In recent years, there has been an increasing prevalence of cases of autism. There is no general cure for autism; however, there are situational treatments available. In this context, plants may be beneficial in suppressing the conditions that may arise in the disease. This study compiles plant species that have been reported in the literature as potential remedies for autism disorders. Furthermore, the general characteristics, usage areas, and biological activities of these plant species have been compiled. As a result of our research, it has been seen that plants can be used to combat many symptoms of autism. It is believed that plants may contribute to the improvement of the well-being of individuals with autism, as a result.

KEYWORDS: autism, medicinal plants, pharmacotherapeutic, complementary medicine.

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1. Introduction

Traditional and complementary medicine refer to a series of treatment methods that have their roots in earlier times, predating modern medicine [1,2]. The active ingredients of many drugs used in modern medicine are obtained directly from natural products or synthesized through the synthetic production of compounds found within natural products [3,4]. Numerous natural products such as fungi, plants, and animals are utilised within the scope of traditional medicine [5,6]. Natural products that are noteworthy for their nourishing properties are plants. They are consumed in many meals of the human diet [7]. In addition to their nutritional properties, plants have been used by humans for years in the fight against diseases [8]. Plants possess numerous medicinal properties due to the presence of bioactive compounds within their cells [9]. Numerous studies have reported that plants exhibit various biological activities such as anticancer, antimicrobial, anti-inflammatory, antioxidant, anti-aging, hepatoprotective and DNA protective activities [10-19]. It can be observed within this context that plants are highly significant natural resources. This study compiles the research conducted on plants used in the treatment of autism as reported in the literature. Furthermore, the general characteristics and other activities of plants used in autism have been compiled.

2. Autism and plants used in alternative therapy

Autism Spectrum Disorder (ASD) is a comprehensive behavioural disorder that affects the social interaction and communication of individuals throughout their lives, starting before the age of three. It is characterised by restricted and repetitive behaviours that limit the use of brain functions. [20] These symptoms differentiate autism particularly from Asperger's syndrome. According to the classification of autism spectrum disorders, Asperger syndrome is a milder form of behavioural disorder [21]. While the incidence of autism spectrum disorder was considered to be 1 in 500 in previous years, according to recent data, autism spectrum disorder is thought to affect approximately 1 in every 54 children. In addition, its prevalence in boys is 4.3 times higher than in girls [22]. Recent research on the mechanism of autism focuses on subcortical-mediated social orientation status, differences in electroencephalography (EEG) and other measures of brain function, and brain changes in synaptic signaling pathways. Among these recent studies, it is thought that especially defects in synaptic protein, changes in synaptic structure, function and neural circuits constitute the mechanism of autism spectrum disorder. It is also stated that synaptopathy is an important component of autism [23].

Autism has a genetic origin. However, despite varying
perspectives, the precise details of genetic factors cannot be fully elucidated. There are opinions suggesting that birth-related disabilities, vaccinations administered at a young age, and illnesses may lead to autism in later years [24]. In recent years, there has been a significant increase in the incidence of autism cases. Although the general cause of this remains unclear, the lack of knowledge regarding the former prevalence and changes in diagnostic methods have resulted in unknown ratios of cases prevalence in the past and presently. Autism affects different regions of the brain. Furthermore, it remains uncertain how it affects the regions it impacts [25]. Parents can diagnose the illness of their children based on symptoms during their early years. Early diagnosis can reveal the potential for behavioural or cognitive interventions in later stages of life, which may enable patients to improve their self-care and social communication abilities. Furthermore, it has been suggested that individuals with autism spectrum disorders may experience a reduction in symptoms as they reach adulthood, allowing them to achieve greater independence [26]. The diagnosis of autism is based on a series of symptoms rather than a single indicator. Symptoms such as social withdrawal, communication impairments, avoidance of contact, hyperactivity, limited attention, repetitive behaviours, and eating disorders have been identified [27]. Autism is perceived to operate through two processes. The pathophysiology of brain structures and processes is linked to the neuropsychological connections between brain structures and behaviours. There is no fundamental treatment method for autism. Treatment is typically administered based on requirements. Early intensive and continuous educational programmes, as well as behavioural therapies, have been shown to promote children's self-sufficiency in later years [28]. Many drugs are used in the treatment of autism. Often after diagnosis, more than half of the cases are children using psychotropic drugs. The most common classes of these medications are antidepressants, stimulants, and antipsychotics. In addition to these, alternative treatment methods are also being applied [29]. The methods of treatment are typically costly. For this reason, individuals utilise natural products that are used in complementary or alternative medicine.

