

Ayurvedic Plants in Brain Disorders: The Herbal Hope

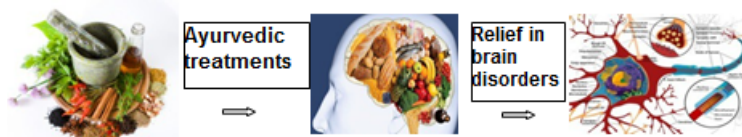
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Abstract

Synthetic drugs for human brain disorders are expensive symptomatic long treatments, sometimes showing serious and unavoidable side effects with poor patient compliance. Therefore, the herbal and Ayurvedic treatments are preferred over synthetic drugs for a range of human brain disorders including, Alzheimer's disease, Parkinson's disease, depression, epilepsy, schizophrenia, anxiety, etc. Ayurvedic system of medicine has traditionally been used in several neurological conditions. The accessibility, negligible incidence of side effects and cost effectiveness of plant products offer considerable advantages. These days much attention is drawn towards the established traditional systems of herbal remedies for many brain disorders, generating positive hopes for the patients. It is estimated that more than 60 million Indian populations suffers from mental disorders while the country lags far behind the world for treatments and spending in the hospitals for mental cure. Nearly 1-2% Indians suffered from schizophrenia and bipolar disorder whereas 5% population showed common mental disorders like depression, anxiety, convulsion, etc. The term mental disease is not restricted to mean insanity and allied conditions of mental derangement but also includes, to a certain extent, the emotional disorders. When emotional factors cross the state of normalcy, one gets deranged to show the syndromes of mental disorder, very often. With the current alarming situation, it is high time to look back to the ancient Indian Ayurvedic system of medicine wherein a number of plants have been described for specific uses for a range of mental disorders, including migraine, epilepsy, convulsion, hysteria, paralysis, memory loss (Alzheimer's), insomnia, anxiety, Parkinson's disease, insanity, depression, etc. The Ayurvedic prescriptions which contain either a single identity of plant or a mixture of plant materials have been proven to be very useful against such disorders. The plant materials prescribed for these problems range from herbs to perennial trees with varied plant parts, ranging from whole plant, roots, stem, bark, leaves, flowers, fruits to seeds. The chemical structure of the major compounds from these plants range from straight chain fatty acids to terpenoids, steroids, flavonoids, alkaloids, peptides, etc. It has been attempted to review the current situation of mental disorder in the society vis-a-vis its effective solution described in the Ayurveda and problem of side effects in synthetic medicines.

Graphical Abstract



Keywords: Ayurvedic plants; Herbals; Medicinal plants; Brain disorder; Ayurvedic treatment; Ayurvedic uses; Chemical constituents

Introduction

It is rightly accepted that the nature has best answers to all the diseases affecting the human body from time to time. When the synthetic drugs fail to be effective or show serious side effects, it is the plant medicine which brings relief. Many of the plant species distributed throughout the world, have some pharmacological action on the body. Herbal treatment is the natural form of healing therapy to cure the diseases of mankind. Now-a-days, the herbal medicines are back into the prominence because the synthetic medicines, which once had universal acceptance, are now known to often cause side effects. Recently, it has been clinically proved that the treatment of high blood pressure using synthetic medicines is having a negative impact on their patient's mental health [1].

Right from the Vedic period, in India, the traditional knowledge on medicinal plants has been passed on through generations. Ayurveda, which was sourced from Atharvaveda, developed and grew into a well-established medical system due to the untiring efforts and great minds of the sages of "gurukulas". The impact of Ayurveda on the public mind in our country was so deep that even the influence of Middle East and Europe could not deter its popularity among the masses of India and neighboring countries. Herbal medicines in the form of Ayurvedic medicines are still popular and available for common masses due

to the untiring efforts of herbal industries of India, especially the Patanjali, Dabur, Zandu, Baidyanath, Himalaya, etc. These days, the drug discovery is based on the reverse pharmacology of Ayurveda in which the drug candidates are first identified based on their traditional medicinal knowledge, followed by the validations through clinical trials. Although the scattered or selective information on medicinal plants, useful in mental disorders, is available in previous reviews [2-4] but a comprehensive compilation, incorporating the Ayurvedic prescriptions, botanical and chemical aspects of the plants, is hardly traceable. Our continued interest on the chemistry and biology of medicinal and aromatic plants [5-9] prompted us to come up with this review article on some of the plants prescribed in Ayurvedic system of medicine for brain disorders.

