receptor activity is linked to conditions such as irritable bowel syndrome (IBS) and functional abdominal pain. Therapeutic strategies targeting these receptors include the use of opioid antagonists to relieve constipation without compromising analgesia, thereby improving the quality of life for affected children.^[17]

Additionally, other receptors such as cannabinoid receptors and serotonin receptors also contribute to gut health. Cannabinoid receptors regulate nausea, vomiting, and appetite, while serotonin receptors are crucial for regulating gut motility and secretion.

Dysregulation of these receptors is implicated in pediatric gastrointestinal disorders like gastroparesis and IBS, highlighting their potential as therapeutic targets.^[18]

The emerging understanding of these gut receptors underscores their importance in maintaining gastrointestinal health and developing targeted treatments for pediatric gastrointestinal disorders. This knowledge paves the way for innovative therapies that can modulate receptor activity to manage symptoms and improve outcomes in children with gut-related diseases.

1.5. Gut Genomics: Nutrition, Medicine, and Ayurveda

Nutrigenomics and pharmacogenomics are burgeoning fields that explore the interactions between genes, diet, and drugs, respectively, to optimize individual health outcomes.

Nutrigenomics focuses on how genetic variations affect nutritional requirements and responses to dietary components. It seeks to understand how nutrients influence gene expression and how genetic differences can impact nutrient metabolism and health.^[19] Pharmacogenomics, on the other hand, examines how genetic variations influence an individual's response to drugs, aiming to tailor drug therapies based on genetic profiles to maximize efficacy and minimize adverse effects.^[20]

Ayurveda considers individual constitution (*Prakriti*) and lifestyle. Integrating genomics with Ayurveda has led to the emergence of Ayurgenomics and Ayurnutrigenomics. Ayurgenomics seeks to correlate Ayurvedic concepts of *Prakriti* with modern genetic markers to understand how genetic variations underpin individual constitutions and disease susceptibilities.^[21] This approach has revealed significant genetic associations with different *Prakriti* types, suggesting a genetic basis for

Ayurveda's personalized medicine.^[22] Ayurnutrigenomics extends this concept by examining how individual genetic backgrounds, as understood through Ayurveda, interact with diet and nutrition. This field aims to personalize nutritional recommendations based on both Ayurvedic principles and genetic profiles, optimizing health and preventing disease through diet.^[23]

1.6. Gut: Stages of Maturation

The maturation of the gastrointestinal (GI) tract in newborns, particularly preterm infants, involves a series of critical developmental stages that are essential for proper nutrition and overall health. Protein digestion begins in the stomach with the secretion of hydrochloric acid and pepsinogen by parietal cells, which are present by the late first trimester. However, gastric acid production is limited in preterm infants. Pancreatic enzymes, including trypsinogen and chymotrypsinogen, become active by 24 gestational weeks but are less efficient in preterm infants. Carbohydrate digestion starts with salivary and pancreatic amylases,

followed by enzymes at the epithelial brush border; however, lactase activity, crucial for lactose digestion, is notably low in preterm infants but can be induced with human milk. Lipid digestion depends on bile acids and pancreatic lipase, which are produced at lower levels in preterm infants, making lipid absorption less efficient. GI motility, which includes coordinated movements of the GI tract, improves with gestational age. The enteric nervous system (ENS), consisting of enteric neurons, glial cells, and interstitial cells of Cajal (ICCs), begins to show significant activity around 16 weeks. The gut-brain axis involves complex interactions between the gut and the brain, mediated through neural, endocrine, immune, and metabolic pathways, with the vagus nerve playing a crucial role. The development of the gut microbiome, which starts at birth, is influenced by factors such as mode of delivery and feeding.

Preterm infants often experience dysbiosis due to premature birth and hospital exposure, which can lead to conditions like necrotizing enterocolitis (NEC) and late-onset sepsis (LOS). Understanding these developmental processes is vital for optimizing nutritional strategies and promoting healthy growth, especially in preterm infants, by ensuring adequate digestion, absorption, and overall GI functionality.^[24]

1.7. Pharmacokinetics and Dynamics in Children: Redefining Doses

Pharmacokinetics (PK) and pharmacodynamics (PD) in children are significantly different from adults due to various anatomical and physiological factors affecting drug absorption, distribution, metabolism, and excretion (ADME). Simple extrapolations of adult doses based on formulae have proven insufficient with events like Grey Baby syndrome (Chloramphenicol). In pediatric populations, drug absorption is influenced by factors such as gastric pH, intestinal transit time, and enzyme activity. For example, gastric pH is higher at birth and gradually decreases, affecting the solubility and absorption of weak acids and bases. Intestinal transit time is shorter in young

children, which can reduce the absorption of sustained-release formulations and poorly soluble drugs.

The distribution of drugs in children is affected by their body composition. Infants have a higher body water content and lower body fat compared to adults, leading to a larger volume of distribution for hydrophilic drugs and a smaller volume for lipophilic drugs. Additionally, protein binding is lower in neonates due to decreased plasma protein concentrations, resulting in a higher free fraction of drugs in plasma, which can increase their volume of distribution.

Hepatic clearance in children is influenced by the maturation of liver enzymes. The activity of cytochrome P450 (CYP) enzymes, responsible for drug metabolism, varies with age. For instance, CYP3A7 is the predominant enzyme in fetuses and neonates, whereas CYP3A4 and CYP3A5 levels increase with age. This impacts the metabolism rates of drugs, requiring age-specific dosing adjustments. The liver size relative to body weight is larger in infants and preschool children, potentially increasing hepatic clearance for some drugs.

Renal excretion, another crucial factor in drug clearance, also undergoes maturation. The glomerular filtration rate (GFR) in neonates is significantly lower than in adults but increases rapidly, reaching adult levels by the end of the first year of life. This maturation affects the elimination half-life of drugs excreted unchanged by the

kidneys. For instance, drugs like gentamicin require higher doses per kilogram of body weight in infants compared to adults to achieve comparable plasma concentrations.

Other factors such as intestinal enzyme activity and the presence of efflux transporters like P-glycoprotein (P-gp) also play roles in drug absorption and clearance. P-gp expression increases during the first few months of life, influencing the bioavailability of drugs it transports.

Overall, these physiological differences necessitate careful consideration of dosing in children to ensure therapeutic efficacy while minimizing toxicity. Pediatric dosing often involves scaling based on body weight or surface area and requires adjustments for the specific developmental stage of the child.^[25]

2. PEDIATRIC DISORDERS

The last two decades have witnessed marked updates in pediatric gut disease nomenclature, diagnosis, and management. Functional Gastrointestinal Disorders, Inflammatory Bowel Diseases, Celiac Disease, and Pediatric Fatty Liver Disease have been some of the most evolving diseases in the past two decades.

2.1. Functional Gastrointestinal Disorders

The Rome IV criteria for functional gastrointestinal disorders (FGIDs) in children have introduced several updates in nomenclature and diagnosis to enhance clarity and reduce unnecessary testing. New disorders such as functional nausea and functional vomiting are now defined, and cyclic vomiting syndrome (CVS) criteria have been updated to emphasize the stereotypical pattern of episodes. The term "abdominal pain related functional gastrointestinal disorders" has been replaced with "functional abdominal pain disorders" (FAPD), and a new

category, functional abdominal pain - not otherwise specified (FAP-NOS), has been introduced for children who do not fit specific disorders like IBS, functional dyspepsia, or abdominal migraine. Functional defecation disorders have also been updated, with specific changes to criteria for conditions like functional constipation and non-retentive fecal incontinence. The diagnostic approach now emphasizes symptom-based diagnosis, replacing the need to exclude all organic diseases with the requirement that symptoms cannot be attributed to another medical condition after appropriate medical evaluation. Updated criteria for CVS, functional nausea, functional vomiting, rumination syndrome, aerophagia, functional dyspepsia, IBS, abdominal migraine, and FAP-NOS reflect these changes. These updates aim to improve diagnostic accuracy, reduce unnecessary testing, and better reflect

clinical realities where FGIDs can coexist with other conditions, facilitating consistent diagnosis for clinical practice and research purposes.^[26]

The updated nomenclature and diagnosis of Functional Gastrointestinal Disorders (FGIDs) in neonates and infants have seen significant revisions based on recent evidence and research. FGIDs in infants are still defined as variable combinations of chronic or recurrent gastrointestinal symptoms not explained by structural or biochemical abnormalities. The main FGIDs affecting neonates and infants include infant regurgitation, infant rumination syndrome, cyclic vomiting syndrome, infant colic, functional diarrhea, infant dyschezia, and functional constipation. The neurodevelopmental understanding of pain in infants has also been expanded, highlighting that infants can experience and process pain differently than older children, which has implications for the diagnosis and management of pain-related FGIDs.

2.2. Inflammatory bowel diseases

Inflammatory bowel diseases (IBDs) are chronic inflammatory conditions of the gastrointestinal tract, primarily including Crohn's disease (CD) and ulcerative colitis (UC). Recent updates in the definition, classification, diagnosis, and management of IBDs have provided a more nuanced understanding of these conditions. Definitions have been refined to better distinguish between CD and UC, as well as recognizing a category for indeterminate colitis when clear differentiation is not possible. Classification now incorporates more detailed phenotypic presentations, including disease location and behavior, aiding in tailored treatment approaches. Diagnosis has seen advancements with the use of non-invasive biomarkers like fecal calprotectin, alongside traditional endoscopic and histological

methods. Management strategies continue to evolve, with an emphasis on personalized medicine. Biologic therapies targeting specific inflammatory pathways, such as TNF inhibitors and integrin blockers, have revolutionized

treatment paradigms. Additionally, there is growing evidence supporting the use of fecal microbiota transplantation and dietary interventions in managing IBDs.

