Integrative Perspectives on Autism Spectrum Disorder: Evaluating the Relevance of Ayurvedic Herbs in Behavioural, Cognitive, and Physiological Management in Children

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Abstract: People with Autism Spectrum Disorder (ASD) often have trouble interacting with others and show behaviors that are limited or repetitive. Lord et al. (2020) says that people may also have difficulties with their senses, their stomachs, their anxiety, and their sleep. Ayurvedic medicines including Brahmi (Bacopa monnieri), Ashwagandha (Withania somnifera), Gotu kola (Centella asiatica), and curcumin (Curcuma longa) have been more popular in integrative medicine lately (Chaudhary & Singh, 2018; Srivastava & Yadav, 2020). Preliminary findings from preclinical and early translational studies suggest that these herbs may influence stress responses, synaptic plasticity, oxidative stress,neuroinflammation,cholinergic/GABA ergic signaling, and the etiology of Autism Spectrum Disorder (ASD), as reported by Gupta et al. (2021) and Kumar et al. (2022). There is a lack of consistent and adequate human evidence on ASD, and research on herbal medicines has produced inconclusive findings due to small sample numbers, varied formulations, and fluctuating quality (Agarwal et al., 2021; Hurwitz et al., 2021). Most strong information about how well these herbs work comes from studies on animals or studies that look at how they can be used for things other than ASD, such improving memory, lowering stress, or protecting the nervous system (Prakash &Kumar, 2014; Stough et al., 2013). It talks about what we know so far regarding Ayurvedic remedies for autism spectrum disorder (ASD), what might be causing it, and what we still don't know about dosage, safety, and the necessity for RCTS.

Keywords: Cognitive Behaviour, Neuro development Condition, Oxidative Stress, AyurvedicHerbs,Autism Spectrum Disorder.

1. Introduction

Autism Spectrum Disorder (ASD) is a severe and persistent neurodevelopmental condition characterized by atypical sensory processing, communication difficulties, and restricted, repetitive behaviors (Lord et al., 2020). Hyman et al. (2020) and Lai et al. (2019) found that people with autism spectrum disorder (ASD) had worse symptoms when they have additional health concerns. Some of these other issues are anxiety, depression, gastrointestinal difficulties, immune system disorders, epilepsy, and trouble sleeping. We need more techniques to deal with autism spectrum disorder (ASD) as more and more people have it. That's why it's crucial for the health of the population. The World Health Organization (WHO) claims that autism spectrum disorder affects roughly one hundred kids over the world.

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The National Institute for Health and Care Excellence (NICE) says that behavioral therapy, educational programs, and medication for symptoms including irritability, hyperactivity, and anxiety are the most common treatments to treat autism spectrum disorder (ASD). Even while these are still highly significant portions of treatment, there are still problems: Zwaigenbaum et al. (2015) noted that pharmacotherapies often address symptoms rather than the fundamental causes of autism. These treatments can also have bad effects or not function as well as they should. Because of these problems, nutritional therapy, herbal medicines, and dietary supplements have become good options for traditional treatment (Hurwitz et al., 2021).

Chaudhary and Singh (2018) contend that numerous plants in Ayurveda, the traditional Indian medicinal system, are considered to possess attributes that protect the nervous system, reduce anxiety, and improve cognitive function. Some of the botanicals that are currently being studied include Bacopa monnieri (Brahmi), which has been found to enhance learning and memory through cholinergic modulation and antioxidant activity (Stough et al., 2013); Withania somnifera (Ashwagandha), which has been extensively studied for its adaptogenic and anti-stress properties (Singh et al., 2011); Centella asiatica (Gotu kola), which is linked to neuronal regeneration and has anxiolytic effects (Devkota et al., 2020); and curcumin, derived from Curcuma longa, which has shown anti-inflammatory and neuroprotective actions in preclinical models of autism (Gupta et al., 2021). Even if the early results are promising, there isn't enough consistent and reliable clinical data about ASD. Some studies suggest that herbal medicines may improve cognitive and behavioral outcomes; however, these studies frequently exhibit small sample sizes, non-standardized formulations, and restricted reproducibility, as emphasized in the systematic reviews by Agarwal et al. (2021) and Hurwitz et al. (2021). It's crucial to think about the possible side effects, how effectively the treatment works, and how medications and herbs might work together when using complementary and alternative medicine (CAM) (American Academy of Pediatrics [AAP], 2019; Hyman et al., 2020). They also stress how crucial it is to employ these therapies with other proven behavioral and educational trategies.