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Current Situation

Every year 10th October is the date when world mental health day is celebrated all over the world. The awareness regarding the balanced mental health is increasing and it is now recognized as a major cause of morbidity worldwide. As per WHO estimate, depression will be second only to cardiac diseases as the leading cause of morbidity and disability worldwide by 2020 [10]. India is, unfortunately, the leading country in adolescent and young age suicides. The condition is made worse by poor socio-economy, substance abuse, gender inequality and poor health infrastructure to deal with mental health issues. Unfortunately, India has got just 4000 psychiatrist for more than a billion populations. Further, in India, being a mentally ill patient carries huge stigma, this perhaps is the biggest of all barriers for mental treatment. Because of the stigma people don't prefer going to a mental health professional for an early evaluation [11-13].

In a global study, India has been ranked 143rd among 188 countries on a range of health indicators including its poor performance on hygiene. However, India scored well for its better performance in areas like neglected tropical diseases including communicable diseases, overweight and harmful alcohol consumption [14]. As India lags behind the world in medical professionals and spending on mental health issues, it is obvious that more than 60 million Indian populations suffers from mental disorder. Nearly 1-2% of its population suffers from severe mental disorders such as schizophrenia and bipolar disorder. About 5% of the population suffered from common mental disorders like depression and anxiety related problems as per the last report available in 2005. This data was recently quoted by Indian health and family welfare minister from national commission on macroeconomics and health forum. According to a more recent report by National Mental Health Survey (NMHS) commissioned by Government of India and implemented and coordinated by National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore, about 150 million Indians aged 18 and above and 7.3% of those aged 13 to 17 years of the total population are suffering from various mental disputes and are in need of mental care service. India's health budget on mental health care is surprisingly 7.5 times lesser than Bangladesh. There is acute shortage of psychiatrists in India with 3 psychiatrists per million populations which is 18 times lesser than the commonwealth nations' norm of 56 psychiatrists per million people. Keeping these facts in mind, a new Bill was passed through Indian Parliament in August 2016 increasing the government funding a little more than before [10-13].

Common Brain Disorders

The term mental disease or brain disorder is not restricted to mean insanity and allied conditions of mental derangement but also includes, to certain extent, the emotional disorders. Often the emotional factors, when cross the state of normalcy, get deranged to become the syndromes of mental disorder. It is stated that the brain has 100 billion nerve cells (neurons) and each of them connect with many others to form communication networks. These nerve cells have special jobs like thinking, learning, remembering as well as to see, hear, and smell. To do their work brain cells, like tiny factories, receive supplies, generate energy, construct equipment, and get rid of the waste. Brain cells also process and store information to communicate with other cells. Keeping everything functional, it requires large amounts of fuel and oxygen for proper coordination [15]. Once the system is disturbed, a range of human brain disorders start appearing, for example, Alzheimer's disease, Parkinson's disease, Huntington's disease, depression, epilepsy, schizophrenia, anxiety, etc. These diseases have

very complex disturbance in the brain function and are beyond the scope of this review. However, a brief description is added here for primary information and understanding the most common brain illnesses.

Alzheimer's disease

Alzheimer's disease (AD) was originally defined as presenile dementia and means an acquired mental disorder with loss of intellectual abilities to interfere with social or occupational functioning. It is associated with localized loss of neurons and brain shrinkage, mainly in the basal fore brain and hippocampus. The beta-amyloid peptide (BAP) plays a significant role in the development of AD. Although there is no cure for AD by synthetic drugs, but, to certain extent, it can be managed with them. Several studies have revealed that natural antioxidants, such as vitamin E, vitamin C, and beta-carotene are useful in scavenging free radicals generated during the progression of this disease. The loss of memory is considered to be the result of shortage of a nerve transmitter, acetylcholine. By inhibiting the activity of the enzyme, acetyl cholinesterase, which splits or breaks down the transmitter substance, it is possible to increase the level of this transmitter in the brain. Synthetic drugs that inhibit the breakdown of the messenger or transmitter acetylcholine, may delay the development of the disease [16,17].

