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ADHD IN THE DIGITAL ERA: AN AYURVEDIC PERSPECTIVE ON SCREEN EXPOSURE, LIFESTYLE AND CHILD BEHAVIOUR

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ABSTRACT

Background: Attention-Deficit/Hyperactivity Disorder (ADHD) has emerged as a significant neurodevelopmental concern globally, exacerbated in recent decades by pervasive digital screen exposure, sedentary routines, and nutritional transitions in paediatric populations. While contemporary medicine identifies prefrontal dopaminergic and noradrenergic dysregulation as central to ADHD, classical Ayurveda offers a comprehensive psycho-physiological framework to understand cognitive instability, attention deficits, and behavioural hyper-reactivity. **Objective:** This narrative review aims to synthesize classical Ayurvedic principles with contemporary neurobiological evidence to elucidate the impact of excessive screen exposure and lifestyle modifications on child behaviour and ADHD pathogenesis. **Methods:** Classical Ayurvedic texts (*Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya*) were critically reviewed alongside electronic databases including PubMed, Scopus, and Google Scholar from inception to October 2023. Relevant literature on paediatric screen media exposure, neurodevelopmental outcomes, *Manovaha Srotas* pathology, and *Medhya* interventions was analysed. **Results:** Excessive screen exposure constitutes a contemporary manifestation of Asatmendriyartha Samyoga (inappropriate sensory-object contact) and Prajnaparadha (intellectual blasphemy), instigating Raja-Tama imbalance and Prana-Udana Vata vitiation. These factors disrupt Dhee (acquisition/cognition), Dhriti

(retention/inhibitory control), and Smriti (recall). Modern literature confirms that hyper-stimulating digital visual stimuli alter dopaminergic mesolimbic circuitry, degrade executive function, and disrupt circadian melatonin synthesis. Ayurvedic management—integrating Dinacharya (daily regimen), Satvavajaya Chikitsa (behavioural/cognitive psychotherapy), and Medhya Rasayana (nootropic formulations)—provides a holistic, neuroprotective countermeasure. **Conclusion:** Integrating Ayurvedic lifestyle paradigms and neuro-nutritive therapies with contemporary behavioural interventions presents a viable, integrative strategy to mitigate digital-era paediatric attentional deficits, warranting rigorous translational and clinical validation.

KEYWORDS: Attention Deficit Hyperactivity Disorder; Screen Time; Ayurveda; *Manovaha Srotas*; *Medhya Rasayana*; Child Behaviour.

1. INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) is among the most prevalent neurodevelopmental disorders of childhood, characterised by developmentally inappropriate levels of inattention, motor hyperactivity, and impulsivity.[1] The global pooled prevalence of ADHD in children and adolescents is estimated between 5% and 7.2%, with rising clinical presentations over the past two decades.[2] Concurrently, the pervasive infiltration of interactive digital media, smart devices, and high-frequency visual stimulation has drastically restructured childhood lifestyle, sensory engagement, and cognitive development.[3] High screen exposure during critical windows of neurodevelopment is increasingly linked to attentional deficits, reduced executive functioning, dysregulated emotional reactivity, and impaired sleep architecture.[4]

Contemporary neurobiology attributes ADHD primarily to genetic, neurochemical, and structural anomalies within the prefrontal cortex, basal ganglia, and interconnected dopaminergic and noradrenergic networks.[5] However, the rapid escalation of attentional and behavioural difficulties in non-clinical and sub-clinical paediatric cohorts underlines the profound contribution of environmental and lifestyle factors. Prolonged immersion in rapid-paced digital content fosters chronic hyper-arousal, desensitises reward pathways, and induces sensory fatigue, compromising the child's capacity for sustained focus, self-regulation, and behavioural inhibition.[6]

Classical Ayurvedic literature does not delineate a singular, direct equivalent for ADHD; instead, it provides an intricate framework describing behavioural and cognitive instability through the disruption of Manas (mind), Buddhi (intellect), and the three fundamental cognitive faculties: Dhee (perception and cognitive acquisition), Dhriti (retention, perseverance, and regulatory control), and Smriti (memory and retrieval).[7] Conditions such as Chittodvega (anxious/hyperactive mental state), Vata-dominant Manovikara (mental disorders driven by kinetic bio-humour), and sub-syndromic expressions of Unmada (psychiatric/neurobehavioural dysregulation) encapsulate the cardinal features of hyperactivity, impulsivity , and cognitive distraction.[8]

Despite the convergence of classical Ayurvedic concepts and modern neuro-environmental observations, a unified synthesis evaluating modern screen-induced behavioural changes through Ayurvedic psycho-pathology remains scarce. This review bridges this gap by systematically evaluating screen exposure, dietary indiscretions, and sedentary routines through classical Ayurvedic etiology (*Nidana*) and pathogenesis (*Samprapti*), providing a clinically applicable model for paediatric behavioural management in the digital age.