As autism spectrum disorder diagnoses become more common and integrative medicine becomes more widely accepted around the world, it is important to carefully look at Ayurvedic medicines as a treatment for autism. This study assesses the mechanicalviability,theoretical underpinnings, and existing evidence of diverse Ayurvedic interventions for ASD, while acknowledging limitations, safety concerns, and the necessity for additional research. The purpose of this argument is to bring together traditional, pharmacological, and clinical points of view to create a practical framework for incorporating Ayurveda into family-centered, holistic treatment for autism.

2. Integration of Autism Spectrum Disorder and Ayurvedic Herbs

Using Ayurvedic herbs to treat autism spectrum disorder (ASD) is a new and interesting development in complementary and alternative medicine. Recent studies (Lai et al., 2019; Lord et al., 2020) demonstratethatalterationsin neurotransmission,neuroinflammation, oxidative stress, and mitochondrial dysfunction are critical contributors to ASD. Ayurvedic remedies have been used in ancient Indian medicine for a long time, and these herbs can aid with these processes in a natural way. Stough et al. (2013) contend

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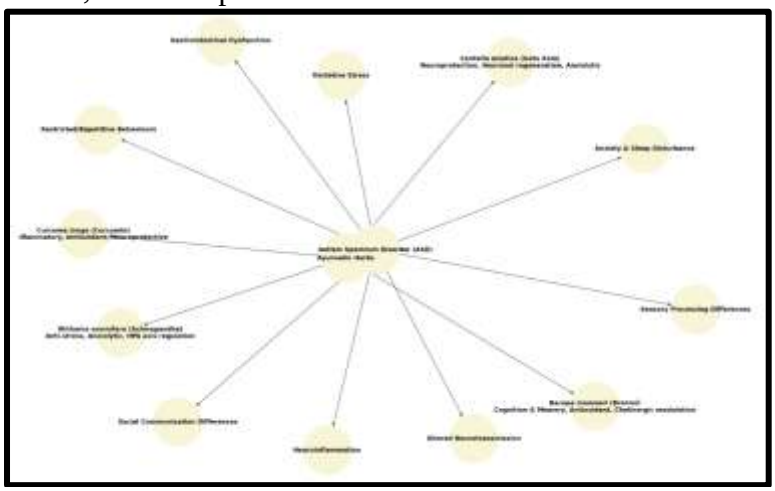
that Bacopa monnieri, known as Brahmi, improves memory and synaptic plasticity via modulating oxidative stress and cholinergic transmission. Singh et al. (2011) contend that Withania somnifera, known as Ashwagandha, can mitigate anxiety and enhance adaptability via modulating the HPA axis and GABAergic transmission. Curcumin, extracted from the spice Curcuma longa, exhibits significant antioxidant and anti-inflammatory properties; it alleviates neuroinflammation and behavioral impairments in autistic mouse models. Moreover, animal research has shown that Centella asiatica, commonly referred to as Gotu kola, can improve learning, alleviate anxiety, and even facilitate neural regeneration (Devkota et al., 2020; Gupta et al., 2021). Although these pharmacological findings correspond with the etiology of ASD, there is an absence of significant clinical data. Limited human trials have demonstrated encouraging enhancements in behavior, sleep, and cognitive function. However, as several large studies have shown, there are problems with the methods, such as small sample numbers and the lack of uniform formulations (Agarwal et al., 2021; Hurwitz et al., 2021). Ayurvedic herbs should not supplant behavioral, educational, and pharmaceutical interventions in the treatment of ASD; rather, they should be regarded as a supplementary approach (AAP, 2019). Because many people with ASD take more than one medication, a full and evidence-based integration would need to include standardizing goods, thorough safety checks, and careful thought about how herbs and drugs can interact with each other. Future research should prioritize rigorous clinical trials and patient-centered, safety-first frameworks to fully use the merging of old Ayurvedic wisdom with modern neurodevelopmental science in the treatment of autism spectrum disorder (ASD).