Fecal calprotectin (FC) is a valuable non-invasive biomarker primarily used in the screening and monitoring of inflammatory bowel disease (IBD) in pediatric patients. It is especially useful in differentiating between IBD and non-organic gastrointestinal disorders, given its strong correlation with intestinal inflammation. Elevated

FC levels indicate neutrophil activity in the gut, which is a hallmark of IBD. Despite its utility in IBD, FC's relevance in other gastrointestinal inflammatory and immune-mediated conditions, such as cow's milk protein allergy and cystic fibrosis, remains limited. However, rising FC levels can signal the risk of necrotizing enterocolitis and help identify gastrointestinal involvement in conditions like Henoch-Schönlein purpura.

Fecal microbiota transplant (FMT) is an emerging therapeutic intervention that involves the transfer of stool from a healthy donor into the gastrointestinal tract of a patient. This innovative treatment aims to restore a balanced microbiota, which is crucial for maintaining gut health and overall well-being. FMT has shown significant promise in treating recurrent *Clostridioides difficile* infections, where conventional antibiotic therapies often fail. Beyond this, research is exploring its potential benefits for a range of conditions, including inflammatory bowel disease, irritable bowel syndrome, and even metabolic disorders. By reintroducing a diverse and healthy microbial community, FMT offers a novel approach to managing diseases linked to dysbiosis, marking a shift towards microbiome-focused therapies in modern medicine.^[27]

2.3. Celiac Disease

Celiac disease is an autoimmune disorder where ingestion of gluten leads to damage in the small intestine. Diagnosis involves initial serological tests such as **IgA tissue transglutaminase (tTG) antibodies and total IgA**, with IgG-based tests used if IgA deficiency is suspected. Endoscopic biopsy is recommended if serological tests are positive, especially in symptomatic children. HLA typing helps exclude celiac disease (CD) in uncertain cases due to its high negative predictive value. Monitoring and follow-up include visits every 3-6 months post-diagnosis, then every 6 months until tTG levels normalize, and subsequently every 12-24 months. Parameters assessed include symptoms, growth, tTG levels, micronutrient status, liver function, and thyroid function. Adherence to a gluten-free diet (GFD) is monitored through regular dietary assessments, symptom evaluation, and periodic tTG measurements. Emerging tools like urinary or stool gluten immunogenic peptides (GIPs) need further validation. Management of nutritional deficiencies involves supplementation of iron, folate, and vitamin B12 until normalization, and addressing vitamin D deficiency for bone health. Persistent high tTG levels may indicate non-adherence to GFD or other conditions, warranting a dietary review and possible biopsy. Refractory CD, rare in children, requires investigation of other causes. A gluten challenge, performed for unclear diagnoses or incomplete diagnostic workup, involves 10-15 g of gluten daily for 3-6 months, with tTG levels checked monthly and every 3 months thereafter. There are no specific drugs for CD; the mainstay is a strict lifelong GFD, with supplements to correct deficiencies. Herbal medicines are still under evaluation for their role in celiac disease.^[28]

2.4. Pediatric Fatty Liver Disease

Nonalcoholic fatty liver disease (NAFLD) in children is characterized by the accumulation of fat

in the liver (steatosis) without significant alcohol consumption, ranging from simple steatosis to nonalcoholic steatohepatitis (NASH), which can

progress to fibrosis and cirrhosis. It has poor consensus in nomenclature with accepted names including NAFLD, Metabolic Dysfunction Associated Fatty Liver Disease (MAFLD), and Pediatric Fatty Liver Disease (PeFLD). Diagnosis involves clinical assessment, including history and physical examination to evaluate risk factors like obesity and type 2 diabetes, and recognize often asymptomatic presentations such as fatigue and hepatomegaly. Laboratory tests include elevated liver enzymes (ALT and AST), lipid profiles, and glucose metabolism assessments. Imaging, primarily ultrasound, is used to detect hepatic steatosis, with MRI/MRS reserved for more accurate fat quantification. Liver biopsy is indicated for uncertain diagnoses or suspected NASH. Monitoring involves regular follow-up every 3-6 months initially, then annually if stable, focusing on liver enzymes, BMI, and complications such as type 2 diabetes. The latest update in NAFLD is the introduction of **elastography (FibroScan)** indicating liver stiffness, a non-invasive investigation as a surrogate for liver fibrosis. Management includes lifestyle modifications with a balanced diet, reduced intake of sugar-sweetened beverages, and daily physical activity. Pharmacotherapy options include Vitamin E for non-diabetic children with biopsy-proven NASH and metformin for insulin resistance or type 2 diabetes, though its evidence in NAFLD is limited. Bariatric surgery is considered for severely obese adolescents with comorbidities after failing lifestyle interventions. Additional considerations include family education, psychological support, and regular screening for comorbidities like type 2 diabetes, dyslipidemia, hypertension, and obstructive sleep apnea.

2.5. Dietary Interventions

Dietary interventions in children, particularly those with gastrointestinal or developmental disorders, have gained significant attention. The FODMAP diet, which reduces fermentable oligosaccharides, disaccharides, monosaccharides, and polyols, has been effective in managing symptoms of irritable bowel syndrome (IBS) by reducing bloating, gas, and abdominal pain. Another commonly implemented diet is the gluten-free and casein-free (GFCF) diet, often used for children with celiac disease and autism spectrum disorder (ASD). Some studies suggest that removing these proteins can improve behavior, social skills, and

gastrointestinal symptoms in some children with ASD. Additionally, the ketogenic diet, high in fats and low in carbohydrates, has shown efficacy in reducing seizure frequency in children with epilepsy. The Specific Carbohydrate Diet (SCD), which eliminates complex carbohydrates, has been used to manage symptoms of Crohn's disease and ulcerative colitis. Each of these dietary interventions requires careful monitoring and guidance from healthcare professionals to ensure nutritional adequacy and effectiveness.

2.6. Non-pharmacological interventions

Non-pharmacological, mind-body interventions in GI disorders primarily focus on managing the behavioral and psychological aspects associated. These include diaphragmatic breathing techniques that help in relaxing the abdominal muscles and coordinating the pelvic floor to aid defecation. Biofeedback therapy is another effective approach, particularly for children with pelvic floor dyssynergia, where it helps teach them how to coordinate their abdominal and pelvic muscles during bowel movements. Cognitive Behavioral Therapy (CBT) is also employed to address any underlying anxiety related to defecation, potentially reducing stool-withholding behaviors.

These interventions are considered safe and are beneficial particularly for children whose constipation includes a significant behavioral component.^[29]

3. UPDATES IN AYURVEDA

3.1. Pediatric Gut Pathologies: The Ayurvedic understanding

According to Ayurveda, Balya or childhood (0-16 years here) the body is bestowed with a physiological predominance of Kapha.^[30] This also implies that *kapha* needs to be maintained at normalcy and needs to be prevented from *kapha*-

oriented pathologies. The states like instability of agni (*aniyatavahnitva*),^[31] and immature *dhatu*s (*asampurnadhatutva*) further complicate management.^[32]

The most prevalent gastrointestinal pathologies seen in children today from an Ayurvedic purview can be classified broadly into two: primary gut pathologies (*svatantra*, where the cause emanates within the gut) and secondary (*paratantra*: the cause lies outside the gut) though differentiated by an unclear margin. Some of them are:

Ajirna: acute and chronic indigestions due to faulty feeding and dietary practices, psychological factors^[33] and intolerance to various proteins^[34], often presenting as diarrhea, vomiting, abdominal distension, and abdominal pain.^[35]

Gulma: *Gulma* is an underdiagnosed entity in general in pediatrics specifically, attributable to its definition as a "palpable mass". Most presentations under the ambit of *gulma* are symptomatically diagnosed, as '*vibandha*' in constipation-predominant, and '*amlapitta*' in acidic reflux-predominant pathologies. However, *gulma* of various types are highly prevalent in children, exhibiting myriads of symptoms and medications indicated in *gulma* such as *Hingvashtaka* and *Lavanabhaskara* are proactively used in children.

Grossly, conditions like mesenteric lymphadenopathy,^[36] FGIDs, functional constipation and disorders of GI motility (vata-kapha) selected gastrointestinal reflux disorders (pitta), NAFLD (kapha-pitta), and other disorders characterized by primary retrograde (*pratiloma*) state of vata are relatable to gulma.

Grahani-vikara: *Grahani* is physiologically underdeveloped in children, leading to expedited gut transit of food, and reduced absorption of nutrients. This state, triggered by intolerance, faulty diet, chronic diseases, seasonal variation, and other factors, results in *grahani*-related disorders. Common features in pediatric *grahani* include the tendency to defecate immediately after food, malabsorption, and altered stool consistency. Chronic intolerances, celiac disease,^[37] irritable bowel syndrome,^[38] and inflammatory bowel disorders^[39] come under the scope of *grahani-vikara*.

Secondary pathologies mostly involved in gastrointestinal disorders are anemia (*pandu*), worm infestations (*krimi*), and toxins (*visha*). All of them have altered appetite (usually anorexia) and bowel as their hallmark features. Anemia is associated mostly with pallor, anorexia, irritability, myalgia (predominantly calf muscles) aggravating at night, and pica. *Krimi* typically manifests emaciation associated with dermatoses (predominantly maculopapular), weakness with non-specific arthralgia, along with pediatric-specific symptoms such as pica and drooling. The *Visha* spectrum includes autoimmune and allergic disorders (including intolerances) of the GI tract, where the body is not able to get habituated to endogenous and exogenous stimuli that are typically non-allergenic in normal individuals, resulting in exaggerated responses to them.

The management of these conditions involves precise identification of the *agni*, *koshtha*, and *avastha* as the cardinal markers and choosing medications and modalities according to them. For example, when '*agni*' is strong (*dipta*) the bowels

are hard (*krura*), and patients experience stiffness in the upper and lower back, the suggested management is an unctuous enema (*anuvasana vasti*). The same *agni* and *koshtha* conditions can also lead to obstruction of flatus, where the remedy involves nourishing foods and drinks that are unctuous and warm (*brahmana*, *snigdha*, *ushna*) in properties. Additionally, patients may present with

dryness (*ruksha*), habitual exercise (*vyayama*), and excess *vata*, managed with a therapeutic enema (*vasti*) or pungent rectal suppositories (*tikshna phala varti*) followed by unctuous purgation (*snigdha virechana*).