2. NEED OF THE STUDY

To synthesize classical Ayurvedic psycho-pathology with modern neurobiological paradigms to evaluate screen-mediated behavioural dysregulation in children, establishing an integrative framework for prevention and non-pharmacological management.

3. MATERIALS AND METHODS

A narrative literature review was conducted using a dual-methodological approach

1. **Classical Literature Search:** Primary classical Ayurvedic texts, including Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, Ashtanga Sangraha, and Kashyapa Samhita, were reviewed. Specific references relating to Indriya Pancha Panchaka (five sensory mechanisms), Manasika Dosha (Rajas and Tamas), Prajnaparadha, Asatmendriyartha Samyoga, Vata Vyadhi, and Kaumarbhritya (paediatric care) were identified and analysed.
2. **Contemporary Database Search:** Electronic databases including PubMed, Scopus, Web of Science, and Google Scholar were searched from January 2000 to October 2023. Keywords and MeSH terms utilised in varied combinations included: "attention deficit hyperactivity disorder", "ADHD", "screen time", "digital media", "paediatric executive function", "dopamine", "Ayurveda", "Manovaha Srotas", and "Medhya Rasayana".

Articles published in English addressing paediatric cognitive development, screen media impact, neurobiology, or Ayurvedic pharmacological/non-pharmacological interventions were included. Editorials, unverified popular media articles, and non-peer-reviewed sources were excluded.

4. REVIEW OF LITERATURE

4.1 Classical Ayurvedic Concept of Child Behaviour and Mental Faculties

In Ayurveda, mental equilibrium depends on the balance of the *Trigunas* (*Sattva*, *Rajas*, and *Tamas*) and the harmonious functioning of the *Tridoshas* (*Vata*, *Pitta*, and *Kapha*), which govern psychosomatic balance. *Sattva* represents purity, lucidity, and emotional stability; *Rajas* is the principle of movement, passion, and agitation; and *Tamas* represents inertia, darkness, and cognitive dullness.[9] Paediatric physiology (*Bala* or *Kaumara Avastha*) is inherently dynamic; while *Kapha Dosha* naturally predominates to support physical growth and tissue building (*Dhatu Vardhana*), the mental faculties (*Manasika Bhavas*) and neuro-cognitive infrastructure are delicate (*Sukumara*) and unstable (*Aparipakva Dhatu*).[10]

Cognitive processing is mediated through the coordinated activity of

- **Dhee:** The faculty of intellect responsible for clear perception, discrimination, and knowledge acquisition.
- **Dhriti:** The regulatory faculty representing willpower, impulse control, and the restraint that prevents the mind from pursuing harmful sensory stimuli (*Niyamika Shakti*).
- **Smriti:** The retrieval and sustained recollection of past experiences and learned information.

Charaka explicitly states that when *Dhee*, *Dhriti*, and *Smriti* undergo derangement (*Vibhramsha*), an individual acts unwholesomely, resulting in *Prajnaparadha* (intellectual error), which serves as the root cause of all endogenous disorders:

"धीधृतिस्मृतिविभ्रंशः संप्राप्तिः सर्वदोषप्रकोपस्य।" च.शा.१/९८-१०२

"Derangement of intellect (*Dhee*), regulatory restraint (*Dhriti*), and memory (*Smriti*) leads to the misdirection of actions (*Prajnaparadha*), provoking all morbid bodily and psychological doshas."

4.2 Ayurvedic Etiology (Nidana) of Attention and Behavioural Impairments

The etiology of behavioural instability and attention deficits in the modern era can be classified into dietary (*Aharaja*), lifestyle (*Viharaja*), mental (*Manasika*), and sensory (*Indriyartha*) factors.