Anxiety

Anxiety is a psychological and physiological state characterized by cognitive, somatic, emotional, and behavioral factors. These factors combine to create an unpleasant feeling that is typically associated with fear, worry or uneasiness. Without an identifiable triggering stimulus, anxiety is a generalized mood state. In fact, it is distinguished from fear, which occurs in the presence of an external threat. As such, anxiety is the result of threats that are perceived to be uncontrollable or unavoidable whereas fear is related to the specific behaviors of avoidance and escape [18].

Depression

Depression is a common affective disorder of mood rather than disturbances of thought or cognition. It is the most common affective disorder which is accompanied by delusions and hallucination. In this disease condition, the neurotransmitters levels such as dopamine, acetylcholine, nor epinephrine etc., in the brain are increased. The symptoms of this disease are of two types (i) biological symptoms: retardation of thought, loss of libido, sleep disturbance and loss of appetite (ii) emotional symptoms: feelings of guilt, loss of motivation, ugliness etc. There are 2 types of depressive syndrome e.g., (i) unipolar depression: mood swinging always in the same direction; (ii) bipolar depression: depression alternates with mania [19].

Huntington's disease

This incurable, neurodegenerative disorder was named after the American physician George Huntington who could explain it in late 19th century. It is called as Huntington disease or simply HD, Huntington's chorea, chorea major, and is the genetic cause of chorea. In Western Europe, it affects up to 70 people per million populations, and can be much higher in localized regions. Onset of physical symptoms can begin at any age but it may start mostly from 35 to 44 years of age. In 1990s, genetic testing was made possible but as such the counseling for HD had to be developed and became a model for other dominant disorders also. The mechanism of the disease is not fully understood, but a number of factors have been identified. There

is no cure for HD, although there are treatments to relieve some of its symptoms. The characteristic initial physical symptoms are jerky, random, and uncontrollable movements called chorea. As the disorder progresses, rigidity and dystonia become evident gradually leading to the dominant physical symptoms [20].

Epilepsy

A seizure is the characteristic event in epilepsy. In fact, epilepsy is associated with high frequency discharge of impulses by a group of neurons in the brain. It can be of two types: (i) Partial epilepsy: In this the localized areas of brain are damaged. Its symptoms depend on the brain regions involved and (ii) Generalized epilepsy: In this case total brain including reticular system is damaged. With the common synthetic medicines for epilepsy relief is possible on long term use but side effects have to be borne [21].

Parkinson's disease

It occurs mainly in the elderly and is a progressive disorder of movement showing continuous shivering. It is commonly associated with dementia and the symptoms include tremor at rest usually starting in the hands. The muscle rigidity can be detectable as an increased resistance in passive limb movement and hypokinesia suppression of voluntary muscles. In this condition the neurotransmitter levels, such as dopamine, 5-hydroxytryptamine, acetylcholine, nor-epinephrine, are decreased, mainly in the substantia nigra and corpus striatum of brain. With synthetic drugs short relief is possible but complete cure is, normally, unachievable [22].

Schizophrenia

The patients of this disease don't know what is happening at present and he does not cooperate with the society and physician for treatment. This disorder has 2 types of symptoms: (i) Positive symptoms: abnormal behavior, delusions, Hallucination, thought disorders. (ii) Negative symptoms: flattening of emotional responses and withdrawal from social contact. In this condition the level of neurotransmitter such as dopamine, 5-hydroxytryptamine, acetylcholine, nor-epinephrine level is increased in the brain. Synthetic drugs can reduce symptoms such as hallucinations, delusions and abnormal thinking. Some people have troubling side effects, including tremors and gaining weight and these drugs may also interfere with other medicines or supplements. It is needless to state that in most cases, medication is a must to treat schizophrenia [23].