In cases where '*agni*' is weak (*manda*) and *koshtha* is mildly unctuous and patients might suffer from abdominal pain and distension in gulma caused by vata, decoctions, powders, and tablets in medicated ghee are indicated. If the cause is kapha (*kaphaja gulma*), the management involves similar decoctions, powders, and tablets. *Kaphaja gulma* conditions with tolerability to alcoholic preparations indicate medicated alcohol preparations (*arishta*). In scenarios where the bowels are heavy and sluggish, symptoms include very mild pain, a tendency to expel doshas, and anorexia, therapeutic emesis (*vamana*) is indicated. If '*agni*' is weak and bowels are hard without additional features, the management includes alkali (*kshara*) and salt (*lavana*) based preparations combined with ghee, followed by purgation.^[40]

3.2. Research: Current Status

The review of Ayurvedic research literature for pediatric gastroenterological advancements yielded three major types of articles: Reviews, case reports, and clinical trials. Review articles primarily constituted of conceptual analysis of novel entities like non-alcoholic fatty liver disease, neonatal jaundice, and probable roles of interventions like *madhutailika vasti*. Multiple herbs have been explored for their action on specific GI disorders: Turmeric (IBD, IBS), Ginger (FAPDs), and Peppermint oil (IBS).^[29] Ayurvedic

Pediatric gastroenterology: Recent advances in biomedicine and Ayurveda

syrups were prescribed by non-Ayurvedic medical professionals as well to manage pediatric anorexia and associated poor growth and weight gain. ^[41] However, evidence building of classical Ayurvedic

preparations through RCTs, and Systematic Reviews is still in its primal phase. Some of the trials and case reports specific to GI disorders in children are mentioned below:

Table 2: Publications in Ayurveda on Pediatric GI disorders

Sl. No.	Study Type	Disease	Intervention	Details
1.	Clinical Trial	Infantile colic	<i>Kuberaksha vati</i> (125 mg) BD for three days	Efficacious in reducing colic among infants above 1 mo age as per Wessel's criteria and subjective scores ^[42]
2.	Clinical Trial	Diarrhea	Vilwa Amra Syrup (age dependent dosing)	Efficacious in diarrhea in age group 1-5 years ^[43]
3.	Clinical Trial	Acute Diarrhea	Probiotic containing <i>Bacillus coagulans</i> against plain honey	Probiotic honey has better efficacy on duration, frequency, abdominal pain, and dehydration grade ^[44]
4.	Clinical Trial	Gut dysbiosis in ASD	Vilwadi Gutika, Rajayadi churnam	Reduced relative abundances of <i>E. coli</i> and <i>Shigella</i> in gut ^[45]
5.	Case Report	Irritable Bowel Syndrome	Protocol	Complete symptomatic resolution in 6 weeks ^[38]
6.	Case Report	Chronic Pancreatitis	Bilvadi gutika, Chundaivattral Churan and Arogyavardhani Vati	Reversal in USG, S. Amylase, and Lipase ^[46]
7.	Case Report	Chronic constipation in Hirschsprung Disease	Protocol	Complete Relief in subjective symptoms in 6 weeks ^[47]
8.	Clinical trial	<i>Grahanidosha</i>	<i>Devadarvyadi Vati</i> , <i>Bhunimbadi Vati</i>	<i>Devadarvyadi</i> showed marked improvement (21.43%), moderate (57.14%), mild (21.43%) ^[48]

3.3. Ayurveda: Research Prospects

Ayurveda has potential solutions for multiple gastroenterological crises in pediatrics. However, the mainstreaming of these solutions needs significant contributions from practitioners and researchers.

Observational studies: Ayurveda has ample etiological descriptions, but they are least explored.

Observational studies can be vital in delineating the relation between gut pathologies and these etiologies. A case-control study identified bowel and tear suppression to be associated with coronary artery disease in adults. Studies on *vegadharana* (suppression of certain natural urges), *krimi* (worm infestation), and maternal diet and regimen on pediatric health may be studied through these designs.^[49]

Questionnaire/Tool development: Though it is well acknowledged that children are not young adults, there are no tailor-made questionnaires available to identify the statuses of *agni* or *koshtha* in children, making it a major research gap. Ayurvedic Prakriti inventory for children is a major step in this direction.^[50]

Stronghold identification and fine-tuning: Ayurveda has potential solutions to offer in inflammatory, allergic, autoimmune, functional, and other pathologies of the gut. Higher evidences are to be generated in these domains including trials and their quantitative and qualitative syntheses.

In-silico pharmacology: In-silico pharmacology studies involving computational drug design can open new horizons of possibilities for Ayurveda. These methods can be used to give preliminary

evidence of drug efficacy in new diseases like those caused by Methicillin-resistant *Staphylococcus aureus*.^[51] It can explain the mode of action of medicines and their components by predicting the target-ligand interactions with reasonable accuracy and precision. The acting mechanisms of Ayurvedic therapeutic modalities like Vasti can also be deciphered at the molecular level with this approach. Molecular docking, dynamics, and network pharmacology are the most used in-silico approaches in herbal medicine.^[52]

IV. CONCLUSION

Pediatric gastroenterology has made large strides in the past two decades. Updates of immediate relevance to Ayurveda have been primarily included. The article details the introduction of biologics, genetic research, and non-invasive diagnostics in biomedicine, alongside Ayurvedic practices that emphasize dietary and lifestyle modifications. Integrating these approaches provides a comprehensive view of gut health, focusing on microbiota and genomics, and explores their systemic impacts via various gut-related axes. Other advancements like breath testing in GI disorders and diseases like Cow milk protein allergy have been omitted for now. Ayurveda has scope in practice, research, and entrepreneurship in these areas. The use of newer research methods, study designs, and setting afoot in newer arenas are some of the solutions for upscaling the role of Ayurveda in pediatric gastroenterology.

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AN OVERVIEW TO THE ANCIENT PRACTICES FOR COMMON AILMENTS IN CHILDREN

Dr K V Ramankutty Warriar, is a highly esteemed and an efficient Ayurveda doctor, known for his profound knowledge and expertise in authentic medicine. His insights have been meticulously documented, preserving the integrity and richness of the original content. Notably, many of the words and passages are in Malayalam, intentionally left untranslated, to maintain its' authenticity and aesthetic value.

Q1. Can you detail some of the single drugs and its combinations extensively used in बालचिकित्सा but has no mention in बृहत्रयी?

- 1) Chembravalli kizhangu
- 2) Panikkoorkkayila
- 3) Thengaanjana
- 4) Paranthethepushpam-Paranthetheppatram
- 5) Naaykkanji kottatthila
- 6) Kolkottathila
- 7) Thekkinkoombe (shakam)
- 8) Japaapatram-Japaapushpam
- 9) Mukkutti
- 10) Maayaakk-Maashikka-Kaushiki
- 11) Dineshavalli- Vembaada
- 12) Karalakattila
- 13) Poothumbakkudam
- 14) Rudraaksham
- 15) Cherula
- 16) Nangelithaali
- 17) Kaanjirathin mori
- 18) Karithumbayila
- 19) Pazhutha perukathinte ila
- 20) Paanal
- 21) Uzhinja
- 22) Kannaaram
- 23) Mulayila – Mulayila veru

Q2. Can you explain some common medicines and combinations that can be used in बालरोग

1)Aravindasavam – Kumkumappoovu (Crocus sativus)

Kashmeeram-Kasharyam

2)Patoladi gana

Patoladi Kashaya(Patolakaturohinyadi)

Patolasavam

Patoladi velichenna

Patola kera ghrtham

3)Moolakaasavam-Moolakaadyarishtam

मूलकत्रिफलानिम्बकारवीरोहिणीबलाः।

यष्टिश्वकृत्वा निष्काथाः बालविसर्पनाशनम्।।

4)Vyoshamrtam

Vyosha + Cumin – Kashaya + Jaggery

Vyosha + Cumin in powder form in ginger juice

5)Surasadi Ganam

Surasasavasam (which is actually arishta) with sugar

Surasadi kera tailam

Surasadi tailam

सुरसादिर्गणश्लेष्ममेदकृमिनिषूदतः।

प्रतिश्यायारुचिश्वासकासघ्नो व्रणशोधनम्।।

6)Ashtapathradi keratailam

An overview to the ancient practices for common ailments in children

7) Karappan tailam

Shatavari(Asparagus racemosus)
 Kanjunni(Eclipta prostrata)
 Karuka(Cynodon dactylon) Swarasa
Thekkinkkoombu
 Thekkinverilattholi
 Irrattimadhuram (Glycyrrhiza glabra)
 Kottam (Saussurea lappa)
 Njazhalppoovu
 Muthanga (Cyperus rotundus)
 Iruvelli (Coleus zeylanicus)
 Kachoorikkizhangu
 Raamacham (Vetiveria zizanioides)
 Takaram (Valeriana wallichii)
 Elattari (Elettaria cardamomum)
 Vizhaalari (Embelia ribes)
 Devathaaram (Cedrus deodara)
 Coconut oil + Coconut milk

Eladi kera ghrtham

Gopaatmajaadi kera ghrtham

10) Dineshavalayaadi Tailam

Tailam-Dineshaladi

Keratailam

Some advice – Coconut oil + Marottiyenna + Nimba tailam base

11) Durvadi keratailam

a) Durva swarasa + Yashtimadhu – Suddha durvadi

b) Durva swarasa + Chethippoovu + Irrattimadhuram + Karinjeerakam

c) Durva swarasa + Nimbapatra swarasam + Irrattimadhuram + Keriksheera

12) Nirgundyadi tailam / Vachadi tailam

वचाहरीतकीलाक्षा कटुकरोहिणी चन्दनैः।

निर्गुण्डीस्वरसैर्सिद्धं तैलमाश्वापचीं क्षणाः॥

13) Brht Nirgundyadi

Base: Coconut oil + Castor oil

Tonsillitis – Otitis

Mass/Tumor inside nose – Adenoid

14) Neelidalaadi keratailam (Prayoga samuchhayam – Loota vishamashesham)