In this study, plant species used in autism in the literature were compiled. The obtained results are shown in Table 1.

### Table 1. Plants used in autism [30-62].

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Family</th>
<th>Used Parts</th>
<th>Geographic regions</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorus calamus</td>
<td>Acoraceae</td>
<td>Stem</td>
<td>Iran, Germany</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Centella asiatica</td>
<td>Apiaceae</td>
<td>Aerial</td>
<td>Iran, Germany</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Asparagus racemosus</td>
<td>Asparagaceae</td>
<td>Stem</td>
<td>India</td>
<td>Oxidative stress suppressor</td>
</tr>
<tr>
<td>Lepidium sativum</td>
<td>Brassicaceae</td>
<td>Seed</td>
<td>Saudi Arabia</td>
<td>Nutritional supplement</td>
</tr>
<tr>
<td>Lobelia inflata</td>
<td>Campanulaceae</td>
<td>Aerial</td>
<td>Iran</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Cannabis sativa and Cannabis spp.</td>
<td>Cannabaceae</td>
<td>Aerial</td>
<td>USA, Israel, Italy</td>
<td>Neurotransmitter function, communication enhancer, cognitive enhancer, behavior controller, gastrointestinal system regulator, sleep regulator, sedative, appetite regulator</td>
</tr>
<tr>
<td>Ginkgo biloba</td>
<td>Ginkgoaceae</td>
<td>Aerial</td>
<td>India, Iran, Egypt, Germany, Italy</td>
<td>Neurotransmitter function, regulating social behavior deficiencies, regulating behavior problems</td>
</tr>
<tr>
<td>Astragalus membranaceus</td>
<td>Leguminosae</td>
<td>Aerial</td>
<td>Iran, Turkey, China, Germany</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Glycine max</td>
<td>Leguminosae</td>
<td>Seed, aerial</td>
<td>India, USA</td>
<td>Nutritional supplement, antithyroid effect</td>
</tr>
<tr>
<td>Salvia spp. and Salvia officinalis</td>
<td>Lamiaceae</td>
<td>Aerial</td>
<td>Burkina Faso, Egypt</td>
<td>Anxiolytic, antidepressant, regulating social behavior deficiencies, neurotransmitter function</td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>Moringaceae</td>
<td>Seed</td>
<td>Egypt</td>
<td>Gastrointestinal system regulator</td>
</tr>
<tr>
<td>Paeonia lactiflora</td>
<td>Paeoniaceae</td>
<td>Stem</td>
<td>Iran</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Passiflora incarnata</td>
<td>Passifloraceae</td>
<td>Aerial</td>
<td>Iran</td>
<td>Oxidative stress suppressor, behavior controller</td>
</tr>
<tr>
<td>Piper nigrum</td>
<td>Piperaceae</td>
<td>Aerial</td>
<td>India</td>
<td>Oxidative stress suppressor</td>
</tr>
<tr>
<td>Bacopa monnieri</td>
<td>Plantaginaceae</td>
<td>Aerial</td>
<td>India</td>
<td>Communication enhancer, cognitive enhancer, neurotransmitter function</td>
</tr>
<tr>
<td>Actaea racemosa</td>
<td>Ranunculaceae</td>
<td>Stem</td>
<td>Iran</td>
<td>Neurotransmitter function</td>
</tr>
<tr>
<td>Camellia sinensis</td>
<td>Theaceae</td>
<td>Aerial</td>
<td>India, Indonesia, Venezuela</td>
<td>Oxidative stress suppressor, neurotransmitter function</td>
</tr>
<tr>
<td>Zingiber officinale</td>
<td>Zingiberaceae</td>
<td>Aerial, stem</td>
<td>India, Saudi Arabia, Iran, England, Germany</td>
<td>Neurotransmitter function, cognitive enhancer, memory booster, reduces antisocial behaviours</td>
</tr>
<tr>
<td>Curcuma longa</td>
<td>Zingiberaceae</td>
<td>Aerial, stem</td>
<td>India, Australia</td>
<td>Protecting from neurodegeneration, cell signaling modifier, neuro-psycho-pharmacotherapeutic</td>
</tr>
</tbody>
</table>
2.1. *Zingiber officinale*