Attention Deficit Hyperactivity Disorder (ADHD)

It is considered as a disorder of children but it is not limited to them. In fact, 30-70% of kids with this disorder, continue showing symptoms of ADHD when they grow up. In addition, people who were never diagnosed ADHD in childhood may develop more obvious symptoms when grown up, causing trouble on the job or in relationships. In people with ADHD, the neurotransmitters are less active in areas of the brain that control attention. It is exactly not known what causes this chemical imbalance, but it is thought that genes may play a role as this disorder often runs in families. It has been found that adults given stimulants have fewer ADHD symptoms and some of them may feel better concentration, but complete cure is often not seen [24].

Natural Ways of Healing of Mind

With the passage of time, new techniques in the medical field are being re-introduced that include herbal healing, yoga, meditation, naturopathy, acupressure, etc. Several individuals as well as organizations are working

in this regard with the aim of fulfilling basic healing requirements of the body. As a matter of fact, there has been enormous change in the mind set of people who once depended on painkillers, are now looking for natural treatments, including Ayurvedic, traditional Chinese, Siddha, Unani, Homeopathy and a number of folklore medicines [25]. Yoga and meditation are also the major key for the fitness of body and mind by enhancing the blood flow in the whole body and calming down the worries and excitements of the mind [26,27]. Throughout the world the plant based systems of medicine have been doing wonders in treating various diseases. So is the case with the mental disorder problems. It is well proven that herbs have excellent properties for treating panic and anxiety affecting the central nervous system, in much the same way as some prescription drugs, without the negative side effects. Lemon balm is good for relieving stress and anxiety. Chamomile tea has been a highly touted herb for anxiety. The roots of kava are used for anxiety and are also well known in the treatment of sleep disorders such as insomnia. Passion flower is also used as herb for anxiety when given in tea or food. Chinese have used ginseng since long for anxiety and natural immune booster. *Cannabis sativa* is usually smoked and can be eaten for anxiety relief. People worldwide are aware of this relief but are sometimes abusing the remedy. Valerian is used throughout the world as a natural sedative and is used for insomnia and panic attacks. It is also a mild painkiller and is considered safe for short term use. *Ginkgo biloba* and *Hypericum perforatum* are very well known Chinese and European plants with neuroprotective properties and useful in improving memory and treating the learning dysfunction [16,28].

Ayurvedic plants mainly described for brain related disorders

Currently, the world is looking towards brain healing prescriptions of traditional medicines, including Ayurveda, for a reliable cure with no or minimal side effects for psychiatric disorders. Indian systems of medicine are very well developed for treating the brain related disorders. The most important among the Indian systems of medicine is Ayurveda which describes the use of hundreds of plants individually or in combination for treating brain related disorders. Description of each and every plant is beyond the scope of this review and has been taken up independently [29], however, the Ayurvedic prescriptions including these plants have been summarized in Table 1. In this Table, the list contains the majority of Indian plants which have been described in the treatment of mental disorders and are currently part of the regular Ayurvedic prescriptions. The plants belong to different plant Families and range from wild and cultivated herbs to shrubs and forest trees. Most of the prescriptions include more than one plant part which supports the synergistic approach of most of the Ayurvedic drugs. Except genetically rooted brain disorders, the Ayurvedic plants have potential to cure most of the mental diseases as given in Table 1.

Current trend on preference for Ayurvedic treatment over synthetic drugs

Most of the synthetic mental drugs act in the brain to produce their euphoric effects. However, sometimes they also cause damage due to seizures, stroke and direct toxic effects on brain cells. A brain disorder also occurs when repeated drug use leads to changes in the function of multiple brain circuits controlling the stress, decision-making, pleasures, impulse control, memory, learning and other functions. These changes make it harder for those with an addiction to experience pleasure in response to natural rewards, such as food, positive social interactions, sex, etc. Additionally, most of the synthetic drugs for brain disorders are prescribed for a long term use and have been showing some kind of side and after effects. There is a long list of synthetic drugs for brain disorders floating in the market, most of