3. Impact of Integration of Ayurvedic Herbs and ASD on the Behaviour of Children

Ayurvedic medicines such as Centella asiatica, Bacopa monnieri, Withania somnifera, and Curcumin may modulate neurochemical activity, stress response, and inflammation, potentially improving behavior in children with autism spectrum disorder. Small sample sizes, irregular doses, and diverse study methodologies

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demand meticulous interpretation of the results.

Table: Ayurvedic Medicines in Managing Behavioral Symptoms of ASD)

Reference	Ayurvedic Medicine / Botanical	Key Findings / Mechanism	Behavioral Impact in ASD	Limitations / Remarks
Hyman et al. (2020)	—	Identifies major behavioral challenges in ASD, including irritability, hyperactivity, aggression, poor attention, and sleep disturbances.	Highlights the need for interventions targeting these behavioral symptoms.	Emphasizes behavioral management difficulties in families; does not test Ayurvedic interventions.
Stough et al. (2013)	*Bacopa monnieri*	Exhibits antioxidant and cholinergic modulation properties that enhance learning, attention, and impulse control.	Potential to improve cognitive regulation, reduce impulsivity, and increase focus in ASD children.	Evidence based on preclinical and small clinical studies; needs replication in ASD-specific contexts.
Singh et al. (2011)	*Withania somnifera* (Ashwagandha)	Demonstrates anxiolytic and adaptogenic effects by modulating stress response pathways.	May reduce irritability, anxiety, and stress-induced aggression among ASD patients.	Limited by small sample size and non-standardized formulations.
Gupta et al. (2021)	*Centella asiatica* (Gotu Kola)	Known for neuroprotective and calming properties that relieve restlessness and enhance concentration.	Can support attention stability and reduce hyperactivity in children with ASD.	Lacks large-scale randomized trials in ASD populations.
Preclinical / Animal Studies	*Curcumin* (from *Curcuma longa*)	Reduces neuroinflammation and oxidative stress; modulates neurotransmitter pathways.	Linked to reduced irritability and hyperactivity in animal models of autism.	Mostly preclinical data; human evidence limited and inconsistent.
Agarwal et al. (2021)	—	Meta-analysis notes high variability in formulations, dosage, and study design.	Suggests potential synergistic use with behavioral therapies for better outcomes.	Calls for standardized dosages, clinical trials, and long-term safety evaluations.

A) Impact on Behavioural Management of Children

Helping someone with ASD take ownership of their actions is a great method to help them. This strategy is supposed to cut down on bad behaviors like hostility, hyperactivity, impatience, and stereotypies while also helping people learn how to pay

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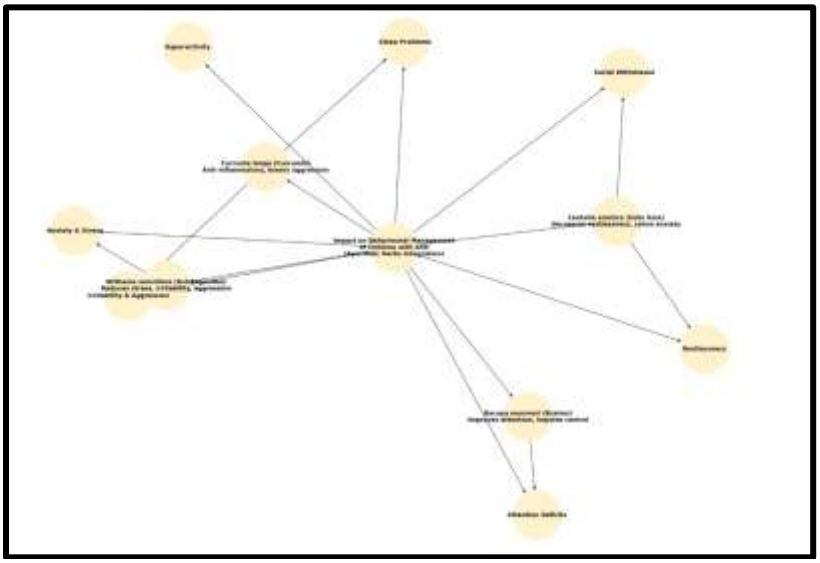
attention, manage themselves, and communicate with others, according to Lord et al. (2020). Traditional behavioral therapy and Ayurvedic medicine may be more effective when used together. Preclinical studies indicate that specific Ayurvedic medicines may influence circuits essential for behavioral regulation. The goal of behavioral training is to help people pay attention longer and stop acting on impulse. Gupta et al. (2021) discovered that curcumin, the active component of Curcuma longa, safeguarded the brain and mitigated aggression in rats with autism. As a result, individuals were more likely to take part in socialactivities.Theseherbsmay inadvertently enhance cognitive-behavioral approaches and Applied Behavior Analysis (ABA),twobehavioralmanagement techniques,by mitigating the neurobiological pressures that exacerbate behavioral disorders. It is important to be careful when interpreting results because the clinical database is small and of poor quality (Agarwal et al., 2021; Hurwitz et al., 2021). Ayurvedic medications cannot supplant conventional treatments for ASD; nevertheless, they may assist in addressing behavioral issues that hinder certain children from engaging in therapy. Because of this, they would be a perfect complement to a therapy plan that includes professionals from many different professions.