Swarasa- നീലീദളമരും നല്ല
 തുളസീകരിനൊച്ചിയും

Kalka – Garlic

Vyosha

8) Gopaatmajaadi ghrtham yogam

Durva ghrtham

Gopaatmajaadi kera tailam

ഗോപാത്മജാദി
 സർവവിസർപ്പമുഗ്രം

കേരളപുതം

9) Kera ghrtham – Vendhavelichenna

Patola kera ghrtham

Lakshadi kera ghrtham

Nalpamaraadi kera ghrtham

An overview to the ancient practices for common ailments in children

Amukkuram(<u>Withania somnifera</u>)	पचेत्परिचकल्केन तैलंक्षीरसमन्वितं ।
Chandana	केरतैलेर्दग्धभागाढ्यं पीनसश्च।सकासनुत्।।
Irattimadhuram(<u>Glycyrrhiza glabra</u>)	
Takara (<u>Valeriana walichi</u>)	
Kottam (<u>Saussurea lappa</u>)	18)Lakshadi kera tailam/ kuzhamb
Sariba (<u>Hemidesmus indicus</u>)	19)Indukantha ghrita
Root of Karalaka	20)Kalyanaka ghrita
Coconut oil	21)Mahakalyanaka ghrita
15)Panchavalkalaadi kera tailam	22)Jeevanthyadi ghrita
Panchavalkalaadi yamakam	23)Saraswatha ghrita
पञ्चवल्कलनिशागोपी कषायेतिलजं पचेत्।	24)Saraswatha churna
रम्भोदकेनमधुकत्वग्सेव्यामय चन्दनैः।	25)Saraswatha mathra
रक्तपित्तोत्तरे कुष्ठे विसर्पे क्लेदवत्यपि।।	26)Vachayashtyadhi churna
16)Paranthaadi kera tailam (Prayoga Samucchayam – Mandalivisha samnaya chikitsa)	27)Brahmighrita
ദുഷ്ടരക്തജലസ്രാവം	28)Kushmanda rasayana
ദുർഗ്ഗന്ധം വിഷമാദിയും	29.Dashamoola rasayana
വ്രണവും തത്സമീപത്തി	30)Manibadhra
ലുണ്ടാകും ചൊറിയെന്നിവ	31)Haridrakhanda
നാഡീ കോച്ചുന്നതും തഥാ	32)Ashtachoorna
മണ്ഡലിപ്പുണ്ണിനത്യർത്ഥം	33)Aragwadhapatradi/ konnayilakadukkaadi
നന്നുമറ്റുള്ള പുണ്ണിനും	34)Eladi churna
17)മരിച്ചാദി തൈലം/ കേരതൈലം	35)Pancharavindha churna[thamara valayam,thamara alli,thamara poov, thamara Kizhang, thamara kuru]
	36)Rasnadi churnam
	37)Kachooradi churnam
	38)Rajanyadi churnam

An overview to the ancient practices for common ailments in children

39)Vidangadi churnam, vidangarishtam

40)Gopichandanadi

41)Balamuttha Gulika – with arichavu

42)Swasanandam Gulika

43)Kombanchadi

44)Kadukamalakadi Kashaya

45)Kadukadrakshadi

46)Chandana parpatakadi

47)Nirgundyadi

48)Guduchyadi

49)Patoladi Kashaya

50)Balajeerakadi

51)Punarnavadi

Q3. Could you explain some oushadha yogas mentioned in Bala chikitsa granthas?

1. For Echippunnu

മച്ചിങ്ങയുടെ മൂക്ക് ചെത്തിയെടുത്തതും പച്ചമണൽ മൊരി നീക്കിയതും കരിഞ്ചീരകവും തൈര് ചേർത്ത് അരച്ച് തേപ്പിച്ച് പഴുത്ത ചെറ്റിയില (പാരന്തി) തിരുമ്പി ഇട്ട് തിളപ്പിച്ചാറിയ വെള്ളം കൊണ്ട് ദേഹം കഴുകുക.

2. For head sweating (*Thalachoodu*)

ഉണക്കനെല്ലിക്കൊത്താണ്, ചന്ദനം ഇവ മുലപ്പാല് തളിച്ചുരച്ച് നെറുകയിൽ ഉള്ളം കൈവട്ടം ഇടുക. മുലപ്പാലിൽ തുണി നന്നച്ച് നെറുകയിലിട്ട് അതിന്റെ മീതെ ഇടണം.

3. For Luta visarpa (*chilanthikkarappan*)

ചിരങ്ങുതലയിൽ കണ്ടാൽ തേപ്പാനുള്ള കുഴമ്പിൽ ഉമ്മത്തിന്നിലയും നല്ല കണ്ണി വെറ്റിലയും തഥാ പരണ്ടാ തുളസീപത്രം ഇല്ലനക്കരിയെന്നിവ കേരളാമുത്തിൽ വറുത്തിട്ടു തേച്ചാലാശുശ്രമിച്ചിടും.

Vaidyaratna's Ashtapatradi Kera Taila is made of the dravyas mentioned in this yoga.

Into the extract of the leaves karuvelathila, nilambaranda, vettilla, thulasi and datura leaves; grhadhooma, irrattimadhura and madhusnuhi are added and made to a kalka and this is boiled in coconut oil. This is how Ashtapatradi Kera Taila is made.

4. For pimples or acnes on head and neck

വേട്ടാളിയൻ കൂടുമരത്ത ചുക്കും മോരാലരച്ചിട്ടഥതേയ്ക്കുന്നായ്

This is also good for mumps.

Rasnadi churna and vettaliyan koodu can be used with butter milk or tamarind leaf juice.

5. For styes on eyelid (kanpolakkuru) – kadukkavenna

കടുകു തന്റെ കുരുപോക്കി രണ്ടിലായ് കറുത്തൊരളളും പൊടിയായ ചന്ദനം നിറച്ചടച്ചിട്ടമൃതിന്റെ പാത്രകെ പൊതിഞ്ഞുകെട്ടീട്ടതു ദുർവ കൊണ്ടതും പാലിൽ പചിച്ചാലതു പഥ്യ വെണ്ണയാം

Method of preparation:

കടുകുരണ്ടു ഭഗവം ഒപ്പമായി മുറിച്ച് തൊണ്ടു കേടുവരാതെ കുരുകളുണ്ണ് ഒരു ഭാഗത്ത് എളളും മറ്റേതിൽ ചന്ദന പൊടിയും നിറച്ച് തമ്മിൽ ചേർത്ത് ചിറ്റമൃതില 5 എണ്ണം കൊണ്ട് പൊതിഞ്ഞ് 3 കറുകവളളി കൊണ്ട് കെട്ടി അത് തൂക്കിനോക്കി 8 ഇരട്ടി പാലിൽ പുഴുങ്ങി പാലുമുഴുവൻ വറ്റുന്നതിനുമുമ്പായി വാങ്ങി ആ പാലിൽ തന്നെ അരച്ച് വെണ്ണകൂടി ഉരസി നീരറുത്ത് കുരുവിന്മേൽ പുരട്ടുക. നീരുവറ്റുകയും പൊട്ടേണ്ടത് പൊട്ടുകയും ചെയ്യും. ഒരു പലത്തിനു പാൽ 2 നാഴിയായാൽ 8 ഇരട്ടിയാകും

6. For swellings or pimples

ഏരണ്ട ബീജം കറുകേടനാക്കും കാരെളളുമൊപ്പം പയസാ പുഴുങ്ങി

പേഷിച്ചു നീരറ്റൊരു വെണ്ണ തന്നിൽ ചാലിച്ചുതേച്ചാലൊഴിയുന്നു വീക്കം.

7. Eranda Beejadi Lepa

ഏരണ്ട ബീജം മലരെളളുമൊപ്പം ഓട്ടിൽ വറുത്തമ്പൊടു പാലിലിട്ട് അരച്ചുതേച്ചീടുക നൈ തലോടീട്ടെന്നാലൊഴിക്കണം ഗുരുശോഫമെല്ലാം വേദന കുറയും.

Or else ellunishadi churna can be used.

8.Amloshitham for conjunctivitis

പുളിയില ചതച്ച് കിഴി കെട്ടി ചെമ്പുപാത്രത്തിലിട്ട് അതിൽ മോരാഴിച്ച് വെച്ച് ഒരു യാമം കഴിഞ്ഞ് കിഴിയെടുത്ത് പിഴിഞ്ഞ് ഒപ്പിയാൽ വേദനയും കണ്ണിന്റെ കല്ക്കവും

9.For mouth ulcers

വായിൽപുണ്ണുപെരുത്തീടിൽ മാശിക്കാ കരിജീരകം മച്ചിങ്ങാമുവവും കൂട്ടി തൈരു തന്നിലരച്ചത്

An overview to the ancient practices for common ailments in children

കൃഷ്ണതൂളസി വെള്ളത്തിൽ

Marma Gulika (prepared by Aushadhi)

കൊടുത്താൽ ശമനം വരും.