S. No.	Botanical name	Family	Hindi name	English name	Major chemical constituents	Ayurvedic recommendations
1	<i>Achyranthes aspera</i>	Amaranthaceae	Chichdha, Chirchita, Latjira, Onga chichri Bach, Ghoda bach	Prickly chaff flower	Oleanolic acid glycosides, amino acids	When inhaled the powder of the seeds, it gives relief from stiffness and headache of migraine.
2	<i>Acorus calamus</i>	Araceae	Bach, Ghoda bach	Sweet flag root	β -Asarone, α -asarone	(i) Bark powder enhances memory and cures forgetfulness. (ii) It is beneficial in anxiety and epilepsy when its powder is taken with honey. (iii) Equal weights of its powder and "shunthi" powder (ginger) are recommended to cure facial paralysis.
3	<i>Adhatoda zeylanica</i>	Acanthaceae	Adusa, Adusi, Safed vasa, Vakas, Visotta	Malabar nut	Vasicine, vasicinone	Its powder with honey cures old epilepsy disorder.
4	<i>Albizia lebbek</i>	Mimosaceae	Siris, Siras	Siris tree	Budmunchiamine alkaloids, saponins	(i) Its seeds and black pepper powder when applied near eyes, cures unconsciousness. (ii) Its seed powder is one of the constituents for treating psychosis, insanity, anxiety, hysteria.
5	<i>Allium cepa</i>	Liliaceae	Pyaz, Kanda	Onion	Dialkenyl sulfides	Tea from its seeds is beneficial in sleeplessness.
6	<i>Anacyclus pyrethrum</i>	Asteraceae	Akarkara, Karkara	Pellitory, pyrethrum	Pyrethrin	(i) When ground with vinegar and licked with honey, it controls the intensity of hysteria. (ii) When a decoction with "brahmi" is given, it controls the epilepsy. This mixture also improves in mental retardation. (iii) Massaging its root powder in mahua oil, heals paralysis. If the powder is mixed with honey and licked regularly morning and evening, effect of paralysis is checked.
7	<i>Bacopa monnieri</i>	Plantaginaceae	Brahmi, Jalneem	Thyme leaved gratiola, Indian pennywort	Bacosides A, B, C	Its juice is taken with "kuth" (<i>Costus speciosus</i> root) powder in honey to help in hysteria. It is also recommended by adding "kuth" and "shankhapushpi" to cure epilepsy and hysteria. It is very useful in the recovery of memory power.
8	<i>Benincasa hispida</i>	Cucurbitaceae	Kushmanda, Petha	Wintermelon, Wax gourd	Multiflorenol and its acetate	(i) Its juice is given with "kuth" powder and honey to cure hysteria. (ii) Its juice when given with "mulethi", helps in epilepsy.
9	<i>Brassica nigra</i>	Brassicaceae	Rae	Black mustard	Gallic acid, quercetin	(i) Its seeds and pigeon's droppings after grinding, are applied on forehead. It helps relieve migraine. (ii) Its fresh oil when massaged, reduces fatigue and laziness.
10	<i>Caesalpinia bonduc</i>	Caesalpinaceae	Kat Karanj	Fever nut	Hematoxylol, stereochoenol A	(i) Seeds in combinations when given as "nasya", cures headache. (ii) Juice of leaves is beneficial in epilepsy.
11	<i>Calotropis procera</i>	Asclepiadaceae	Madar, Aak, Akwan	Swallow wort, Madar	Ursane triterpenoids	(i) Flowers and its milk have been described to be useful in epilepsy. (ii) Yellowish dried leaves are used as "nasya" for migraine. When the mixture of its shade dried leaves with cardamom, peppermint and camphor is inhaled, it relieves migraine pain. (iii) Its roots, in a complex herbal combination, are recommended for relief in paralysis.
12	<i>Cannabis sativa</i> Linn.	Cannabinaceae	Bhang	Marijuana	Tetrahydro cannabinoids	Its leaves along with asafoetida have been used for epilepsy type problem in women. It is also useful in treating sleeplessness.

