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### Herbal beneficiaries in autism spectrum disorder

V. Selvakumari\*, R. Senthamarai, T. Shri Vijaya Kirubha, P. Balasubramanian, V. Kavitha

Department of Pharmacognosy, Periyar College of Pharmaceutical Sciences, Tiruchirappalli 620 021, Tamil Nadu, India.

\*Corresponding author: V. Selvakumari

Email: [gmoon571997@gmail.com](mailto:gmoon571997@gmail.com)

#### ABSTRACT

The fundamental features of autism spectrum disorder (ASD) are continuous deficiency in social communication and interaction, repetitive patterns of behavior, interests, or activities. The reasons for autism are unclear, but various theories of genetics, immunity, biological and psycho-social factors have been proposed. Autism is a complex disorder with definite causes that usually co-occur. Kids with autism spectrum disorder tend to have thinner bones than kids without it, so bone-building foods are important. Although no medicine has been recognized to treat this disorder, Risperidone is the only drug approved by the FDA for children affected with autism spectrum disorder. Pharmacological treatment can be effective in reducing its signs, such as self-mutilation, aggression, repetitive behaviors, hyper activity and sleeping disorders. Traditional uses of medicinal plants have become widely known among society for various diseases. Medicinal plants with Neuro protective effects on autism have been reported. Medicinal plants such as *Curcuma longa*, *Zingiber officinale*, *Terminalia chebula*, *Vitis vinifera*, *Prunus dulcis*, *Glycine max*, *Ginkgo biloba* and *Punica granatum* have been claimed for Neuro protective effects and might be beneficial for this problem. Study on the medicinal plants for the treatment of autism would be a promising source for the preparation of new Anti-autism drugs.

**Keywords:** Autism, Neuro protective effects, Medicinal herbs, Risperidone

#### INTRODUCTION

Autism spectrum disorder (ASD) is a heterogeneous group of Neurodevelopmental disorder characterized by the presence of impaired social communication, reciprocity, stereotyped pattern of behaviors and interests [1]. According to estimates from Center for disease control and prevention (CDC) data, approximately 1 in 68 children has been identified with ASD studies in

North America, Asia, Europe have reported the average prevalence of individuals with autism as between 1% and 2% [2]. Additionally, more than 50% of children with autism have compromised gastrointestinal health, including food allergies, mal digestion and mal absorption issues. Altered intestinal permeability, otherwise known as “leaky gut”, has also been found in 43% of individuals with autism, which leads to debilitating vitamin and mineral deficiencies [3]. It is the world’s third most

common developmental disorder. To spread awareness in every year 2<sup>nd</sup> April is marked as World Autism Day [4]. Children and adults diagnosed with autism must balance blood sugar levels, check for brain-polluting heavy metals, exclude food additives, identify allergies, ensure intake of essential fats, and monitor overall nutrient deficiencies. [5]

### Autism spectrum disorder

Autism is a complex neurobehavioral condition that includes impairments in social interaction and developmental language and communication skills combined with rigid, repetitive behaviour. Because of the range of symptoms, this condition is now called Autism Spectrum Disorder (ASD). Children with autism have trouble in communicating. They have trouble understanding what other people think and feel. This makes it very hard for them to express themselves either with words or through gestures, facial expressions and touch.

A child with ASD who is very sensitive may be greatly troubled - sometimes even pained by sound, touch, smell or sight that look to be normal to others. Children who are autistic may have repetitive body movements such as rocking, pacing or hand flapping. They may have unusual responses to people, resistance to change their routines and self-injurious behaviour. Some children with autism may also develop seizures. [6]

### CAUSES OF AUTISM

- Advanced age of the mother or father increases the chance of an autistic child.
- When a pregnant woman is exposed to certain drugs or chemicals, her child is more likely to be autistic (Use of anti-seizure drugs).
- Vaccinations cause autism.
- Exactly why autism happens is not clear. Research suggests that it may arise from abnormalities in parts of the brain that interpret sensory input and process language. [7]

### Symptoms

Symptoms of autism usually begin after the age of six months, become established by age of two years and continue through adulthood. [6]

### Sensory problems

Many children with autism spectrum disorders either under react or over react to sensory stimuli. At

times they may ignore people speaking to them, even to the point of appearing deaf. However, at other times they may be disturbed by even the softest sounds. Sudden noises such as a ringing telephone can be upsetting, and they may respond by covering their ears and making repetitive noises to drown out the unwanted sound. Children on the autism spectrum also tend to be highly sensitive to touch.

