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HERBAL SUPPLEMENTS USED IN SCHIZOPHRENIA: AN OVERVIEW

Megha S. Shah*, Tapkir Madhuri, Waghmare Monika and Dr. Rajesh J. Oswal

Department of Pharmacognosy, Genba Sopanrao Moze College of Pharmacy, Wagholi, Pune-412207, India.

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***Corresponding Author**
Megha S. Shah
Department of Pharmacognosy, Genba Sopanrao Moze college of Pharmacy, Wagholi, Pune- 412207, India.

ABSTRACT

Mental disorders have become highly prevalent due to ambitious lifestyle, urbanization and stressful environment. Schizophrenia is a debilitating, hereditary, disorder of the brain, resulting from abnormalities that arises early in life and disrupt normal development of the brain and has a lifetime risk of 1% and affects at all age groups, approximately 10% die from suicide. Schizophrenia has three major categories of symptoms. Positive or psychotic symptoms, where a person's experiences hallucinations, delusions and thought disorders; negative symptoms such as a difficulty with showing normal emotional response and behaviours (including "flat affect", reduced feelings of pleasure, and reduced speaking); and cognitive symptoms that affect a person's memory or other aspects of thinking. Also other symptoms include problems with using information, decision making and paying attention. Although antipsychotic drugs are the mainstay of treatment of schizophrenia, but they are associated with serious adverse effects such as tardive dyskinesia, oxidative stress, EPS. In addition, about 20% of people do not respond adequately to the treatment. Growing evidences supporting the dysregulation of antioxidant defense mechanism and a parallel increase in oxidative load has been reported by several studies in schizophrenia. Although oxidative stress was produced by long term use of conventional antipsychotic medication, Ayurvedic, herbal medicines and some dietary supplements score positively on this aspect, since they can be used long-term without any serious side effects and also possess antioxidant potential. Several herbal and dietary combinations are now available which can be used independently in patients with mild to moderate symptoms of schizophrenia. For Schizophrenic patients with severe symptoms, the Ayurvedic medicines and dietary supplements can be added to a

modern medicine as adjuvant therapy, so that the therapeutic effect is optimized, without increasing the side-effect load.

KEYWORDS: Schizophrenia, Herbal drug, Oxidative stress, Dietary supplements, Antioxidants.

INTRODUCTION

Schizophrenia is a complex, chronic mental health disorder characterized by an array of symptoms, including delusions, hallucinations, disorganized speech or behaviour and impaired cognitive ability. The early onset of the disease, along with its chronic course, make it a disabling disorder for many patients and their families.[1] Disability often results from both negative symptoms (characterized by loss or deficits) and cognitive symptoms, such as impairments in attention, working memory, or executive function.[2] In addition, relapse may occur because of positive symptoms, such as suspiciousness, delusions and hallucinations.[1, 2] Schizophrenia is one of the top five causes of disability among adults in developed nations, ranking with heart disease, arthritis, drug abuse and HIV.[3]

Antipsychotic agents are the cornerstone of acute and maintenance treatment of schizophrenia and are effective in the treatment of hallucinations, delusions and thought disorders, regardless of etiology. In recent decades, the modern psychiatry has introduced herbal medicine in the treatment of psychiatric disorders including schizophrenia. After the rise of a pharmaceutical industry in the last century and significant progress in the treatment, a period of disappointment comes in accepting the fact that synthetic drugs are not almighty. Due to this fact, there has been a growing interest in the last decades for the treatment of psychiatric disorders including schizophrenia by using alternative and complementary methods [4] and a study revealed that 44% of psychiatric patients with schizophrenia (9%) had used herbal medicine (mainly for psychiatric purposes) during the previous 10-15 Years.[5]

Plants contain various phytochemicals and these phytochemicals can play an important role in reducing occurrences of many diseases by boosting up various organ functions of the human body. Many traditional healing herbs and their parts have been shown to have medicinal value and can be used to prevent, alleviate or cure several human diseases.[6] It has also been observed that number of modern drugs has been derived from plants used by the indigenous people.[7] Modern drugs like aspirin, atropine, ephedrine, digoxin, morphine, quinine, reserpine and tubocurarine are examples, which were originally discovered through

observations of traditional cure methods of indigenous peoples.[8] Presently, there is a resurgence of herbal medicine as people want more control in their personal healthcare. It is interesting to note that four (Ginkgo, St. John's Wort, Valerian, and Kava) of the top ten herbs have psychotropic activity.[9]