*Zingiber officinale* Roscoe, commonly known as ginger, is a botanical species widely recognised among the general population. This plant is a perennial herb. The general distribution area is the Southeast Asia region. However, it is being propagated and multiplied by being incorporated into cultures in many regions of the world. The height can reach up to one metre. Ginger has various applications in terms of both pharmacology and flavour [63]. It has been reported that ginger possesses various biological activities such as antioxidant, anti-inflammatory, antimicrobial, cytotoxic, neuroprotective, cardiovascular-protective, antiobesity, anti diabetic, antinausea, and antiemetic effects [64,65].

When examining the impact of ginger on autism, research conducted in Germany, the United Kingdom, Saudi Arabia, Iran, and India has investigated the effect of the *Z. officinale* plant’s spice properties on children with autism. Many studies have reported that ginger is effective against propionic acid, which causes behavioral disorders [30-35].

2.2. *Acorus calamus*

The plant *Acorus calamus* L. is known by various names, including cinnamon sedge or sweet cinnamon. The nomenclature of this plant includes various names such as sedge, sweet sedge, flag root, gladdon, myrtle grass, myrtle sedge, sweet myrtle, myrtle flag, sweet root, sweet cane, and sweet rush. This is a long-standing aquatic plant. The distribution areas encompass India, Russia, Japan, the USA, China, Sri Lanka, and Burma. The use of bay leaves has enabled the substitution of ginger, cinnamon, and coconut in culinary applications. The areas of application encompass both nutritional and pharmacological fields. Particularly in the field of health, fever, toothache, nerve pain, and digestive problems are among the most prevalent conditions [66,67]. It has been reported that *A. calamus* possesses various biological activities such as antimicrobial, antioxidant, insecticidal, cytotoxic, anti-inflammatory, anticholinesterase, antitumor, and analgesic properties [68,69].

2.3. *Actaea racemosa*

The plant *Actaea racemosa* L. (*Ranunculaceae*) is commonly known as black cohosh among the general population. The general distribution area is North America. Due to its pharmacological properties, it is widely used. Among conditions it is used for are menopause, irregular menstrual cycles, and neural problems [70,71]. It has been reported that *A. racemosa* exhibits various biological activities such as antioxidant, antiestrogenic, anticancer, cytotoxic, and antimicrobial effects [72].

2.4. *Lobelia inflata*

*Lobelia inflata* L. is also known as Indian tobacco or emetic weed. Typically, it is an herbaceous plant that lasts for one or two years. The stems are typically hairy, the leaves are oval and serrated, and the flowers bloom in mid-summer. Remedies for muscle disorders and respiratory problems, and laxative use are among the health-related applications of *L. inflata*. Apart from the healthcare sector, incense and insecticides are also used in religious ceremonies [73-75]. It has been reported that *L. inflata* exhibits various biological activities such as antimicrobial, anti-inflammatory, antitumor, antidepressant, and antioxidant properties [76].

2.5. *Paeonia lactiflora*

*Paeonia lactiflora* Pall., commonly referred to as the Chinese peony, Chinese herbaceous peony, or common garden peony, belongs to the family *Paeoniaceae*. *P. lactiflora* is a perennial plant that is characterized by its showy and floral appearance. Asia ranks first in terms of general distribution area. In the field of healthcare, it is used for conditions such as dysmenorrhea, rheumatoid arthritis, cramp pain, hepatitis, muscle pain, and systemic lupus erythematosus [77-79]. It has been reported that *P. lactiflora* exhibits various biological activities such as anti-inflammatory, cytotoxic, antimutagenic, antitumor, antioxidant, antimicrobial, and hepatoprotective effects [77, 80].

The effects of *A. calamus*, *A. racemosa*, *L. inflata* and *P. lactiflora* on autism within the scope of a study conducted in Germany and Iran are presented in Table 1. According to the studies conducted, it has been reported that the plant samples used have neuroprotective properties for autism [32,34].