### Emotional difficulties

Children with autism spectrum disorders may have difficulty regulating their emotions or expressing them appropriately. For instance, your child may start to cry, or laugh hysterically for no apparent reason. When stressed, he or she may exhibit disruptive or even aggressive behaviour (breaking things, hitting others, or harming him or herself). The National Dissemination Center for Children with Disabilities also notes that kids with ASD may be unfazed by real dangers like moving vehicles or heights, yet be terrified of harmless objects such as a stuffed animal.

### Cognitive abilities

ASD occurs at all intelligence levels. However, even kids with normal to high intelligence often have unevenly developed cognitive skills. Not surprisingly, verbal skills tend to be weaker than nonverbal skills. In addition, children with Autism spectrum disorder typically do well on tasks involving immediate memory or visual skills, while tasks involving symbolic or abstract thinking are more difficult. [8]

### TREATMENT

#### Complementary alternative medicine therapy for autism

- Biologically based CAM treatment
- Non - biologically based CAM treatment

### BIOLOGICALLY BASED CAM TREATMENT

#### Dietary interventions

Among CAMs currently used in autism, elimination diets, especially gluten and/or casein-free diets are one of the most popular, because the gluten and casein may originate opiate-active metabolites in the gut that could reach the systemic circulation.

Additionally several gastro intestinal abnormalities have been observed in subjects with ASD, such as increased permeability of the gut barrier and bacterial overgrowth which could benefit from elimination diet.

The ketogenic diet should be mentioned. That is low carbohydrate, high fat diet which has been successfully administered in children with refractory epilepsy, this dietary regimen determines a better seizure control and has an effect comparable to antiepileptic drugs. [9]

### **Nutraceuticals**

The term nutraceutical is defined as “any substance that is food or a part of food and provides medical or health benefits, including the prevention and treatment of disease”. Usually, nutraceuticals consist of dietary supplements (such as vitamins, minerals, amino acids, and herbal substances) or functional food. Nutraceuticals could represent a potential treatment for autism with limited or no side effects, and they are commonly used in families with ASD. [4]

### **Vitamins**

Vitamin supplementation is another popular CAM therapy in ASD. The rationale for this treatment is based on the frequently observed dietary deficiency of vitamins and micronutrients in children with ASD. In fact, it has been reported that children with ASD introduce less than recommended amounts of calcium, vitamin D, vitamin K, vitamin A, vitamin E, zinc, vitamin B6, and tetrahydrobiopterin. These deficiencies could be the result of food selectivity or altered gastrointestinal absorption. Several trials evaluating vitamins supplementation in ASD have been conducted. [10]

### **Non- biologically based cam treatment**

The National Center for Complementary and Alternative Medicine (NCCAM) divides non-biological CAM therapies in three groups: mind-body medicine (i.e., prayer, yoga, meditation, music, dance, and art in general), manipulative and body-based practices (i.e., massage, chiropractic care and acupuncture) and energy medicine (i.e., Reiki or Homeopathy). [11, 12]

## **PLANTS SOURCE**

### **Flavonoids**

Some individuals with ASDs have been exposed to environmental pro-oxidant factors such as heavy metals, pharmaceutical compounds (thalidomide, valproic acid and retinoic acid), air pollutants, chemical and toxins, and bacterial and viral infections; those might be the triggering of oxidative stress in autism. To decrease levels of oxidative stress, green tea therapy using *Camellia sinensis* extract has been proposed. This plant is an important dietary source of polyphenols, specifically flavonoids. The main flavonoids present in *Camellia sinensis* extract include catechins (flavan-3-ols) such as epigallocatechin-3-gallate, epigallocatechin, epicatechin-3-gallate, and epicatechin; It also contains gallic acid, chlorogenic acid, caffeic acid, and flavonol derivatives such as kaempferol, myricetin and quercetin which are other constituents of green tea. [3]