Humans consume a wide range of foods, drugs and dietary supplements that are derived from plants and which modify the functioning of the central nervous system (CNS). The psychoactive properties of these substances are attributable to the presence of plant secondary metabolites; in many cases, the effects of these phytochemicals on the human CNS might be linked either to their ecological roles in the life of the plant or to molecular and biochemical similarities in the biology of plants and higher animals.[10] Schizophrenia as well as other psychotic disorders is likely to involve a complex interplay of many brain systems and neurotransmitters including dopamine, serotonin, and glutamate and there is extensive evidence that schizophrenia is a biological disease of the brain. The primary mechanism of action involves modulation of neuronal communication, via specific plant metabolites binding to neurotransmitter/neuromodulator receptors[11] and via alteration of neurotransmitter synthesis and general function[12] Other mechanisms involve stimulating or sedating CNS activity and regulating or supporting the healthy function of endocrine system,[13, 14] Traditional antipsychotics have been the first step in treating schizophrenia, that is, thorazine (chlorpromazine) is dopamine antagonist, which effectively blocks the action of dopamine and diminishes positive symptoms in approximately 75–80% of people with schizophrenia who take such antipsychotic medication.[15] Traditional antipsychotics have sedative properties which affect patients quickly, such as sedation and improvement in psychotic symptoms can take anywhere from 5 days to 6 weeks.[16]

Pathophysiology of schizophrenia

Schizophrenia is a severe psychotic condition which is signified by loss of contact with the reality. This mental disorder is result of many combined condition such as extreme imaginary thinking, behavior, hallucinations and delusions. Abnormalities in neurotransmission have provided the basis for theories on the pathophysiology of schizophrenia. Pathophysiology of the schizophrenia is explained by imbalance of neurochemical transmitter which is known as dopamine hypothesis of schizophrenia. Most of these theories center on either an excess or a deficiency of neurotransmitters, including dopamine, serotonin, and glutamate. Other theories

implicate aspartate, glycine, and gamma-aminobutyric acid (GABA) as part of the neurochemical imbalance of schizophrenia.[1]

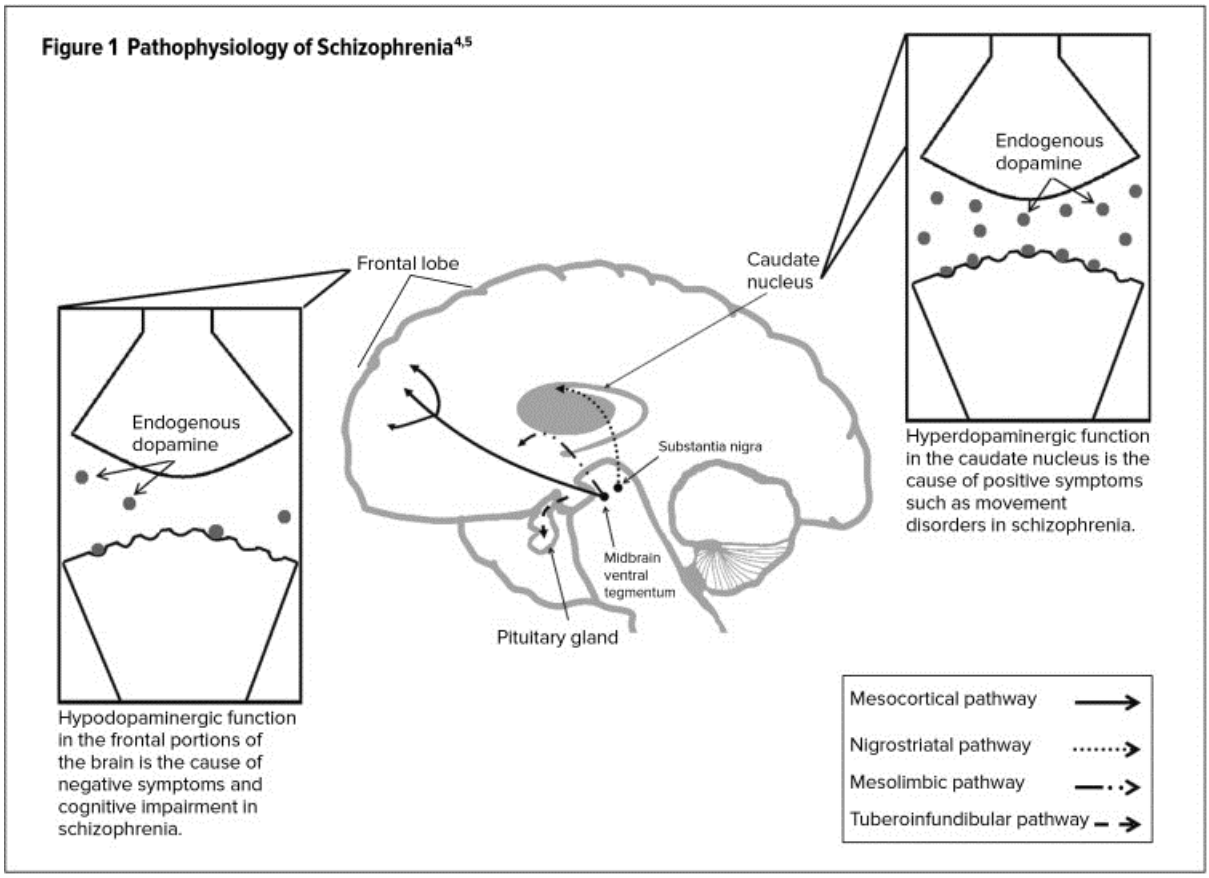
Abnormal activity at dopamine receptor sites (specifically D2) is thought to be associated with many of the symptoms of schizophrenia. Four dopaminergic pathways have been implicated (Figure 1)[17] The **nigrostriatal pathway** originates in the substantia nigra and ends in the caudate nucleus. Low dopamine levels within this pathway are thought to affect the extrapyramidal system, leading to motor symptoms. The **mesolimbic pathway,**extending from the ventral tegmental area (VTA) to limbic areas, may play a role in the positive symptoms of schizophrenia in the presence of excess dopamine.[1]