2.6. *Camellia sinensis*

Various types of tea, such as black tea, white tea, green tea, yellow tea, and fermented tea, are derived from *Camellia sinensis* (L.) Kuntze (*Theaceae*). The distribution area and origin of the *C. sinensis* plant are commonly recognized as South and Southeast Asia. However, it is also cultivated in tropical and subtropical regions. The leaves are typically hairy, and the flowers are clustered singularly or in groups of three at the stem axil. It has been reported that tea is used for conditions such as coronary artery disease, bad breath, asthma, and angina pectoris, in addition to its consumption as a beverage [81,82]. It has been reported that *C. sinensis* exhibits various biological activities such as antimicrobial, antioxidant, antimutagenic, cytoxic, antitumor, and anti-inflammatory effects [83,84].

Table 1 displays the varying effects of *C. sinensis* on autism. Within this context, a study conducted in India investigated the effects of tea obtained from the leaves of the *C. sinensis* plant on children with autism. According to the research findings, it has been reported that *C. sinensis* tea suppresses the oxidative stress condition that is present in autism and has a neurological impact [35,39]. A study conducted in Indonesia reported that the compound L-theanine derived from the *C. sinensis* plant serves as an inhibitor that blocks the binding of glutamic acid (Fig. 1) to glutamate receptors on postsynaptic membranes, thereby exhibiting neuroprotective properties. [36]. A study conducted in Venezuela reported that the consumption of 300 mg/kg tea extract of *C. sinensis* led to regeneration in the Purkinje layer and cells of mice [43].
2.7. *Piper nigrum*

*Piper nigrum* L., a perennial plant belonging to the Piperaceae family, is commonly known as black pepper. The general distribution area is India. However, in recent times, it has been cultivated in all warm climates. It has been reported that, apart from its use as a condiment and spice, it is also used for ear or nose-throat pains, digestive issues, and respiratory ailments [85,86]. It has been reported that *P. nigrum* exhibits various biological activities such as antimicrobial, analgesic, anti-inflammatory, antioxidant, antimitagenic, antilavicular, antidepressant, and hepatoprotective effects [87,88].

The effects of *P. nigrum* on autism are presented in Table 1. A study conducted in India examined the effects of the aerial parts of *P. nigrum* on autism. According to the study findings, it has been reported that the piperine (Fig. 2) alkaloid present in *P. nigrum* possesses antioxidant, neuroprotective, and cognitive-enhancing properties [35,39].

![Fig. 2. Chemical formula of piperine](image)

2.8. *Curcuma longa*

*Curcuma longa* L. is also known as turmeric, curcumin, saffron root, yellow root, Indian saffron, and turmeric root. The distribution area encompasses Bangladesh, India, China, and Pakistan. It has been reported that it is used for purposes beyond its use as a food and dye, such as for muscle pain, osteoarthritis, and allergic conditions [89]. It has been reported that *C. longa* exhibits various biological activities such as antioxidant, antiproliferative, antimicrobial, anti-inflammatory, anticancer, cytotoxic, anticholinesterase, antidiabetic, and antidepressant effects [90,91].

The effects of *C. longa* on autism are presented in Table 1. Within this context, studies conducted in India and Australia have examined the effect of *C. longa* on autism. According to the study findings, it has been reported that curcuminoid compounds and other compounds such as luteolin have an impact on conditions such as neurodegeneration, cell signalling, and neuroprotection [35,38-40]. In another study conducted in India, it was reported that *C. longa* administered to male Sprague-Dawley rats exhibiting autistic phenotypes at a dose of up to 200 mg/kg reduced oxidative stress, mitochondrial dysfunction, tumour necrosis factor (TNF) release, and matrix degradation metalloproteinases, indicating a potential neuro-psycho-pharmacotherapeutic effect [37].

2.9. *Bacopa monnieri*

*Bacopa monnieri* (L.) Wettst. is also known as thyme-leaved gratiola, herb of grace, water hyssop, and Indian pennywort. The plant in question is a perennial herbaceous species commonly found in marshy areas. The distribution range of the species encompasses South and East India, Australia, Europe, Africa, Asia, and North and South America [92,93]. It has been reported that *B. monnieri* possesses various biological activities such as antioxidant, antimicrobial, anticancer, antidepressant, cytotoxic, antitumor, analgesic, anti-inflammatory, and anti-diabetic properties [94,95].