13	<i>Cassia occidentalis</i>	Caesalpiniaceae	Kasaundi	Negro coffee	Flavonoid glycosides	Decoction of whole plant or its roots, are useful in relieving the epilepsy and hysteria. Inhaling the flowers or their decoction is beneficial in hysteria.
14	<i>Cassia tora</i>	Caesalpiniaceae	Panvad, Chakravada	Foetid carria, Ringworm plant	Cassiside, toralactone	The seeds are ground in "kanji" (gruel of beans) and applied on forehead to get relief from migraine attack.
15	<i>Celastrus paniculatus</i>	Celastraceae	Malkangani, jyotishmati	Black oil plant, staff tree, intellect tree	Celapanin, celapanigin triglycerides	Its seed powder is used in combination of almond, pepper and cardamom powder to improve memory.
16	<i>Centella asiatica</i>	Apiaceae	Brahmi, Gotu Kola	Indian penny wort	Asiaticosides	(i) Dry plant when taken in preparations of combinations, improves memory power. (ii) Its powder when mixed with unboiled cow milk and taken, shows relief in insomnia. (iii) Its powder is mixed with honey or pepper or cow's "ghee" (purified butter) and taken to ease in anxiety.
17	<i>Citrullus colosynthis</i>	Brassicaceae	Indrayan	Colocynth, Bitter apple	Cucurbitacins colosynthesides	(i) Fruit juice or oil cooked root bark when applied on head, cures migraine and ear pain. (ii) "Nasya" of its root powder cures epilepsy.
18	<i>Citrus aurantifolia</i>	Rutaceae	Neembu, Kagaji nimbu	Lemon	Bergamottin, bergapten	(i) Seeds and juice are beneficial in insanity related disorder. (ii) Lemon juice is given to the patient of anxiety to regularize the heart beat.
19	<i>Clitorea ternatea</i>	Papilionaceae	Aparajita, Koel	Winged leaved clitoria, Butterfly pea	Inositol, hirsutene	The paste of seeds and roots when taken in equal amount and applied as "nasya", it relieves from the migraine pain.
20	<i>Convolvulus microphyllus</i>	Convolvulaceae	Shankhapushpi, Shankahuli	Shankhapushpi	Convovine, convolamine	(i) Its powder is mixed with milk or "bach" (Acorus calamus roots) or honey and "ghee" and taken to improve the memory power. (ii) Its juice with honey cures the epilepsy, psychosis and insanity. Shade dried powder alone or with "bach" or Indian pennywort strengthens the mind.
21	<i>Coriandrum sativum</i>	Apiaceae	Dhania	Corriander	Linalool, geranyl acetate	When its extract is regularly taken, the vertigo and headache is relieved.
22	<i>Cuscuta reflexa</i>	Cuscutaceae	Amarbail, Akashbail	Dodder plant	Cuscutoside A and B	Its juice is taken in water for improvement in brain disorders.
23	<i>Cynodon dactylon</i>	Poaceae	Doob, Doorba	Conch grass, Doob grass	Flavonoids, β -sitosterol	Extract of whole plant helps cure madness and epilepsy.
24	<i>Cyperus scariosus</i>	Cyperaceae	Nagarmotha	Nutgrass	Cyperene, Patchouli alcohol	It cures epilepsy when given with cow milk.
25	<i>Datura metel</i>	Solanaceae	Dhatura	Thorn apple	Hyoscine, hyocyanine	Its seeds are ground with black pepper and given for treating psychosis.
26	<i>Daucus carota</i>	Apiaceae	Gajar	Carrot	Carotenoids, α -Pinene, sabinene	Leaves are extracted with warm "ghee" and drops given in nose and ears to cure migraine through sneezing.
27	<i>Eclipta alba</i>	Asteraceae	Bhangra, Bhangraiya	Trailing eclipta	Widelolactone and glycoside	After mixing black pepper powder in its juice, it is applied on forehead for relief in migraine.
28	<i>Ficus benghalensis</i>	Moraceae	Bargad, Badha	Banyan tree	Bengalenosides, Leucopelargonidin glycoside	Its root bark powder when taken in sugar and cow's milk, improves memory power.
29	<i>Ficus religiosa</i>	Moraceae	Peepal	Peepal tree, Sacred	Pelargonidine glycosides, sterols	Extract of branches cures madness.
30	<i>Glycyrrhiza glabra</i>	Papilionaceae	Mulethi	Fig, Liquorice root	Phenolics, glabridin	Root powder in ghee brings improvements in epilepsy.
31	<i>Helianthus annuus</i>	Asteraceae	Hurhul	Sunflower	Diterpenoids, Kaurenoic acid	Its leaves' juice and seeds are grinded together and applied on forehead to get relief from migraine.