In the brain a specific pathway is present which controls behavior and emotions; this pathway is known as mesocorticolimbic pathway. The **mesocortical pathway** extends from the VTA to the cortex. Negative symptoms and cognitive deficits in schizophrenia are thought to be caused by low mesocortical dopamine levels.[1]

The **tuberoinfundibular pathway** projects from the hypothalamus to the pituitary gland. A decrease or blockade of tuberoinfundibular dopamine results in elevated prolactin levels and as a result, galactorrhea, amenorrhea and reduced libido. The serotonin hypothesis for the development of schizophrenia emerged as a result of the discovery that lysergic acid diethylamide (LSD) enhanced the effects of serotoninin the brain. Subsequent research led to the development of drug compounds that blocked both dopamine and serotonin receptors, in contrast to older medications, which affected only dopamine receptors. The newer compounds were found to be effective in alleviating both the positive and negative symptoms of schizophrenia.[1]

Another theory for the symptoms of schizophrenia involves the activity of glutamate, the major excitatory neurotransmitter in the brain. This theory arose in response to the finding that phenylcyclidine and ketamine, two noncompetitive NMDA/ glutamate antagonists, induce schizophrenia-like symptoms.[18]

This, in turn, suggested that NMDA receptors are inactive in the normal regulation of mesocortical dopamine neurons and pointed to a possible explanation for why patients with schizophrenia exhibit negative, affective and cognitive symptoms.[19]



LIST OF HERBAL PLANTS EFFECTIVE IN MENTAL ILLNESS

Ginseng

Ginseng is the dried root of various species of panax, like *P.ginseng, P.japonica, P. notoginseng* and *P. quinquefolium*. Ginseng contain a mixture of several saponin glycoside, belonging to triterpenoid group. They are grouped as Ginsenosides, panaxosides, chikusetsusaponin. Constituents found in most ginseng species include ginsenosides, polysaccharides, peptides, polyacetylenic alcohols and fatty acids. Most pharmacological actions are attributed to the ginsenosides that belong to a group of compounds known as steroidal saponins, steroid molecules with attached sugar residues. To understand maternal immune activation (MIA) during prenatal development, the synthetic double-stranded RNA polyriboinosinic-polyribocytidylic acid [poly (I:C)] has been widely used in animal models to induce behavioral deficits similar to those in schizophrenia and other psychotic disorders.