The effects of *B. monnieri* on autism are presented in Table 1. Within this context, a study conducted in India examined the effect of *B. monnieri* on autism. According to research findings, it has been reported that bacosides found in *B. monnieri* plant have a positive effect on communication and cognition [35]. In another study conducted in India, the IC50 value of *B. monnieri* on SH-SY5Y human neuroblastoma cell lines was reported to be 93.61 µg. In addition, in the study, it was predicted that the cause of this effect was due to compounds such as alkaloids, glycosides, flavonoids, phenols, saponins, tannins, terpenoids and quinones in the plant [41]. In another study, the effect of valproic acid derived from *B. monnieri* on autism was investigated. According to the study findings, it has been reported that plant usage significantly affects the altered histoarchitecture of the cerebellum by increasing normal behaviour, oxidative stress, and serotonin levels when compared to the normal control group [42].

2.10. *Glycine max*

The plant commonly referred to as *Glycine max* (L.) Merr. is known by the names soybean, soya bean, or soya bean. It is a legume species specific to East Asia. This product has a high nutritional value [96,97]. It has been reported that *G. max* exhibits various biological activities such as antioxidant, antimicrobial, anticancer, anti-inflammatory, and antitherbicidal effects [98,99]. The effects of *G. max* on autism are presented in Table 1. Within this scope, the status of the *G. max* plant on autism has been investigated in India and the United States of America. The use of *G. max* has been suggested as a means to prevent the variability and decrease in dietary intake observed in individuals with autism as a result of the study conducted. It has been reported that this is due to the richness of B6 and B12 vitamins, magnesium, and selenium [35,48]. Another study conducted in the USA reported that genistein and daidzein (Fig. 3) obtained from the *G. max* plant were effective in terms of anti-thyroidism in individuals with autism [47].

![Fig. 3. Chemical formulas of genistein (a) and daidzein (b)](image)
2.11. Ginkgo biloba

Ginkgo biloba L., also known as ginkgo or gingko, is a botanical species. Under normal circumstances, G. biloba can reach heights of up to 20-35 m. One of the most significant distribution areas is China. The G. biloba plant is used to treat schizophrenia, stress, memory loss, Alzheimer's disease, macular degeneration, and cardiovascular ailments [100]. It has been reported that G. biloba exhibits various biological activities such as allelopathic, antioxidant, anti-neuroinflammatory, anti-inflammatory, antimicrobial, cytotoxic, antiallergic, and anticancer, as well as antidepressant properties [101-103].

The effects of G. biloba on autism are presented in Table 1. In this context, a study was conducted in Germany, Iran, and India to investigate the effect of G. biloba plant on autism. According to the study findings, compounds such as terpenes, flavonoids, alkyphenols, luteolin, carboxylic acids, and polyphenols derived from G. biloba have been reported to be effective against neurodevelopmental disorders and neuroprotective conditions [32,34,39]. Another study conducted in Egypt reported the impact of flavonoid and phenolic compounds derived from G. biloba on social behaviour deficits and neurological aspects [44]. In another study conducted in Italy, it was reported that the administration of 100 mg/kg G. biloba twice a day effectively resolved behavioural problems [46].

2.12. Cannabis species

The various types of cannabis are also known as hemp. Initially, China and India were the primary regions of general distribution. However, due to factors such as adaptability to the environment and compatibility with soil, it exhibits a wide range of distribution. Due to its fibre properties, it has the potential to be used in various fields. It has been reported that it is used in conditions such as respiratory disorders, digestive system disorders, muscle disorders, poisoning situations, and postpartum difficulties [104,105]. It has been reported that Cannabis species exhibit various biological activities such as insecticidal, antioxidant, termiticidal, antimicrobial, cytotoxic, anticancer, antiproliferative, anticholinesterase, and anti-inflammatory properties [106-108].