32	<i>Hibiscus rosasinensis</i>	Malvaceae	Gudahal	Shoe flower, China rose	Cyanidin, quercetin	Dried leaves and flowers are powdered together and given in sweet milk for improving memory power.
33	<i>Hyoscyamus niger</i>	Solanaceae	Khurasani ajawayan	Henbane	Hyoscine, coumarinolignans	Taking few drops of henbane oil in water at frequent intervals, controls hysteria in women.
34	<i>Juglans regia</i>	Juglandaceae	Akhrot	Walnut	Fatty acids, linoleic acid	Walnut seeds are ground in "nirgundi" (<i>Vitex negundo</i>) juice and given as nasal drop for hysteria.
35	<i>Lawsonia inermis</i>	Lythraceae	Mehendi	Henna	α - and β -ionones, lawsone	Seeds in honey or decoction of flowers are given to cure giddiness.
36	<i>Moringa oleifera</i>	Moringaceae	Sahijan, Munga	Drum stick plant	Moringine, Moringinine	(i) After grinding the bark, the liquid is squeezed and put into the nostrils or given orally as drink to cure meningitis. (ii) Decoction of its roots is given for epilepsy and hysteria in women.
37	<i>Mucuna pruriens</i>	Fabaceae	Kapikachhu, Kewanch	Velvet bean	L-DOPA, amines, alkaloids	In Ayurveda, it has been described for use in several illnesses and overall body strength. Scientifically it has also been found to be effective in Parkinson's disease.
38	<i>Nardostachys jatamansi</i>	Valerianaceae	Jatamansi, Balchhad	Spikenard	Jatamansone and terpenoids	It is useful in hysteria, epilepsy when taken with "ghee". "Jatamansi", "bach" and "brahmi" juice are mixed in honey and given in mental problem.
39	<i>Papaver somniferum</i>	Papaveraceae	Posta, Post, Afeem	Poppy, Opium	Morphine, codeine, thebaine, papaverine	Poppy is beneficial in delirium, sleeplessness, convulsion, etc.
40	<i>Piper longum</i>	Piperaceae	Peepal	Long pepper	Piperine, Pipelongumine	(i) Its roots in jaggery are given to overcome sleeplessness. (ii) Mixture of "peepal" and "bach" are given in milk to cure migraine pain.
41	<i>Piper nigrum</i>	Piperaceae	Kali mirch	Black pepper	Piperine and related alkaloids	On empty stomach, pepper powder and "bach" are given to treat hysteria.
42	<i>Psidium guajava</i>	Myrtaceae	Amrud, Safari	Guava	Oleanolic acid, ursolic acid	(i) Decoction of leaves is given to cure mental and physical deformities. (ii) Tincture of leaves is massaged on the backbone of children for convulsions.
43	<i>Punica granatum</i>	Punicaceae	Anar	Pomegranate	1-(2-propenyl)- piperidine in leaves, anthocyanins in fruit	(i) Leaves after boiling with water and concentrating, the extract is given in warm milk to cure fatigue, tiredness and insomnia. (ii) Leaves and rose flowers are cooked in water and concentrated. It is given in ghee to cure madness.
44	<i>Sapindus mukorossi</i>	Sapindaceae	Reetha	Soapnut tree	Triterpenoid, sesquiterpenoid, saponin, glycosides	(i) Its fruits are ground with black pepper and few drops are poured in the nostrils to get relief from migraine pain. (ii) Its seeds along with kernel and peel are ground and to be inhaled regularly to cure epilepsy, completely.
45	<i>Sesbania grandiflora</i>	Fabaceae	Agastiya, Agust	Sesbane	Leucocyanidin, cyanidin, triterpenoids	(i) Sesbane leaves and black pepper are ground in cow urine and made to inhale. It brings immediate relief from epilepsy. (ii) Few drops of leaf or flower extract are put in the opposite nostril of migraine pain giving immediate relief.