Panax ginseng (PG) extract is widely used to treat various kind of nervous system disorders in Asia particularly China and Korea. The present study aimed to examine the effects of PG extract on MIA offspring using behavioral activity tests and protein expression analyses. Pregnant mice were exposed to poly(I:C) or vehicle treatment on gestation day 9 and the

resulting MIA offspring were subjected to vehicle or PG (300 mg/kg) treatment. In the acoustic startle response test, MIA-induced sensorimotor gating deficit was ameliorated by PG. The majority of behavioral parameters measured in the social interaction (non-aggressive or/and aggressive pattern), open field (number/duration of behavior) and forced swimming test (immobility behavior) were significantly altered in the MIA offspring. Western blot and immunohistochemical analyses of the medial prefrontal cortex indicated that the expression levels of certain neurodevelopmental proteins, including dihydropyrimidinase-related, LIM and SH3 domain, neurofilament medium and discs large homolog were decreased in the untreated MIA offspring, whereas PG treatment improved behavioral impairments and increased neurodevelopmental protein expression in MIA offspring. These results suggested that PG may be useful in neurodevelopmental disorder therapy, including psychiatric disorders such as schizophrenia, owing to its antipsychotic effects.[20]

Ashwagandha

It consists of dried root and stem bases of *Withania somnifera*, belonging to family Solanaceae. This plant grows wildly in all dry parts and subtropical India. Other common names of Ashwagandha are Indian ginseng, poison gooseberry and winter cherry. More than 35 phytochemicals are isolated and identified in Ashwagandha. Main chemical constituents are alkaloids and steroidal lactone. Somniferine, somnine, somniferinine, withananine, pseudo-withanine, tropine, pseudo-tropine, 3-a-gloyloxytropane, cuscohygrine and anaferine are the alkaloids present in Ashwagandha, with withanine being the major one. The main steroidal lactones are withaferin A, withanolides A-Y, withasomniferin-A, withasomidienone, withasomniferols A-C, withanone. Identified neuroprotective phytoconstituents of Ashwagandha are sitoindosides VII-X, withaferin A, withanosides IV, withanols, withanolide A, withanolide B, anaferine, beta-sitosterol, withanolide D with key pharmacological effects in brain disorders mainly anxiety, Alzheimer's, Parkinson's, Schizophrenia, Huntington's disease, dyslexia, depression, autism, addiction, amyotrophic lateral sclerosis, attention deficit hyperactivity disorder and bipolar disorders. Further, multiple available marketed products and patents recognized its beneficial role in various brain disorders; however, very few data is available on mechanistic pathway and clinical studies of Ashwagandha for various brain disorders is scarce and not promising.[21]

***Ginkgo biloba* (gb)**

Gb extract contains mainly terpenoids, flavonol glycosides and proanthocyanidins. The most prevalent of these three groups are the flavonol glycosides (quercetin, catechin). The terpenoids include ginkgolides and bilobalides, which represent unique components of Gb. Terpenoids, flavonoids and proanthocyanidins are thought to be responsible for the pharmacological properties of Gb. Gb extract is thought to module different neurotransmitter systems: it is a strong inhibitor of monoamine oxidase A and synaptosomal uptake of DA, 5-HT, and norepinephrine. Additionally, Gb displays a free radical scavenger activity and has neuroprotective and antiapoptotic properties, such as inhibition of amyloid-β neurotoxicity and protection against hypoxic challenges and increased oxidative stress. A systematic review and a meta-analysis of three randomised controlled trials in patients with schizophrenia. Gb treatment reduced positive symptoms in patients with schizophrenia and improved cognitive function and activities of daily living in patients with dementia. No effect of Gb on negative symptoms in schizophrenic patients was found. Three randomized clinical trials evaluating Gb extract in patients with schizophrenia were included in the analysis. Two studies were double-blind and placebo controlled. Randomization procedure and methodology were considered adequate in all cases. Gb was used as an adjunctive therapy to different antipsychotics: clozapine, haloperidol, and olanzapine. Recently, evaluated Gb extract as a potential treatment for tardive dyskinesia in patients with chronic schizophrenia.[22, 23]