### **Piperine**

The World Health Organization reported that medicinal plants are the best source of drugs. The major alkaloid commonly used for seizure disorders present in *Piper longum* and black pepper *Piper nigrum* is piperine. It has been shown to own antioxidant, neuroprotective, anxiolytic and cognition enhancing effects. A study reports amelioration effects of piperine on behavioral alterations and oxidative stress markers in autism induced murine model, revealing that piperine treatment restored the motor deficits and decreased the reorientation time, due to its capability to struggle with the induced cerebellar damage by sodium valproate. [2]

Piperine also has neuroprotective effects on glutamate at concentration of 20 mg/kg, which induced cell viability restoration. Oxidative stress alterations might be meaningfully reversed by treatment with piperine; besides, a neurobiological finding in ASD is the restoration of the integrity of the cerebellum by a decrease in number of Purkinje cells, which are connected with cerebral cortex and limbic system. Therefore, autism could be a pharmacological condition for biomedical treatment with piperine.

## Curcumin

Indian spice turmeric (*Curcuma longa*) is well known for its protective effects against neurodegenerative diseases and neuropsychiatric disorders, in which the major curcuminoid is curcumin (diferuloyl methane), a nontoxic molecule, able to cross blood brain barrier. Also, it is reported to have positive effects on the treatment of autism as curcumin targets several cell signaling pathways, and its effects are as follows: increasing intracellular levels of glutathione, reducing inflammatory components, mitochondrial dysfunction, oxidative/nitrosative stress, and protein aggregation, counteracting the damage caused by heavy metals, and supporting liver detoxification. [6]

## Bacosides

Bacosides are medicinal substances widely used by Indian tribes and are the main bioactive

compounds extracted from *Bacopa monnieri* (L.) Two triterpenoid glycosides denoted as bacoside A and bacoside B are the major bioactive constituents found in *B. monnieri*; both of them are able to improve cognition. Pharmacological effects are attributed to the number of alkaloids, saponins, and sterols, which compose the extract. It has been reported that these bacosides modulate cholinergic densities along with acetylcholine levels, and in presence of these compounds, the central nervous system shows  $\beta$ -amyloid scavenging properties and anxiolytic reliving processes. Although its biological molecular mechanisms have not been proven, it is well known that bacoside-A interferes with aggregation and membrane activity in fragments of the prion protein 38; induction of fibril formation corresponding to inhibition of membrane interactions is likely the main factor that reduces amyloid protein toxicity by bacoside-A. [14]

**Table 1: Medicinal herbs used for treatment of autism [3, 13]**

SCIENTIFIC NAME	FAMILY	COMMON NAME	EFFECT
<i>Curcuma longa</i>	Zingiberaceae	Turmeric	Turmeric has been reported to be effective in animal models but needs to be studied with autistic patients.
<i>Ginkgo biloba</i>	Ginkgoaceae	Ginko	A study also found that a chemical compound called sulforaphane, obtained from broccoli sprouts, may help improve the symptoms of autism in some people.
<i>Prunus dulcis</i>	Rosaceae	Badam	Taking vitamin B6 and B12, magnesium, and selenium is helpful for autistic patients.
<i>Glycine max</i>	Fabaceae	Soya	Taking vitamin B6 and B12, magnesium, and selenium is helpful for autistic patients. It is recommended that autistic people use magnesium rich sources such as soya bean.
<i>Terminalia chebula</i>	Combretaceae	Myrobalan	The first drug of choice for autism in adults and children with slowness is processed <i>Terminalia chebula</i> combined with honey.

## CONCLUSION

Few years back autism was a unrecognized mental disorder but in current days it is a recognized as one of the independent neurological problem or pervasive developmental disorders in which no specific drugs are available, but rather there are few therapies and herbal resources for the treatment autism. Numerous researches is undergoing for the treatment of autism in this herbal sources are resulting as a successful and prominent treatment.

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