കൂവന്നൂറ് പലം നാല്

മാശിക്കാ - മായാക്ക് കൗശികാ

കുന്തുരുക്കം പല ത്രയം

ചെന്നിനായകമേകർദ്ധം പലം ഒന്ന്

കറുപ്പർദ്ധ പലം തമാ

10. Nandyaarvattaadhi kuzhambu for Apaci

കറ്റുവാഴപിഴിഞ്ഞുള്ള

കണ്ണ കക്ഷ ച മാറിൽ താൻ

രസേനന്നായരചുടൻ

വീങ്ങി കുരു കൾപോലെയോ

(കരസ്കരസമാമാത്രാ

ചൂടുമേറ്റം പനിച്ചീടും

നിഴലിൽ പരിശോഷയേൽ)

അപചീക്കുള്ള ലക്ഷണം (Balachikitsa)

തേപ്പുനെയ്യതുകൂട്ടിട്ടു

ചർമ്മക്ഷാഭങ്ങൾ പോയിടും

11. Specific kuzhambu that are mentioned for abscess on back, stomach, marma places of the body

കുത്തും കടച്ചിലും ചൂടും

ചലംവറ്റും കന്നം വിടും

In marmachikitsa prakarana

- Arrowroot Powder (koovapodi)
- Maranta arundinacea- 8 parts
- Dried Aloe vera gum.(chenninayakam) – 4 parts
- Wild frankincense (kunthurukkam) Boswellia sacra- 8 parts
- Karupp – 1 part

These are powdered and mixed well using Triphala kashaya, mould into bolus and apply over the acne.

12. Testicles swollen disease in children

കഴഞ്ചിവേരച്ചിട്ടു

കാടിവീഴ്ത്തീട്ടുനേരവേ

തെയ്ക്കമനോഷ്ഠമായിട്ടു

വൃദ്ധിവിക്കം ശമിച്ചുപോം

Water obtained after washing brown rice(unakkalari) - (kaadi)

13.For Daiper dermatitis (Gudakuttaka)

An overview to the ancient practices for common ailments in children

First wash with irattimadhura kashaya (Glychorrhiza glabra). Wipe off using a cloth and Apply there Jatyadikera tailam with Durvadhikera tailam

“ഗുഹ്യദേശവ്രണങ്ങൾക്കു

നന്നു ജാത്യാദി തൈലവും “

“ദുർവസ്വരസകൽക്കാഭ്യാം

സിദ്ധം തൈലം വ്രണേ ഹിതം “

14. Vayukshobam – kasa, swasa

(M. K. Kunjiraman vaidyar Kannur)

വായുശാന്തിക്കുന്നന്നേറ്റം

നയോപായംകഷായവും

മേപ്പൊടിവായുഗുളികാ

അരച്ചിട്ടുകൊടുത്തിടാം

അയി! പ്രാണനാഥേ! ബലാ പത്തുഭാഗം

പ്രിയേ! ജീരകം ചുക്കുമോരോരുഭാഗം

നയോപായമെന്നാണു പേരികഷായം

ജയിക്കും ജവം ശ്വാസ ഹിഡ്മാദി രോഗം.

10 പഴുത്ത പ്ലാവിലത്തെട്ടികൂടി
ചതച്ചിടാറുണ്ട്.

ഇതുതന്നെ

ആരോഗ്യരക്ഷാകല്പദ്രുമത്തിൽ

ബലയാദശഭിർഭാഗൈ: ദ്വാഭ്യാം
ജീരകവിശ്വയോ :

സിദ്ധ: നയോപായ: ശ്വാസഹിഡ്മാഹര:
പരം

15. In polio like condition

കരിക്കുനിഞ്ഞി ദേവദ്രു

നാഗരൈ:കപമിതം ജലം

തൃണിദ്വൈകമിദം സർവം

വാതരോഗവിശേഷത:

പാൽകഷായംവെച്ച് ഇനുകാന്തഘൃതം

ചേർത്ത് നൽകുന്ന പതിവുണ്ടായിരുന്നു.

പനിമാറിയശേഷം 5-6 തുള്ളി.

16.For Knee Swelling

ചെറുനാരങ്ങവെള്ളത്തിൽ

തേങ്ങാപ്പാലുപകർന്നത്

ചന്തമോടൂരസിത്തേപ്പു

മുട്ടുവീക്കമൊഴിഞ്ഞുപോം.

17.Kulachhaamb

Mix asthachurnam in *Butea monosperma* (bark)
decoction (plashin tholi)and add buttermilk and give
it to drink after boiling.

18. Aaranyathulasikera Thailam

ആരണ്യതുളസിപത്രം പിചുകത്തില
വെറ്റില

മുതുകിൻകടയും തൃത്താ
ശിവനിർമ്മാല്യവുമാ

നല്ലുഴിഞ്ഞചുരത്തണ്ട്
നാഴ്വത്തത്തിലപർപ്പടം

പൂവരശ്മിനുടെതോലും
ഒപ്പിച്ചിട്ടിവയൊക്കവേ

ഇടിചാശുപിഴിഞ്ഞിട്ടു
കൽക്കംകൂട്ടുവതിനിഹ

എരട്ടിമധുരം കൊട്ടം
അറിയാറുമമുക്കുരം.

വയമ്പും ജീരകം മൂന്നും
ത്രിഫലാദേവദാരും

പാവും കടുത്രയം ദീപ്യം ജാതിക്കായ
കറമ്പുവും

ജാതിപത്രികചീനത്തെ മുളകെന്നിവയും
സമം.

കൂട്ടികാച്ചിയകേരാജ്യം നന്നുപാരം
കരപ്പൻ.

ശമിക്കും പാരമെന്നാലും
മൽഗുരോക്തമതായത്.

19.ചെമ്പരുത്യാദി കേരതൈലം

ചെമ്പരത്തിയുടെ പുഷ്പം പത്രം
പിഞ്ചുനൽക്കുവളത്തില

തെച്ചിപ്പു കൊടിഞ്ഞാലീ ച മുക്കുറ്റി
കൃഷ്ണതൃത്തുവാ

കീഴാർനെല്യമരീപത്രം ജീരകം
രണ്ടുകല്ക്കമായ്

കാച്ചിതേപ്പിക്ക തിലജം ആശ്വര്യം
ബാലകന്നുടൽ

ചൊറിയും കുരുവും വീക്കം ചിരങ്ങും
നീരിറക്കവും

ചോപ്പും കരപ്പനും തീരും ചോരനന്നായ്
തെളിഞ്ഞിടും

വൈദ്യതാരകത്തിൽ ഏലാദിഗണ കല്ക്കം
പറയുന്നു.

20.നിർഗുണ്ഡ്യാദി ഗുളിക

നിർഗുണ്ഡികാമുളകുതാണിചെറുക്കുരു
മ്പാ

ചൊൽക്കൊണ്ടഴും ജനനി
വൈരികറുത്തതുമ്പാ

പാഠാവയമ്പുമിലസും കൊടുവേലി
വേലി

പാടീരവുത്രികടുകായചഘോരിവേരും.

ചൊല്ലാമവിൽപൊരിഫലത്രയമശ്വസ

ന്ധം

വെളുത്തുള്ളി

പാണൽകടുകരോഹിണിപുതിഗന്ധീ

യഷ്ടാഹവയം കൊടിയതുവു

വെളുത്തടന്ധം

26. Bala jeerakarishtam

കുവളമബ്ബമജാജി ബലേക്ഷു ഓരില
ദാരു വൃഷം മലർ വിശ്വം ഈ
വിധമുണ്ടാരുനല്ല കഷായം
വാവതിലേങ്ങിവരും കുരനീങ്ങൾ
(ഗുഹക് - ഒരിലയാണ് vosൽ
ചേർക്കുന്നത്)

21. Warm rice + Indukantha Ghrita + Ashtachurna

22. Avipathi + Honey + Ghee

23. ആവണക്കണ്ണയിന്നുപ്പും വെണ്ണയും
നൽകടുകയും മലദ്വാരത്തു
തേപ്പിച്ചാലിളകും മലമപ്പൊഴെ

24. ആലുതന്നിലയൊ തെച്ചിയിലയൊ,
ദുർവ്വയുഗ്രയോ ബാലോ വെന്ത ജലം
നന്നു ബാലന്മാർക്കു കളിക്കുവാൻ
(പഴുത്ത ഇലകൾ വേണം ഗുരുപദേശം)

25. തലയ്ക്കു ചൂടുള്ളതുവേണ്ട, ശീതം
ജലം പക്ഷമുണ്ട് തിളച്ച വെള്ളം
ശരിയായ് തണുത്താൽ
തലക്കുന്നെന്നിവനുള്ള പക്ഷം (M. K.
Kunjiraman Vaidyar)

27. അഷ്ടച്ചൂർണത്തിൽ കായം 8 ൽ ഒന്ന്
ചേർക്കുന്ന രീതി ബാലവൈദ്യമാർ
ചിലർ സ്വീകരിക്കുന്നു.

28. കുമിക് കുപ്പമഞ്ഞൾ മോരിലരച്ചു
കലക്കി കുടിക്കണം.

29. തുമ്പക്കുടം മോരിലരച്ചു കാച്ചീട്ടമ്പിൽ
കുടിച്ചാൽ കുമി ചത്തുപോകും.

കുമിശ്ശത്രുകൂടെ (ചാരുശൂരം) ചേർക്കുക.

30. Avipatti Prayoga

അവിപത്തി ദിനേ ദിനേ
ദിനാന്തെയിരുപത്തൊന്നു
ദിനത്തൊളംഭുജിക്കിൽ
പെരുപിത്തമൊഴിഞ്ഞുപോകുമേകന്നി
രൂപത്നിഭരണാൽ സുഖംകണക്കേ
ഡാഡിമാദി / ദശസ്വരസം / കല്യാണകം

An overview to the ancient practices for common ailments in children

മുതലായ ഘൃതങ്ങൾ എടുക്കുക.

കോരണ്ഡമുള്ളി സുരദാരു കുറുന്തുവട്ടി-

ത്വഗ് രോഗമാണെങ്കിൽ മഹാതിക്തകം

യേരണ്ഡമൂലി കരിനൊച്ചിയരത്ത
ചുക്കും

31. Punarnavadi

പടോല ശുണ്ഠിതവിഴാമനിംബ

നേരപ്പൂ വർഗ്ഗമിതു കൊണ്ടു പച്ചില പേയം

കടുക്കതിക്താമൃത ദാർവ്വിസിദ്ധം (ദാരു)

സൈരണ്ഡതൈലമഖിലാനില
ബാധതീർക്കും

പയ ശ്ലിശൂനാമ്പനിപിത്ത

പാണ്ഡാമയഞ്ച

38. Bala Tailam

ശോഫഞ്ചമുടിക്കുമാരേ്യ .