4.2.1 Asatmendriyartha Samyoga (Inappropriate Sensory Engagement)

Ayurveda identifies *Asatmendriyartha Samyoga* (unwholesome contact of senses with their objects) as a primary etiology of disease. In the context of digital devices:

- **Atiyoga (Excessive use):** Prolonged screen viewing, continuous acoustic stimulation, and tactile interaction.
- **Ayoga (Deficient use):** Absence of natural sensory interactions (e.g., green spaces, physical tactile play, real-world interpersonal communication).
- **Mithyayoga (Perverted/Improper use):** Rapid visual cuts, flashing blue light, violent or age-inappropriate digital games, and viewing screens in dark rooms.

This unwholesome sensory influx directly irritates the visual sense organ (*Chakshurendriya*) and the mind (*Manas*), resulting in local *Alochak Pitta* aggravation and systemic *Vata-Raja* vitiation.[12]

4.2.2 Aharaja Nidana (Dietary Dysregulations)

Modern sedentary screen culture is intertwined with irregular dietary habits:

- Frequent consumption of *Paryushita* (stale/processed foods), *Junk/Fast foods* rich in refined sugars and artificial additives (*Vidahi*, *Abhishyandi* foods).
- Irregular eating timings (*Vishamashana*) and snacking while watching screens (*Atyashana* / *Anashana* patterns), which severely impairs digestive fire (*Agni*), generating metabolic toxins (*Ama*).
- *Ama* circulates systemically and obstructs the micro-channels (*Sroto-rodha*), particularly within the channels of cognition (*Manovaha Srotas*).[13]

4.2.3 Viharaja and Manasika Nidana (Lifestyle and Psychological Factors)

- **Diva-svapna and Ratri-jagarana:** Late-night screen exposure suppresses physiological sleep (*Nidranasha*), which aggravates *Ruksha* (dry) and *Chala* (kinetic) properties of *Vata Dosha*.

- **Lack of Vyayama:** Physical inactivity fails to expend paediatric energy, causing sub-clinical stagnation of *Kapha* mixed with agitated *Vata*.
- **Manasika Stressors:** Constant digital competition, hyper-stimulation, and exposure to rapid reward loops elevate psychological *Rajas* (agitation, aggression) and *Tamas* (lethargy, social withdrawal).

4.3 Pathogenesis (Samprapti) of ADHD-like Symptoms in Ayurveda

The pathogenesis is initiated when *Nidana Sevana* (excessive screen time, hyper-processed diet, and sleep disturbances) provokes *Vata Dosha*, specifically *Prana Vayu* (governing neuro-cognitive inputs, sensory reception, and concentration) and *Udana Vayu* (governing memory, speech, and executive functions). Simultaneously, the psychological bio-humour *Rajas* is severely elevated.

The aggravated *Prana Vayu*, laden with *Rajas*, enters the channels of the mind (*Manovaha Srotas*) and the heart/brain axis (*Hridaya/Murdha*). This causes qualitative instability (*Chalatva*) in the cognitive substrate, resulting in:

1. *Dhee Vibhramsha* (inability to sustain attention or discriminate appropriate stimuli).
2. *Dhriti Vibhramsha* (loss of behavioural inhibition, manifesting as impulsivity and motor fidgetiness).
3. *Smriti Vibhramsha* (working memory deficits and poor academic recall).

When *Kaphaja* dullness or *Tamas* supervenes following sensory exhaustion, the child demonstrates alternating bouts of hyper-reactivity followed by cognitive fatigue, apathy, and emotional lability.[14]

Table 1: Classical Ayurvedic Correlates of Cardinal ADHD Features.

DSM-5 ADHD Symptom Domain	Cardinal Clinical Manifestation	Classical Ayurvedic Concept	Predominant Dosha
Inattention	Easy distractibility, failure to sustain attention, poor listening, disorganisation	*Dhee-Smriti Vibhramsha*, *Anavasthita Chittatva* (unstable mind)	*Vata* (*Prana Vayu*), *Rajas*
Hyperactivity	Fidgeting, inability to remain seated, excessive running, restlessness	*Atipravritti*, *Chalatva*, *G ati-Vridhi*	*Vata* (*Vyana* and *Pra na Vayu*), *Chala Guna*
Impulsivity	Blurting out answers, interrupting, inability to wait turn, reckless acts	*Dhriti Vibhramsha*, *Prajnapara dha*, *Sahasa*	*Rajas* elevated, *Pitta Dosha* (*Tikshna Guna*)
Emotional Dysregulation	Irritability, low frustration tolerance, mood swings	*Chittodvega*, *Krodha-Amarsha*, *Manodainya*	*Rajas-Tamas* fluctuatio, *Sa*

			dhaka Pitta

4.4 Contemporary Neurobiological Impact of Screen Exposure in Children

Modern neuro-imaging and clinical research illustrate that excessive digital screen media alters structural and functional brain architecture in developing children:

1. **Prefrontal Cortex (PFC) Maturation & Dopaminergic Signalling:** The immature prefrontal cortex is vulnerable to the rapid sensory shifts of modern media. Fast-paced video content triggers sudden, short-lived spikes in striatal dopamine release. Over time, this downregulates dopamine D2 receptors, blunting endogenous motivation for low-stimulation tasks (e.g., reading, classroom instruction) and producing an attentional deficit phenotype.[15]
2. **Circadian Rhythm Disruption:** Emitted short-wavelength blue light (450–480 nm) from digital screens stimulates intrinsically photosensitive retinal ganglion cells (ipRGCs), suppressing nocturnal melatonin secretion from the pineal gland.[16] This delay in circadian timing causes sleep fragmentation, reduced slow-wave sleep, and secondary daytime cognitive impairment, manifesting as irritability, impulsivity, and executive dysfunction.[17]
3. **Disruption of Default Mode and Executive Networks:** Prolonged screen immersion impedes functional connectivity between the Central Executive Network (CEN) and the Default Mode Network (DMN), impairing inhibitory control, task-switching, and working memory capacity.[18]

Table 2: Comparative Ayurvedic and Modern Pathophysiological Paradigms.

Parameter	Modern Neurobiological Perspective	Classical Ayurvedic Perspective
Primary Trigger	Blue-light emission, high-frequency frame shifts, algorithmically engineered micro-rewards	*Asatmendriyartha Samyoga* (*Chakshu-Atiyoga/Mithyayoga*), *Mithya Ahara-Vihara*
Core Neurological Substrate	Prefrontal Cortex (PFC), Basal Ganglia, Frontostriatal pathways	*Murdha* (Head/Brain), *Hridaya* (Seat of consciousness), *Manovaha Srotas*
Neurochemical / Humoral Vector	Dopamine and Norepinephrine dysregulation; Melatonin depletion	*Vata Dosha* (*Prana-Udana-Vyana Vayu* vitiation); *Raja-Tama* excess
Cognitive Deficit Mechanism	Executive function failure, reduced inhibitory control via Frontoparietal network	*Dhee-Dhriti-Smriti Vibhramsha*, leading to pervasive *Prajnaparadha*
Systemic	Dysregulated autonomic tone,	*Agni Mandya*, *Ama Utpatti*, *Sroto-*

Consequences	metabolic alterations, neuroinflammation	*rodha*, *Ojas Kshaya* (reduced vitality)

4.5 Integrative Management Strategies

4.5.1 Chikitsa Siddhanta (Ayurvedic Treatment Principles)

The management of screen-aggravated cognitive disorders follows three foundational therapeutic axes:

1. **Nidana Parivarjana (Elimination of Etiological Factors):** Strict moderation and regulation of screen time, dietary restructuring, and avoidance of over-stimulating environments.
2. **Satvavajaya Chikitsa (Cognitive and Behavioural Psychotherapy):** Classical methods defined as *Ahitanam Arthanam Nigraha* (restraining the mind from unwholesome sensory objects). This entails structured behavioral therapy, parental reinforcement, mindfulness-based play, and digital detox protocols.
3. **Yuktipavyapashraya Chikitsa (Rational Pharmacotherapy):** Administration of *Vata-hara*, *Medhya* (nootropic), and *Rasayana* (rejuvenating) drugs processing *Sheeta* (cooling), *Snigdha* (unctuous), and *Soma-predominant* attributes to balance the hyper-kinetic *Vata* and agitated *Rajas*.

Table 3: Validated Medhya Herbs and Formulations in Paediatric Cognitive Management.