B) Impact on Cognitive Management of Children

Cognitive management approaches designed to improve attention, memory retention, problem-solving abilities, and the capacity to learn new information can benefit children diagnosed with Autism Spectrum Disorder (ASD). Damage to these skills often results from anomalies in sensory processing, problems in executive function, and aberrant brain connections (Lai et al., 2019; Lord et al., 2020). Ayurvedic drugs may enhance neurocognitive function when used alongside behavioral and educational interventions. The Ayurvedic herb Bacopa monnieri (Brahmi) has shown promise in improving attention, learning capacity, and working memory in both children and adults by reducing oxidative stress, increasing synaptic plasticity, and modulating cholinergic transmission (Stough et al., 2013; Prakash & Kumar, 2014). These pathways may be beneficial for cognitive training programs for children with ASD if

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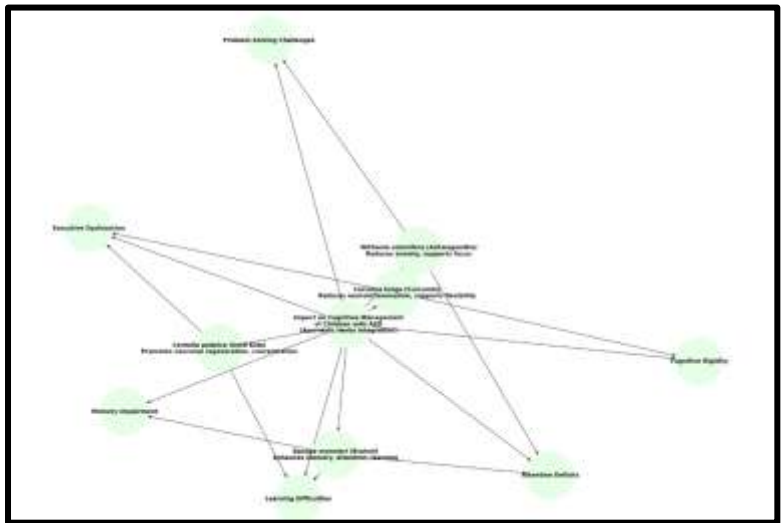
they enhance sustained attention and memory recall. Withania somnifera (Ashwagandha) may enhance cognitive function indirectly by alleviating anxiety-related impediments to learning and concentration, as demonstrated by its anxiolytic and anti-stress properties (Singh et al., 2011). Centella asiatica, known as Gotu kola, has been used in traditional medicine for a long time since it is said to help with attention and brain regeneration (Devkota et al., 2020). Gupta et al. (2021) found that curcumin, the main part of curcuma longa, made neuroinflammation and oxidative imbalance worse in preclinical autism animals. These characteristics are significantly correlated with cognitive inflexibility and impairments in executive function. The number and quality of human studies focused on ASD are still lacking, however there are signs that cognitive control may be beneficial (Agarwal et al., 2021; Hurwitz et al., 2021). Ayurvedic medicines may enhance ASD cognition by strengthening the neurobiological foundation; nevertheless, they should not be seen as replacements for evidence-based educational and cognitive interventions, but rather as complementary therapies.