Oil+castor oil+ Neem oil

32. Ardhavilwam

ചുക്കുചുണ്ടകടലാടിച്ചുണ്ടവേര് $\frac{3}{4} \times 4$

ബലാകഷായത്തിനുതുല്യമായിപ്പാലും
ബലാകൽക്കവുമായ് സുസിദ്ധം

മുക്കഴിഞ്ചിവ പുനർന്നവത്രയൈ 3×1

തൈലംതിലാമണ്ഡക നിംബജാതം
ബാലർക്കുളാം വാതഗമം ജയിക്കും.

വെക്കുമംബു

മലബന്ധകാമിലാവീക്കമെന്നിവയെ

നീക്കിടും പ്രിയെ.

36.എരട്ടിമധുരം തേനിലരച്ചുതേക്കുക.
പാലുണ്ണിക്ക്, ഗദക്കുട്ടകത്തിന്.

33. For Poultice Vidradhi

യവഗോധുമമുദ്ഗാനാം

മാമരച്ചു പൊതിഞ്ഞിടിൽ

രൂപകപം കുരുവെന്നാലു

മബലേഃ പൊട്ടിടും ക്ഷണാൽ

34. Ashtavarga

ROLE OF DAIVAVYAPASRAYA CIKITSAMONG THE PRACTITIONERS OF YUKTIVYAPASRAYACIKITSAM

Dr. Anand P. K. V.

Vaidyaratnam Ayurveda College, Ollur

Medicine in general is with and intention of either urjaskara or rogaghna. The materials used for these purposes may either be substances like formulations, hence called as dravya cikitsa; or exposure to various means like fasting, consolations, incantations etc., known as adravya cikitsa. (upavasanilaatapa chaya mantra saantvana daana bhayotraasa samksobhana harshana bharsana hasana svapna jaagarana samvaahanaadeeni (ashtaanga samgraham/su/12/3). The former is differentiated from the later by being physical & material, which are objects to sensory and motor organs (dravyam moortam sakalendriya vishayam ca - indu). Another major division of medicine, which is relevant in the context is daivavyapasraya, yuktivyapasraya and satvaavajaya treatments. All of these are used simultaneously with a lot of intermixing, when practically applied. They are tailored for individual cases and not differentiated separately for generating prescriptions. In general, vaidyaas are trained to use

yuktivyapasrayacikitsa while they refer the cases to the experts of daivavyapasraya or satvaavajaya, whenever need arises.

Among these three, the practice of satvaavajaya has a limited application in kaumaarabhritya. This method, being a self-educating & training method, it needs to reduce dependency on others, which is not safe for kids. They are of avara satva and upbringing them to madhyasatva and pravarasatva is age and IQ dependent.

Yuktivyapaasrayam is the treatment using both dravya and adravya based on their potency to influence the dosha status in the body with respect to the suitability of situations. As a prerequisite, it is planned with and intention to reverse the logically recreated natural history of diseases in that individual patient or a homogenous group of patients.

The selection of treatment plan in a yuktivyapasraya treatment is based on identifiable causes. Such explainable cases of diseases are grouped as pratyutpanna karmaja (drishtahetava pratyutpanna karmajaa - indu). These yuktivyapasraya treatments are applied in diseases with intensity of symptoms proportionate to the exposure to the degree of exposure to the causes. When the causes are not identifiable and not proportionate to the

intensity of causes, it makes the logical recreation of natural history of disease (sampraapti) is not possible in that disease / case. Such cases are identified as daivajanmaana, referred with synonyms like poovakarmajaa or aniyataa. (tasmaat evam stite roga svayam dushtena apathyaahaaraadinaa hetunaa jaayante te pratyutpannakarmajaa iti vijneyaa, etadvipareetaa yeshaam heturna drshta utpaatshca te daivajanmaano jneyah, yetu svalpena hetunaa nidaanena jaataa mahaarujashca te daivapratyutpannobhayaatmakaa jneyaa - indu)

Thus, by definition, daivavyapasraya cikitsa arises when the cause of the diseases is not known. In children, especially in infants, illnesses do not appear by the negligence of themselves, but only by the care takers, as they are dependent on them. Hence, in the cause-effect analysis, if no valid relation can be established either as ahita aahaaravihaara or manodosha and sampraapti cannot be visualised, the appearance of such disease in a case is considered as random (aniyatam). In such situations, a medical intervention is also not possible with evident cause-effect relation with treatment and the cure. The fixity (niyatam / drshta hetava) and randomness (daivam / aniyatam) of causes are the determinants of selection between yuktivyapasraya modalities

of treatment and daivavyapasraya modalities of treatment. One modality cannot substitute or bypass other, but can be used combined in the diseases of a third group of diseases (ubhayaatmaka). The ubhayaatmaka manifestation is diagnosed by the presence of protracted presentation of symptoms that are disproportionate to the identified causes in that individual case.

Advancements in finding out the etiopathogenic factors has moved so many diseases from the list of adrshtahetu to the list of drshtahetu. This has made the practice of daivavyapasraya cikitsa less relevant in current era. This is reflected alone in the field of kaumaarabhritya, where daivavyapasraya was a popular practice a century ago. Now many of the prevalent diseases are well classified, researched and are with known hetu & sampraapti. This makes them fit for yuktivyapasrayacikitsa. As researches progress further and awareness among the public gets wider and the doctor's skills get higher, more and more diseases are expected to get into the group of drshtahetava. As a consequence, the adrshtahetu disease group is sure to get shrunk further to narrow the space for daivavyapasraya cikitsa.

The pattern of diseases prevalent in the society are continuously changing. Diseases of earlier decades are giving way to new diseases or old

diseases getting redefined or reclassified. Many such newly named diseases are having a brief or long period making them fall into adrshta hetu group until the sampraapti is defined and researched out treatments are accepted. Also there are diseases with causative factors described as idiopathic, insidious etc. and with partially identified causes like genetic, immune related etc. Even though these disease don't have a drshtahetu, they are not seen attended by daivavyapasraya cikitsa at any period.

Practitioners of yuktivyapasrayacikitsa will struggle to find the logic of daivavyapasraya cikitsa. This is because they are conditioned to check for logical equations before generating prescriptions. The struggle happens due to the disregard for the basis of classification of these 3 kinds of treatments. As their differentiation and scope of application are entirely different, the logics of one will not apply for other.

Hence, searching for justifications for daivavyapasraya and satvaavajaya using the enquiry tools of yuktivyapasraya will not be fruitful. It is not easy to think the effects of gems and hymns, says the books (cintikkaanelutaavatalla manermantraushadhaanaam phalam). In the phalashruti of kottamcukkaadi tailam, in order to emphasize the effectiveness, salient features and to show futility for the efforts of logical

deduction of daivavyapasraya cikitsa are briefed (idamaagama siddhatvat, pratyaksha phaladarshanaat, mantravat samprayoktavyam na meemaamyam kathamcana - sahasrayogam). It says, that should not be a matter of logical discussion and should be applied like a mantra, which is acquired as a traditional knowledge and bases only on empirical results. Both these are out of scope of modern research methods. Hence any attempt to explain them logically will end up in effective.

In spite of these mismatches, if at all any attempts are to be made to learn about daivavyapasraya cikitsa, it will be fruitful only through tadvidya sambhaasha, which is defined as interacting with the subject experts. They should have seen it, learned it, practiced it or researched in and around the field of daivavyapasraya cikitsa. Discussion among those who have learned and learning yuktivyapasrayacikitsa should enlighten on the need of accepting or rejecting daivavyapasraya cikitsa after a thorough perusal.

Ayurvedic practitioners are often accepted by their patients as more than a doctor who examines and prescribes medicines. He often has to address their beliefs, cultural and religious practices also. This puts him in a dilemma as patients are ready to trust a vaidya on his opinions on the matters for which he is

not trained. When a similar enquiry about recommendations made by a parallel medical system is attended, the advice always goes in the favour of that modern expert who has made the recommendation. In contrast to this, when enquired about such practices of daivavyapasraya cikitsa, the practitioners tend to deny such possibility and does not favour the expert of that subject. This actually stops us from making observations about the effects of such practices. We should be ready to search and observe them from both books and practices before making opinions, instead of imposing modern research methodologies and asking to come clean. daivavyapasraya cikitsa also has to be designed, tested and accepted by its practitioners. They also should undergo tests of close observation and research.

It is the time that brings treatments to connect with the sampraapti, says ashtanga hridayam (kaalo bhesajayogakrt). In ubhayaatmaka diseases, where there are obvious causes seen with disproportionately intense manifestations, the effectiveness of treatments depends also on the karma vipaakam of the individual. In such cases the unknown causes should be identified with the help of daivajna and based on their recommendations, various daivavyapasraya means should be performed. The clinical skill lies in recognising the limits of yuktivyapasraya

and recommending daivavyapasraya thereafter or to combine both for the cure.

Like the training and teaching a vaidya should undergo before practicing ayurveda, the practice of daivavyapasraya cikitsa has 3 areas of learning and skill development, before entering into the 4th area of practicing whatever is learned. Only after having learned the siddhaanta, having a life style i.e., aacaara and having skill development through yoga, praanaayaama, dhyana etc., the practitioner can do the practice daivavyapasraya cikitsa effectively. The need to keep a specific life style leads to change the life style of whole family. This has resulted in familial inheritance of this knowledge in Kerala. In northern parts of India, the lifestyle change has led to guru & shishya oriented non-familial inheritance of this knowledge.