The effects of cannabis strains on autism are presented in Table 1. Within this context, research has been conducted in Italy, Israel, and the United States on the effects of Cannabis sativa L. on autism. According to the findings of these studies, it has been reported that the cannabidiol (Fig. 4a) derived from the plant, along with tetrahydrocannabinol (Fig. 4b), cannabigerol (Fig. 4c) and some other compounds, have neurological, sleep modifying, communication, behavioural, cognitive, and gastrointestinal effects [45,49,51-54,57]. A study conducted in Israel on 60 children reported that compounds such as cannabidiol derived from Cannabis sp. reduced sleep disorders, irritability, and loss of appetite by 61% [50].

2.13. Astragalus membranaceus

Astragalus membranaceus (Fisch.) Bunge (current name: Astragalus propinquus Schischkin), a perennial plant belonging to the Fabaceae family, is also known as Mongolian milkvetch. The general distribution area encompasses China, Mongolia, Kazakhstan, Serbia, and Russia [109]. It has been reported that A. membranaceus exhibits various biological activities such as anti-ageing, anti-tumor, anticancer, antioxidant, anti-inflammatory, and antimicrobial effects [110,111].

The effects of A. membranaceus on autism are presented in Table 1. In this context, studies conducted in Germany, Iran, Turkey, and China have examined the effects of A. membranaceus on autism. According to the findings of the study, it has been reported that A. membranaceus has a neuroprotective effect [32,34,55,58].

2.14. Centella asiatica

Centella asiatica (L.) Urb., also known as Indian pennywort or Asiatic pennywort, is an herbaceous plant belonging to the Apiaceae family. Its distribution is observed on islands located in Asia, Australia, Africa, and the Pacific Ocean. C. asiatica is commonly used in food products and beverages. It has been reported that it is used in health issues such as dermatitis and skin irritation [112]. It has been reported that C. asiatica exhibits various biological activities such as antioxidant, cytotoxic, antimicrobial, anti-allergic, anti-pruritic, anti-inflammatory, antiproliferative, and anticancer effects [113,114].

The effects of C. asiatica on autism are presented in Table 1. A study conducted in Germany and Iran reported the neuroprotective effect of C. asiatica on the condition of autism [32-34].

2.15. Salvia species

The most common species in the Salvia genus (Lamiaceae) is Salvia officinalis L. (commonly known as sage). The general distribution area encompasses the Mediterranean, eastern and southwestern Asia, Mexico, and South America. In addition to its usage in food, beverage, spice, and dye applications, it has also been employed in various contexts such as dental hygiene, ointments, expectorants, cosmetics, food preservation, inflammation, and gum disease [115,116]. It has been reported that Salvia species possess various biological activities such as antioxidant, antimicrobial, cytotoxic,
anti-inflammatory, anticholinesterase, antiviral, antiprotozoal, insecticidal, antiandrogenic, anti-diabetic, and anticancer properties [115,116].

The effects of *Salvia* species on autism are presented in Table 1. In a study conducted in Burkina Faso, the anxiolytic and antidepressant effects of *Salvia* sp. were investigated in the context of autism. The study employed the Social Interaction Test (SIT), Elevated Plus Maze (EPM), and Forced Swim (FS) test methods to evaluate the effects of plant-derived essential oils on mice. According to the research findings, it has been reported that valproic acid has an anxiolytic effect by reducing anxiety levels and an antidepressant effect in VPA 500 rats with severe depression [56]. According to a study conducted in Egypt, it has been reported that flavonoid and phenolic compounds obtained from *S. officinalis* have an impact on social behaviour deficits and neurological aspects. This is documented in reference [44].

2.16. *Lepidium sativum*

*Lepidium sativum* L., commonly known as Garden Cress or Chandrasoor, belongs to the family Brassicaceae. The general distribution area is Asia. However, it is also cultivated in many other places. It has been reported that it is used in conditions such as asthma, syphilis, abortion, bleeding, cough, and as an expectorant [117]. It has been reported that *L. sativum* exhibits various biological activities such as antioxidant, antimicrobial, antiparasitic, anti-diabetic, anti-inflammatory, phytotoxicity, allelopathic, hepatoprotective, and anticancer properties [118,119].

The effects of *L. sativum* on autism are presented in Table 1. In this context, a study conducted in Saudi Arabia investigated the effect of *L. sativum* seed on autism. According to the study findings, the plant utilised in the research can serve as a supplementary food source for individuals with autism due to its non-starch carbohydrates, omega-3 polyunsaturated fatty acids and their precursors, flavonoids, and vitamins. [60].