C) Impact on Physiological Management of Children

Children with ASD often have systemic issues with digestion, sleep, stress reactivity, the immune system, and metabolism (Hyman et al., 2020; Lai et al., 2019). To help these kids with these difficulties, physiologic management is performed. The necessity for comprehensive therapy is emphasized by the tendency of these co-occurring illnesses to aggravate behavioral and cognitive difficulties. Ayurvedic medicines have been shown to be able to affect certain of these body parts. Singh et al. (2011) claim that Withania somnifera, also known as Ashwagandha, has adaptogenic effects on the hypothalamic-pituitary-adrenal (HPA) axis. These effects include lowering cortisol levels and helping people sleep better. In principle, this may help autistic youngsters who are tired and grumpy. People with ASD may be grumpy, have stomach problems, or have an immune system that doesn't work well. Curcumin, a component of curcuma longa, can ameliorate these symptoms by reducing neuroinflammatory markers and oxidative stress (Gupta et al., 2021). Brahmi, also

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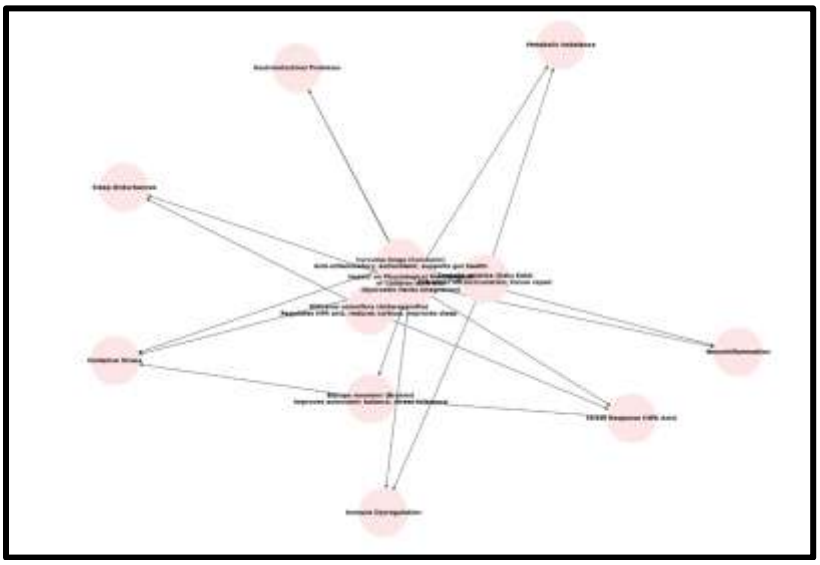
known as Bacopa monnieri, has been utilized historically to regulate autonomic functions and enhance stress resilience. Stough et al. (2013) discovered that it exhibited cognitive effects as well. These findings indicate that Bacopa may assist in regulating the body's response to excessive sensory input. Centella asiatica, often known as gotu kola, may improve physical and neurological health by increasing microcirculation and speeding up tissue healing (Devkota et al., 2020).



4. Conclusion

Medical, psychiatric, and other professionals must collaborate to address the various dimensions of ASD, including the individual's biology, cognition, and behavior. Integrative medicine has created new approaches to study the therapeutic applications of Ayurvedic botanicals, but old strategies like managing medications, starting educational programs, and treating behavior are still very important. Preliminary and translational research suggests that botanicals, including Bacopa monnieri, Withania somnifera, Centella asiatica, and curcumin from Curcuma longa, exert beneficial effects on anxiety, neuroinflammation, synaptic plasticity, neurotransmitter modulation, stress responses, and other processes related to ASD. These effects may be advantageous for children with ASD since they contribute to physiological stability, augment cognitive abilities, and modulate behavior.

While thinking about the potential of integration, it's important to keep in mind the limits that are already in place. We can learn a lot from people and animals who don't have autism spectrum disorder (ASD). There are not enough complete and well-regulated clinical trials involving human subjects. It's already hard to put into effect, and there are other problems, such different formulas, inconsistent dosages, and not enough safety checks. You shouldn't only use Ayurvedic medicines for therapy. Instead, they should be thought of as a good thing that could improve the effectiveness of current medications and enhance patients' quality of life.

The integration of Ayurvedic principles with contemporary biological research offers hope for the future treatment of autism spectrum disorders. We need extensive

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randomized controlled studies, standardized herbal formulations, and cooperation between researchers, doctors, and traditional healers to find out if a medicine is safe and effective. Integrative frameworks that combine contemporary neuroscience research with ancient herbal wisdom can effectively assist families impacted by autism spectrum disorder.

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