Books like Ishanagurudeva paddhati etc., deals with the first three at a basic theories in authentic ways. Books like tantra samuccayam, kuzhikkaattu pacca etc, aayurveda books like veerasimhaavalokanam, vishvavijayee tantram etc. and books of kaumaarabhritya like kumaaratantram of raavana, pillai pini vaahatam etc., gives only the practical tips. Similar to the practice of doshadoosha cikitsa, daivavyapasraya cikitsa also consists of

classical and complex methods to very light house -hold tips and tricks.

Aayurveda graduates can have an all-inclusive or all materialistic or a combined attitude in the clinical practice, all of which are with its own merits. Accepting everything with physical, materialistic and logical and rejecting whatever fails to qualify the tests of modern era is all materialistic approach. It helps us to learn more and more about every manifestation only to end up in finding a cure for each later. All-inclusive attitude is to where ever a limitation to yuktivyapasrayacikitsa is identified, look for the potentials & possibilities of daivavyapasraya and satvaavajaya methods and to use the help of

experts of that area for the benefit of patients. A combined attitude is to learn and get trained in all these methods and to keep the life style to suit that of daivavyapasraya practitioner in order to practice all of them together. All these are appreciated as long as it aims at the well-being of the patient and not to make a propaganda. For a learned and experienced person in the subject, the effect of his intervention does not depend on and beliefs or religious practices. For him, what matters is the effective response to the struggles of his patients. Because disease is defined in various ways such as permutations of doshas, graha baadha, bhootaabhishanga or purvakarma phalam.

vaidyaa vadanti kaphapittamarut vikaaraa jyotirvido
grahamatim parivartayanti bhootaabhishanga iti
bhootavido vadanti praaceena karmabalavat munayo
vadanti

(quote from maarkandeya puraana in vaidyakeeya subhaashita saahityam 21st chapter 28th sloka)

RECENT UPDATES IN ATTENTION DEFICIT HYPERACTIVE DISORDER: A REVIEW

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INTRODUCTION :

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity, which can vary in severity and impact daily life, social relationships, and academic performance in affected children. ADHD affects 4-12% of school-going children worldwide and often persists into adulthood(1). Diagnosis of ADHD is a complex process relying solely on clinical evaluation and can be challenging due to the disorder’s heterogeneity in both clinical and pathophysiological aspects. It requires a comprehensive and individualised approach to understand each person’s unique profile and need. This article provides an insightful review of recent advances in the neurobiology of Attention Deficit Hyperactivity Disorder (ADHD) and explores the potential of Ayurvedic management approaches in addressing this complex condition.

RECENT ADVANCES :

1. MICROSTRUCTURE ALTERATION AND DEVELOPMENT DELAY :

Recent advances in MRI and fMRI technologies have enhanced our understanding of ADHD neural basis, enabling the researchers to map brain structures and functions and informing the targeted treatments. During childhood and adolescence , the brain undergo significant changes in synaptic pruning ,myelination, neuroplasticity and gray matter volume changes. These changes support the cognitive , emotional and social development. Recent studies in ADHD reveal a nuanced localised delay in cortical maturation ,rather than a global delay .The findings includes : reduction in intracranial volume to 3-5%, Slow cortical thinning in prefrontal and cingulate regions linked to hyperactivity and impulsivity and Altered white matter integrity in fronto-striatal -cerebellar circuits , affecting the motor control , cognition and behavioural functions (2). Few Voxel Based MRI and Diffuse Tension Imaging studies link brain structure to emotional dysregulation and impulsivity and highlights the importance of specific white matter tracts in cognitive control and attention systems(3).

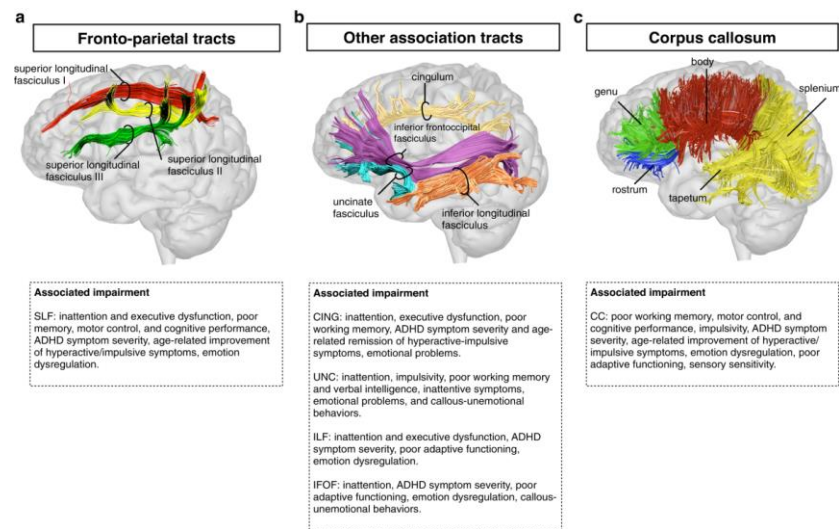


Fig (1)(4)

2. NEUROTRANSMITTER ALTERATION

In spite of ADHD being a highly polygenic disorder, it's possible that these variants may converge on common underlying mechanisms. One proposed mechanism involves the dysregulation of monoaminergic neurotransmission systems, specifically the Dopaminergic system and the Noradrenergic system. These transmitters are said to follow an inverted "U" curve pattern, i.e., too much or too little dopamine / norepinephrine can impair cognitive and executive processes in ADHD (5). Recent genotype studies and neuroreceptor imaging have shown to relate to the symptomatology, especially altering the neurotransmitters Dopamine and Norepinephrine.

ROLE OF DOPAMINE :

Dopamine's action on D1 and D2 receptors in the Prefrontal Cortex (PFC) regulates executive function, attention, memory, and cognitive processing. Imbalance in D2 and D4 receptors, particularly the D4 receptor variant common in ADHD, can lead to excessive inhibition, reduced excitation, and neurochemical imbalance (6). Moderate D1 stimulation improves focus by reducing "neural noise", while excessive stimulation can cause rigid thinking and behavior.

ROLE OF NOREPINEPHRINE :

In the Prefrontal Cortex, moderate Norepinephrine (NE) levels enhance attention, behavior, and emotional regulation by strengthening neuronal connections via α -2A receptors. However, excessive NE impairs cognitive function by binding to α -1 and β -1 receptors, disrupting normal function (7). Optimal NE levels are crucial for healthy cognitive function.

ROLE OF SEROTONIN

Serotonin regulates impulsivity, attention, and emotions, and plays a crucial role in child development. Children with ADHD may have low serotonin levels, receptor abnormalities, and genetic variations, suggesting a link between serotonin deficiency and ADHD symptoms (8). Serotonin-based therapies have been shown to improve attention and impulsivity in children with ADHD.

GABA AND GLUTAMATE ROLE :

To achieve balance in the brain, GABA calms and glutamate stimulates. In ADHD, low GABA levels lead to impulsivity, while glutamate levels are inconsistent. Research reveals abnormal GABA and glutamate levels in ADHD, which correlate with symptom severity, offering new insights into the disorder's mechanisms and potential treatments.

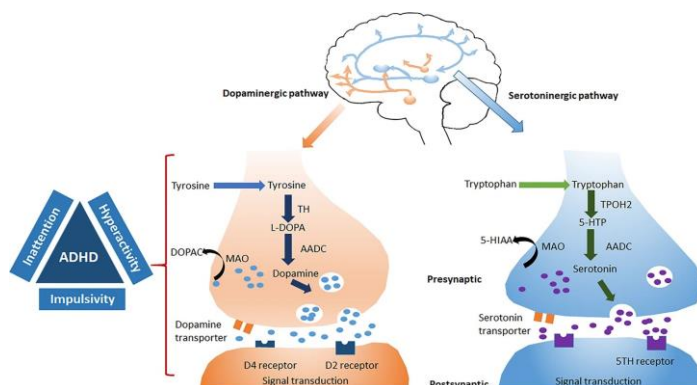


Fig 2 (9):

ROLE OF AGNI :

The gut, home to the digestive fire Agni, is a hub of bodily balance, influencing metabolism, immunity, brain development, and overall well-being. With its imbalance linked to ADHD and various gastrointestinal issues, highlights the importance of nurturing a healthy gut-brain axis for optimal health. It has four states: normal (Samagni), weak (Mandagni), excessive (Tiksnagni), and irregular (Vishamagni). A strong Agni digests food efficiently, while a weak Agni leads to poor digestion, ama buildup, and potential health issues. Ama, a toxic residue, forms in the gut due to poor digestion and progresses through stages, interacting with doshas (energies) and dhatus (tissues), leading to disease manifestation (10). The stages include formation, interaction, disease manifestation, complication, and resolution. ADHD falls under the category of

Unmada, a range of mental health conditions, requiring personalized assessment and treatment. It's linked to gastrointestinal issues like inflammation, constipation, and digestive problems. Understanding the relationship between Agni (digestive fire), Ama, and ADHD helps to plan Ayurveda treatment, focusing on enhancing digestion, eliminating toxins, and balancing doshas, rather than just prescribing brain tonics (Medhya drugs). A two-step approach is recommended: Palliative treatment (Shamana Chikitsa): Clears the mind channels with Deepana-Pachana drugs ad then enhance cognitive function with Medhya drugs. Other is the Purificatory treatment (Shodana Chikitsa) which adopts Unmada principles, using Rookshana and other therapies to calm senses, reduce Vata and Pitta doshas, and improve overall condition.

Research conducted in Ayurveda:

Sl no	Study type	Article	HIGHLIGHTS
1	Systemic Review	Effective and Safety of Ayurveda intervention in children and adolescent with ADHD(10)	A meta analysis on the evidence. Of Ayurveda intervention in children and adolescent with ADHD was conducted by searching the published and unpublished articles. Among the 39 articles 10 met the inclusion and exclusion criteria was systemically review, concluded that due to some concerns like small sample size and low methodology there were limitation to draw a reliable conclusion regarding the effectiveness of Ayurveda intervention.