2.17. *Asparagus racemosus*

*Asparagus racemosus* Willd. is also known as satavar, shatavari, shatamull, and shatawari. The general distribution areas include Africa, India, Asia, and Australia. In addition to its nutritional value and its ability to increase milk production in animals, it has been reported that this substance has various applications such as regulating sexual dysfunction, regulating menstrual cycles, treating endometriosis, gonorrhoea, uterine prolapse, and alleviating symptoms of the common cold [120]. It has been reported that *A. racemosus* exhibits various biological activities such as antimicrobial, antioxidant, anti-inflammatory, anti-ulcerative, anti-helminthic, DNA damage protective, anti-apoptotic, cytotoxicity, analgesic, anti-diarrhoeal, and anticancer properties [121,122].

The effects of *A. racemosus* on autism are presented in Table 1. In the context of this study, an investigation was conducted in India to examine the effects of an extract derived from the roots of the *A. racemosus* plant on autism in mice. According to the study findings, it has been reported that the root extract administered at 100 and 200 mg/kg to pregnant Wistar female rats significantly reduced the oxidative stress caused by valproic acid [61].

2.18. *Passiflora incarnata*

The plant species *Passiflora incarnata* L. (current name: *Passiflora edulis* Sims), belonging to the Passifloraceae family, is commonly referred to as passionflower. The general areas of distribution include regions such as the United States and India, as well as Mexico, the Netherlands, Italy, and Argentina. Furthermore, it can be cultivated even in extremely cold climates. The areas of application include conditions such as nicotine addiction, alcohol addiction, convulsions and sexual dysfunctions [123]. It has been reported that *P. incarnata* exhibits various biological activities such as anti-anxiety, anticonvulsant cytotoxic, anti-diabetic, antioxidant, antimicrobial, antihypertensive, antitumor, aphrodisiac and anti-inflammatory properties [124,125].

The effects of *P. incarnata* on autism are presented in Table 1. Within this context, a study conducted in Iran investigated the effect of the hydroalcoholic extract of *P. incarnata* on the condition of autism. In the study, it was reported that administering *P. incarnata* extract at doses of 30, 100, and 300 mg/kg to male Wistar rats until the 35th day after birth resulted in a significant improvement in behavioral disorders and a significant reduction in oxidative stress. [59].

2.19. *Moringa oleifera*

*Moringa oleifera* Lam., also known as the drumstick tree and horseradish tree, belongs to the Moringaceae family. Typically, the distribution areas are located in tropical and subtropical regions. Apart from its uses in the food, beverage, and cosmetic industries, it has also been employed in various medical conditions such as headache, cough, sensory impairments, digestive disorders, ocular ailments, joint afflictions, cholera, anemia, and blackheads [126]. It has been reported that *M. oleifera* possesses various biological activities such as antioxidant, antimicrobial, antitumor, anti-inflammatory, anticholinesterase, antivenin, anticancer, anti-diabetic, cytotoxic, and antitoxin properties [127,128].

The effects of *M. oleifera* on autism are presented in Table 1. Within this context, an investigation conducted in Egypt evaluated the effect of oil extracted from *M. oleifera* seeds on autism. According to the study findings, *M. oleifera* has been reported to have a positive effect on *Candida* species including *C. albicans*, *C. dublinesis*, *C. glabarata*, *C. kefyr*, *C. krusei*, and *C. lusitania* in faecal samples of autistic children and is promising for improving gastrointestinal problems [62].

3. Conclusions

Plants are the source of modern medicine and the most important elements of traditional medicine. Plants can be used to increase the well-being of patients with autism, which is quite common today and consists of many stages with complex treatment. Our research has compiled the plants used to support the treatment in autism cases in the literature. As a result of the research, it was seen that plants support the healing process of autism patients, especially with their neurotransmitter function, oxidative stress suppressor, and gastrointestinal system regulator. However, the paucity of human studies compared to in vivo/in vitro studies has indicated the need to concentrate...
on autism treatment. For this reason, in order to reach more detailed and highly reliable scientific data, well-designed clinical studies are needed to determine the real efficacy and safety of plants that have been supportive in the fight against diseases for humans since ancient times.

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