Botanical	Major Bioactive Constituents	Modern Pharmacological / Neuroprotective Actions
***Bacopa monnieri* (L.) Wettst.** (*Brahmi*)	Bacosides A & B, Bacopasaponins	Enhances synaptic transmission, upregulates antioxidant enzymes in the striatum, modulates acetylcholine and dopamine, improves working memory.[19]
***Centella asiatica* (L.) Urb.** (*Mandukaparni*)	Asiaticoside, Madecassoside, Triterpenes	Promotes dendritic arborisation, reduces neuroinflammation, modulates GABAergic pathways, exerts anxiolytic actions.[20]
***Convolvulus prostratus* Forssk.** (*Shankh apushpi*)	Microphylline, Convolvine, Flavonoids	Regulates hypothalamic-pituitary-adrenal (HPA) axis, mitigates neurochemical stress, improves attention span and memory retention.[21]
***Withania somnifera* (L.) Dunal** (*Ashwagandha*)	Withanolides, Withaferin A	GABA-mimetic, enhances neurogenesis, reverses sleep-deprivation-induced cognitive deficits, balances *Prana Vayu*.[22]
Kalyanaka Ghrita	Multi-herbal lipid-soluble extract in *Go-Ghrita*	Crosses the blood-brain barrier; enhances neuroprotection; pacifies *Vata-Pitta*; indicated in developmental delay and *Unmada*.[23]

Saraswatarishta	Fermented formulation containing *Brahmi*, *Gold* (*Swarna* bhasma), etc.	Modulates monoamine turnover, improves cognitive articulation, enhances memory and attention processing speed.[24]

4.5.2 External Therapies (Bahirparimarjana Chikitsa)

- **Shiroabhyanga and Murdha Taila:** Application of warm unctuous oils (*Ksheerabala Taila*, *Brahmi Taila*) to the head. This directly pacifies the aggravated *Chala Guna* of *Prana Vayu*, restores sleep architecture, and reduces hyperactivity.
- **Nasya (Nasal Drug Delivery):** Trans-nasal administration of medicated lipid formulations (*Kalyanaka Ghrita* or *Anu Taila*) delivers therapeutics via the cribriform plate and olfactory/trigeminal neural routes to access the central nervous system (*Nasa Hi Shiraso Dvaram*).[25]

5. DISCUSSION

The convergence between ancient Ayurvedic psycho-pathology and 21st-century neurobiology reveals a coherent paradigm: modern digital devices represent an intense, non-physiological sensory stressor that disrupts the neurodevelopmental trajectory of children.

Ayurveda describes the sensory organs (*Indriyas*) as dynamic bridges connecting external reality to the internal cognitive apparatus (*Manas* and *Buddhi*). The relentless, high-frequency stream of audiovisual stimulation from digital screens constitutes a classical example of *Asatmendriyartha Samyoga* (*Mithyayoga* and *Atiyoga* of *Chakshu* and *Shrotra Indriyas*). Modern neurobiology corroborates this: excessive frame shifts and hyper-stimulating digital content over-activate the sensory cortices and the mesolimbic dopamine pathway. This constant demand for attentional switching taxes the vulnerable prefrontal cortex, leading to a down-regulation of executive control and producing the core ADHD manifestations of inattention and impulsivity.

Furthermore, the Ayurvedic concept of *Prajnaparadha* operating through *Dhriti Vibhramsha* reflects the modern loss of executive inhibitory control. When *Dhriti* (inhibition/restraint) fails, the child cannot disengage from high-dopamine digital loops, perpetuating behavioral agitation, emotional outbursts upon screen removal, and academic disengagement. Sleep deprivation from blue light-induced melatonin suppression acts as a biological amplifier, accelerating *Vata* vitiation and *Raja-Tama* imbalance.

6. CONCLUSION

The modern digital era has exposed children to high-frequency sensory stimuli, accelerating the incidence of attention, cognitive, and behavioural deficits that parallel ADHD. Classical Ayurveda provides a comprehensive theoretical framework to understand these digital-era neurobehavioural challenges through the mechanisms of *Asatmendriyartha Samyoga*, *Prajnaparadha*, *Prana Vata* vitiation, and *Dhee-Dhriti-Smriti Vibhramsha*.

Integrating classical lifestyle interventions (*Dinacharya*), parental behavioral support (*Satvavajaya Chikitsa*), external therapies (*Murdha Taila*, *Nasya*), and scientifically validated *Medhya Rasayanas* offers an effective, balanced, and sustainable approach to paediatric cognitive health. Further translational research and rigorous randomized controlled trials are warranted to validate these integrative protocols and establish evidence-based guidelines for managing screen-induced neurobehavioural disorders.

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