Spinach

Spinacia oleracea Linn. family Chenopodiaceae commonly known as spinach is endowed with a number of medicinal properties. It is an excellent package of unique phytoconstituents such as ascorbic acid, apigenin, astragalin, caffeic, lutein, β-carotene, ferulic acid, kampeferol, rutin, querecetin, myricetin, luteolin, ortho-coumaric acid, para-coumaric acid, stigmasterol, protocatechuic acids, methylenedioxy flavonol, glycoglycerolipids, 20-hydroxyecdysone, vitamins, spirasaponins violaxanthin etc., which are responsible for its biomedicinal & pharmacotherapeutic effects. study was carried to explore the protective effects of *Spinacia oleracea* seed extract (SOEE) in an experimental model of ketamine-induced schizophrenia in mice. Ketamine was used to induce stereotyped psychotic behavioural symptoms in mice. Behavioral studies (locomotor activity, stereotype behaviors, immobility duration and memory retention) were carried out to investigate the protective of SOEE on ketamine-induced psychotic symptoms, followed by biochemical, neurochemical and cellular alterations in the brain. Treatment with SOEE for 15 consecutive days

significantly attenuated stereotyped behavioral symptoms in mice. Biochemical estimations revealed that SOEE reduced lipid peroxidation and restored total brain proteins. Furthermore, SOEE remarkably reduced dopamine levels, AChE activity & inflammatory surge (serum TNF-α) and increased the levels of GABA and reduced glutathione in mice. The outcomes of the study suggested that SOEE could ameliorate ketamine-induced psychotic symptoms in mice, indicating a protective effect in the treatment of schizophrenia.[24]

Restraint stress causes inflammation in nervous system that leads to emersion of neurodegenerative diseases. Spinach contains different agents with antioxidant, antiapoptosis and hepatoprotective properties. This study examined the effect of spinach hydroalcoholic extract (SHE) on TNF-α and IL-1β expression in hippocampus of male Wistar rats exposed to chronic restraint stress. The results showed that the expression of IL-1β and TNF-α was increased in hippocampus of rats exposed to stress compared to control groups. Furthermore, the expression of these proinflammatory cytokines was decreased in SHE treated group as compared to control group. Immobility also caused neuronal death in CA1 region of hippocampus and SHE reduced damage in CA1 pyramidal neurons layer in stressed rats. Spinach decreases neuroinflammation in hippocampus of stressed rats, which may be due to its abundant antiinflammatory and antioxidant phytochemicals. study suggest that spinach may be effective in the prevention and treatment of neurodegenerative diseases.[25]

Ziziphus jujube

Ziziphus jujube commonly called jujube (sometimes jujuba), red date or Chinese date, is a species of *Ziziphus* in the buckthorn family Rhamnaceae, used primarily as a fruiting shade tree. The *Zizyphus jujuba* tree originated in China where it has been cultivated for several thousand years. A number of compounds are present in *Zizyphus jujuba*, including saponins, jujubosides and triterpenoic acids. *Zizyphus jujuba* is used in the Orient for its calming effects. This herb does appear to have some relaxation potential although others herbs such as passion flower, kava and supplements such as 5-HTP, tryptophan, serotonin and theanine are good options. Compounds in *Zizyphus jujuba*, called jujubosides, have inhibitory effects on glutamate-mediated excitatory signal pathway in the hippocampus and probably act through their anticalmodulin action. Glutamate is the major excitatory neurotransmitter in human brain. After binding to NMDA receptors it open calcium ion channel and increases entry of calcium ions. These calcium ions interact with calmodulin and regulate the release of glutamate by increasing the formation of NO (nitric oxide) through nitric oxide synthetase.

So by showing anti-calmodulin action, *Zizyphus jujube* can be used to reduce glutamate mediated excitotoxicity in schizophrenia.[26]

Crocus sativus

Crocus sativus L. (C. sativus), is a perennial herb member of the Iridaceae family, the line of Liliaceae. Chemical analysis of *C. sativus* stigmas has shown the presence of about 150 volatile and non-volatile compounds. The volatiles consist of more than 34 components that are terpenes, terpene alcohols and their esters among which safranal is the main component. Non-volatile compounds comprise crocins, crocetin, picrocrocin and flavonoids (quercetin and kaempferol). schizophrenia-like effects of NMDA receptor antagonists (e.g., ketamine) include increased levels of glutamate, hypermotility, stereotype and cognition deficits. In this context, it has been reported that acute systemic administration of safranal reduced kainic acid-induced increase of extracellular glutamate concentrations in the rat hippocampus. Further, it has been demonstrated that *C. sativus* extracts inhibited glutamatergic synaptic transmission in rat cortical brain slices. Collectively, these findings suggest that this reduction of glutamate levels by saffron and its constituents might be critical for the beneficial action exerted by crocins on ketamine-induced behavioural deficits. An alternative hypothesis to explain the beneficial action of crocins in an animal model of schizophrenia is based on the well-known antioxidant properties of crocins. As a whole, these data indicate that the beneficial effects of crocins on ketamine-induced behavioural deficits might be associated with their antioxidant properties.[27, 28]