Sl no	Study type	Article	HIGHLIGHTS
2	Systemic Review	Role of Ayurveda in ADHD : A Critical review (World Journal of Pharmaceutical Science & Technology)(11)	A critical review of existing literature on Ayurvedic interventions for ADHD suggests that a multimodal approach, incorporating complementary therapies and lifestyle modifications, may be a promising strategy for effectively managing ADHD symptoms in children and adolescents.
3	Research article	Ayurvedic approach for improving reaction time of attention deficit hyperactivity disorder affected children.(AYU Journal)(12)	A study of 43 children with ADHD (ages 6-16) investigated the effectiveness of Ayurvedic interventions. The results showed that both Ayurvedic compound I syrup and compound I combined with Shirodhara treatment significantly improved reaction time, outperforming the placebo group.
4	Research article	Evaluation fo Brhami ghrtam in children suffering from Attention Deficit Hyperactivity Disorder (Ancient Science)(13)	A study in children with mixed ADHD (ages 6-12) found a significant 66% improvement in ADHD symptoms, as per DSM-IV criteria, highlighting the potential effectiveness of the intervention in managing symptoms in this age group .
5	Case report	A case report on Ayurvedic management of Attention Deficit Hyperactive Disorder in children (Journal of Ayurveda and integrated Medical Science)(14)	A case study demonstrated the efficacy of a comprehensive Ayurvedic treatment protocol, comprising Deepana, Pachana, Shirodhara, Matrabasti, and Shaman therapies with Medha drugs, in effectively managing ADHD symptoms.

Sl no	Study type	Article	HIGHLIGHTS
6	Case report	Case report on the Ayurvedic management of Attention Deficit Hyperactive Disorder (Kerala Journal Of Ayurveda)(15)	A 3.5-year-old boy with hyperactivity and short attention span showed remarkable improvement after 2 months of Ayurvedic treatment and therapy, highlighting the benefits of holistic approaches for early-onset ADHD-like symptoms."
7	Case report	A case study of ADHD with Ayurvedic Management (Indian Journal of research Paripex)(16)	A 6-year-old child with ADHD saw significant improvement in attention span and impulsivity after a comprehensive Ayurvedic treatment protocol, showcasing the effectiveness of this holistic approach in managing ADHD symptoms."

CONCLUSION:

This review explore biological foundation of ADHD, highlighting the interplay of neurochemical and neuroanatomical factors. Similarly, review explores a promising multimodal

approach of Ayurveda, but notes need for rigorous future studies to confirm efficacy of Ayurveda due to its current limitations in sample size and methodology.

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SKIN DISORDERS IN CHILDREN- RECENT UPDATES

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Skin disorders in children can be complex, influenced by various internal and external factors. Understanding the physiology, anatomy, and Ayurvedic principles is essential for effective diagnosis and treatment. Recent advances in skin physiology have revealed crucial insights into the protective, thermoregulatory, and sensory functions of the skin. The epidermis acts as the outermost barrier, shielding the body against external noxious stimuli and UV radiation, while maintaining moisture balance. Thermoregulation is another vital function, facilitated by connective tissue, nerve endings, and glands. The role of brown adipose tissue (BAT) in thermoregulation and metabolism, particularly in newborns, has been recognized. The skin is also richly innervated with sensory nerve endings, responsible for discriminating pain, temperature, touch, and vibration through mechanoreceptors such as Meissner's corpuscles and Pacinian corpuscles.

Water storage within the skin is crucial for maintaining its physical and mechanical properties, influencing the molecular arrangement and dynamics of keratin proteins in the stratum corneum. The skin's ability to absorb substances has been studied extensively, particularly in the context of massage and skin hydration, supporting the Ayurvedic practice of oil application. Moreover, the skin synthesizes Vitamin D when exposed to UVB rays between 10 am and 3 pm, converting 7-dehydrocholesterol in the epidermis to cholecalciferol, which is then metabolized in the liver and kidneys.

Anatomy of the Skin

The skin's anatomy is divided into three main layers: the epidermis, dermis, and subcutaneous tissue. The **epidermis** consists of several layers,

including the stratum basale, which contains melanocytes and Merkel cells, the stratum spinosum with keratinocytes and Langerhans cells, the stratum granulosum with additional keratinocytes, the stratum lucidum present only in palms and soles, and the stratum corneum composed of dead cells. The **dermis** is made up of connective tissue, capillaries, nerve endings, hair follicles, and glands, with the papillary layer regulating skin temperature and providing nutrients to the epidermis, and the reticular layer containing collagen fibers for strength and elasticity. The **subcutaneous tissue** comprises fat and connective tissue, offering insulation and protection to internal organs, and contains leptin, a hormone involved in metabolism regulation.

Skin Protection and Disorders

Disruption of the epidermal homeostasis can lead to various skin disorders, including ichthyosis, xerosis, atopic dermatitis, and psoriasis. New research has shown promise in managing these conditions, such as using human-induced pluripotent stem cell (hiPSC)-derived keratinocytes from ichthyosis patients for wound healing, and goat's amnion for faster healing of varicose ulcers.

Atopic Dermatitis

Atopic dermatitis is characterized by skin barrier abnormalities and immunological factors. Filaggrin and ceramide levels, crucial components of intercellular lipids in the stratum corneum, are often altered. Ayurvedic management focuses on both internal and external treatments, such as **Bahya Abhyanthara Sneham** to maintain skin moisture, **Mahathikthaka Ghrithm** (internal) and **Shashtika Thaila** (external) for treating skin barrier abnormalities, culminating in **Thwachyam** therapy.

Psoriasis

Psoriasis is a genetically determined proliferative skin disease, although it is rare in children. It manifests in various subtypes, including flexural, guttural, scalp, and pustular psoriasis. Management in Ayurveda begins with **Kapha-Pitta Samana** using formulations like **Aragwadadi**, **Padola Kadurohinyadi**, and others, followed by treatments with **Haridrakhanda**, **Dooshivishari**, and **Manibhadra Gulam** in later stages.

Other Common Skin Disorders

Ichthyosis Vulgaris is an autosomal dominant disorder marked by mild scaliness and generalized skin scaling. Ayurvedic management includes **Bahya Abhyanthara Snehana** for Vata-Kapha dominance. **Urticaria (Seetha Pitha)**, triggered by food, medication, pollen, and dust, is managed with Ayurvedic formulations like **Padoladi Kashaya**, **Haridrakhanda**, and **Thriphala Kwatha**.

Bacterial Infections such as non-bullous and bullous impetigo contagiosa, caused by **Staphylococcus aureus** and **Streptococcus**, respectively, are treated using **Visarpa Chikithsa** with preparations like **Chandanadi Kashaya** and **Thikthakam Kashaya**. **Viral Infections** including warts, molluscum contagiosum, and herpes zoster are managed using Ayurvedic treatments like **Yasda Bhasma**, **Kshara Karma**, **Nirgundyadi Kashaya**, **Krimighna Vati**, and others.

Scabies, characterized by severe nocturnal pruritus, is treated with **Nimba Pathradi Churna**,

Krimighna Vati, and other Ayurvedic formulations, while **Hand Foot Mouth Disease** is managed with **Saribasavam**, **Gopichandanadi**, and similar treatments.

Ayurvedic Management: Concepts and Therapies

In Ayurveda, the management of skin disorders begins with the identification of the involved **Doshas** (Vata, Pitta, Kapha) to plan appropriate treatments. Understanding the **Samprapthi** (pathophysiology) is essential, including the involvement of **Kapha Dushti**, **Kleda** accumulation, and **Dhathu** involvement. **Lesion Classification** into primary lesions like macules, papules, vesicles, and secondary lesions like scales, crusts, and ulcers aids in diagnosis.

Conceptual Advances in Ayurveda

Dietary management, including **Roga Vridhi** and **Pathyam**, is crucial for preventing and managing skin disorders, along with the avoidance of **Viruddha Ahara** (incompatible food combinations). Detoxification therapies using anti-toxic drugs like **Vilwadi**, **Dooshivishari**, and **Avipathi Choorna** are essential for chronic skin conditions. **Virechanam** and **Raktha Moksha** are purification therapies for systemic detoxification and improving blood circulation, while specialized treatments such as **Lekhana Karma**, **Lepanam**, **Dhoopana**, and **Kshalana** are unique to Ayurveda and play a critical role in managing various skin conditions.

DEPARTMENT OF KAUMARABHRITYA (PAEDIATRIC HEALTH CARE IN AYURVEDA):

Kaumarabhritya is one of the eight significant limbs of ayurveda dealing with care of an individual from the phase of pre-conception to the adolescence. The department of pediatrics in Ayurveda, Kaumarabhritya, is a part of this institution since the beginning.

The record since its establishment shows that 30% of the occupancy in the college hospital of Vaidyaratnam P. S. Varier Ayurveda college Kottakkal is from this department. The department intervenes and oversees children with differential abilities and a good many cases are of cerebral palsy and autism. Around 500 cases are managed annually.

Infrastructure:

The department has 16 staff in total including the head of department, an associate professor, a resident medical officer, a senior research fellow and a junior research fellow, chief consultant of CIMCD, client coordinator, speech pathologist, psychologists, special educators, occupational therapist and physiotherapist.

The outpatient department functions 6 days in a week from 8am to 9pm with an average inflow of 40 patients a day. The inpatient department possesses almost 30% of the occupancy of the hospital. The graduate students and the interneers are trained under the faculties of department.

VAIDYARATNAM P. S. VARIER AYURVEDA COLLEGE KOTTAKKAL



This institution was founded by the pioneer of Ayurveda, Vaidyaratnam P.S. Varier. It has a legacy in health care for more than a centennial. The institution continues to serve thousands of health seekers round the globe. Alongside, it continues as a paramount institute in Ayurvedic education and research.