Hypericum perforatum

Early studies suggested that extracts of St. John's wort inhibited monoamine oxidase but more recent studies have failed to find such inhibition at the tissue concentrations that occur following typical dosages. Instead, it appears that the extract may block the reuptake of norepinephrine and serotonin and down regulate serotonin receptors. This mechanism of action might be possible reason for antidepressant activity, since in depression MAO activity get enhanced which increases metabolism of neurotransmitter and decreases their level. In schizophrenia hyperactivity of serotonergic system was correlated to positive symptoms and many have now theorized that increased levels of serotonin in the prefrontal cortex will result in lower dopamine levels in this area. These reduced dopamine levels, which may be responsible for the negative symptoms of schizophrenias and cognitive deficits. Since this plant also down regulate serotonin receptors, whose activity was found to be enhanced in

schizophrenia, it can be used in schizophrenia to alleviate some positive, negative and cognitive symptoms.[26]

Rhodiola rosea

The plant arctic root (*Rhodiola rosea*, L. family Crassulaceae) is growing in northern regions of Europe, Asia and North America. Extracts of *R. rosea* are used in traditional medicine for various conditions related to nervous system function. According to scientific studies from the last decades, the plant might have potential for use in the treatment of memory impairments, stress and depressions, but reports concerning other neuropsychiatric disorders are scarce. The investigations on the phytochemistry of *R. rosea* root have revealed the presence of about 28 compounds classified into 6 distinct category. (1) Phenylpropanoids: rosavin, rosin, rosarin (rosavins is the general term for all 3) (2) Phenylethanol derivatives: salidroside (rhodioloside), tyrosol (3) Flavanoids: rodiolin, rodionin, rodiosin, acetylrodalgin, tricin (4) Monoterpenes: rosiridol, rosaridin (5) Triterpenes: daucosterol, beta-sitosterol (6) Phenolic acids: chlorogenic and hydroxycinnamic, gallic acids.[30]

Researcher tested the effects of *R. rosea* root extract on prepulse inhibition in rats and mice. Prepulse inhibition is an established operational measure of sensori motor gating, which is impaired in schizophrenia and other psychotic disorders. *R. rosea* root extract increased prepulse inhibition in rats and mice. Interestingly, the *R. rosea* extract had stronger effects in those individual animals that had low baseline levels of prepulse inhibition. Therefore, studied further experiments in which we pharmacologically induced a prepulse inhibition deficit by two different psychostimulants, either the dopamine D2 receptor agonist apomorphine or the NMDA receptor antagonist dizocilpine (MK-801). Pre-treatment with the *R. rosea* extract significantly restored both, apomorphine- and dizocilpine induced prepulse inhibition deficits.[29]

Bramhi

Brahmi (*Bacopa monnieri*, family: Scrophulariaceae), an Ayurvedic herb has primarily been used to enhance cognitive ability, memory and learning skills. A case study of schizophrenia in which add-on Brahmi extracts 500 mg/day for a period of one month resulted in reduction in psychopathology without any treatment emergent adverse effect. Although preliminary, case study suggests therapeutic efficacy of add-on Brahmi in schizophrenia, thus opening up a new dimension of its role in alternative medicines.[31]

Decreased gamma-aminobutyric acid (GABA)-ergic neurons in the brain of both schizophrenic patients and animal models indicates that impairment of GABAergic function is implicated in pathophysiology of the disorder. Decreased GABAergic neurotransmission might be also involved in cognitive impairment, which is developed in schizophrenia. Brahmi could be a new treatment and prevention for this cognitive deficit in schizophrenia by increasing GABAergic neurons to a normal level. To study cognitive enhancement and neuroprotective effects of Brahmi on novel object recognition memory and GABAergic neuronal density, defined by the presence of calcium binding proteins (CBPs; calbindin (CB), parvalbumin (PV) and calretinin (CR)) in a sub-chronic (2 mg/kg, Bid, ip) phencyclidine (PCP) rat model of schizophrenia. A discrimination ratio (DR) representing cognitive ability was obtained from the novel object recognition task. CB, PV and CR immunodensity were measured in the prefrontal cortex, striatum, and cornuammonis fields 1–3 (CA1–3) using immunohistochemistry. Reduced DR was found in the PCP group, which occurred alongside reduced CB, PV and CR in all brain regions except for CR in the striatum and CA1–3 in the cognitive-enhancement-effect study. PCP + Brahmi showed a higher DR score with increased CB in the prefrontal cortex and striatum, increased PV in the prefrontal cortex and CA1–3, and increased CR in the prefrontal cortex. The Brahmi + PCP group showed higher DR score with increased CB in all areas, increased PV in the striatum and increased CR in the prefrontal cortex and striatum. The present study demonstrated the effects, both partial restoration of cognitive deficit and neuroprotection of Brahmi and elucidated its underlying mechanism of actions via increasing GABAergic neurons in a PCP-induced schizophrenic like model.[32]

Kava

Kava is one of the few herbal remedies in which the pharmacologically active ingredient is known. Kavain and Kavapyrone are a biologically active compound from the Oceanic plant *Piper methysticum* (kava). Exactly how the kavapyrones produce these effects is unclear, as they have a variety of actions involving inhibition of voltage-dependent sodium channels, increasing $GABA_A$ (γ- amino-butyric acid) receptor densities, blocking norepinephrine reuptake and suppressing the release of glutamate. The fact that NMDA-receptor (N-methyl-Daspartate) abnormalities may produce psychotic symptoms is due to their effects on striatal and limbic dopaminergic neurotransmission. NMDA receptor hypofunction reduces stimulation of cortical dopamine release, which produces negative and cognitive symptoms of schizophrenia. Simultaneously it reduces stimulation of GABA release, which is responsible

for disinhibition of mesolimbic dopamine release and produces positive symptoms. Since Kava act by increasing $GABA_A$ receptor densities and suppressing the release of glutamate, this mechanism might explain its usefulness in schizophrenia.[33-35]

THE MOST COMMON COMPLIMENTARY METHODS USED IN THE TREATMENT OF SCHICOPHRENIA

Omega 3 – fatty acids ((DHA and EPA)

This is recommended as a complementary therapy to a standard psycho pharmacotherapy with various forms of depression and in the treatment of a bipolar affective disorder and schizophrenia, as well as for those who work in stressful environments. The popularity of this supplement is based on the fact that the Eskimos, despite the intake of extremely fattening foods, are protected of a heart disease due to multiple unsaturated fatty acids known as Omega 3. Research shows that people with schizophrenia can have up to 25% reduction in symptoms when taking Omega-3.[36]

Glycine

There are several studies that show that nonessential amino acid glycine increases the activity of neurotransmitters and reduces the negative symptoms of schizophrenia when used with an antipsychotic therapy, especially with haloperidol, thioridazine and perphenazine.[37-39]

Multivitamin products

For the majority of patients suffering from schizophrenia it is recommended to use multivitamin products due to their poor diet. People do not produce vitamins, vitamin D is an exception and they must be taken from an outside source to properly feed the brain and other organs. B vitamins have an integrative role in functioning of the nervous system. They help the brain in the synthesis of neurotransmitters, which affect mood and judgment and can be useful in the treatment of schizophrenic patients. Vitamin C plays an important role in the synthesis of a norepinephrine neurotransmitter and neurotransmitters are of critical importance for the brain and can affect behavior. Vitamin C is also a very effective antioxidant. Vitamin E stabilizes the fatty membranes in the brain and protects it from a damage that occurs through the formation of free radicals in cells and thus it slows down the loss of mental abilities.[40]

CONCULSION

Plants have been used for the treatment of diseases all over the world since the beginning of civilization. There has been growing interest in the therapeutic use of plants because of their safety, economical and effective use. In this review, some plants have been mentioned, which are previously explored by the various researchers for their antischizophrenic activity. Collectively, behavioural studies of plants have created a unique opportunity for the development of new pharmacotherapies for Schizophrenia. The herbal extracts and constituents with demonstrable psychotherapeutic effects in animal models may deserve further evaluation in clinical studies. Some dietary supplements such as antioxidant vitamins, EPA omega-3 fish oils also helps to improve symptoms of schizophrenia. Therefore, better results can be achieved by herbal therapy along with dietary supplements. On the other hand, our health also depends on our lifestyle choice.

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