46	<i>Sida cordifolia</i>	Malvaceae	Jangli methi, Bariyar, Khrainti	Country mallow	Sidasterone A and B	(i) Its powder after cooking in milk, is given to the patient or massaged, giving relief in facial paralysis. (ii) To control the excessive anxiety, the plant and "apamarg" (<i>Achyranthes aspera</i>) are boiled in milk until concentration and given.
47	<i>Solanum surratense</i>	Solanaceae	Bhatkataiya, Kantakari, Laghukai	Yellow berried night shade	Solasodine, solasonine	Its roots and poppy seeds are grinded in child's urine and put in the nose to be relieved from epilepsy.
48	<i>Sphaeranthus indicus</i>	Asteraceae	Mundi, Gorakhmundi	East Indian globe thistle	Sterols, sesquiterpenoids	It and clove powder are given in honey to cure Parkinson's disease.
49	<i>Syzygium aromaticum</i>	Myrtaceae	Lavang, Laung	Clove	Carvacrol, thymol, eugenol	Cloves are grinded in water and the paste is applied on the earlobes to cure migraine.
50	<i>Terminalia chebula</i>	Combretaceae	Harad	The chebulic or black myrobalan	Ethyl gallate, luteolin	Seeds are grinded in warm water and applied on forehead for relief in migraine.
51	<i>Valeriana jatamansi</i>	Valerianaceae	Tagar	Valerian	Jatamansone, jatamansinol	Its juice is useful in epilepsy. When taken in honey, it helps in hysteria. "tagar" when taken in combination of other plants, helps controlling the delirium.
52	<i>Vitex negundo</i>	Verbenaceae	Samhalu, Meudi	Five leaved chaste	Negundoside	The powder of its fruits is given in mental disorder.
53	<i>Vitis vinifera</i>	Vitaceae	Munakka, Angur, Dakh	Grapesvine, Raisins	Glycosides of pelargonidin, cyanidin	(i) Grapes and "amla" (<i>Phyllanthus emblica</i>) are boiled together and crushed and Ginger powder is added. When given in unconsciousness due to fever, it helps. (ii) "Munakka", pomegranate bark, khus khus are grinded together and soaked in water overnight. Strained and given for faintness. (iii) "Munakka" is roasted and given for dizziness.
54	<i>Withania somnifera</i>	Solanaceae	Ashwagandha, Asagandha	Winter cherry, Poisonous gooseberry	Withaferin A, withanolide A	In Ayurveda, this plant has been described for use in several illnesses and overall body strength. Scientifically, it has also been found to be effective in ischemia.
55	<i>Xeromphis spinosa</i>	Rubiaceae	Main phal	Emetic nut	Oleanolic acid glycoside	Its fruits and sugar are grinded in cow milk and given as "nasya" to treat migraine headache.
56	<i>Zizyphus mauritiana</i>	Rhamnaceae	Ber	Jujube	Peptide and cyclopeptide alkaloids, sanjoinine	Although not prescribed in Ayurveda, its fruit is used in mental healing as scientifically proved for epilepsy.

Table 1: List of commonly recommended Ayurvedic plants in brain disorders.

them with proven side effects on brain function or other organs of the body [30]. Therefore, discussing each of them individually, is beyond the scope of this paper, however, the basic difference in the ground of treatments between the two, have been discussed below and listed in Table 2.

Side and after effects of synthetic drugs for brain disorders

The effectiveness of allopathic medicines during an emergency is the main reason why it is adopted by most of the people all around the world. In allopathy, the doctors are restricted to concentrate on the symptoms of a disease and not on the causes of those symptoms. It appears that there is a pill for each symptom and then, a pill for all their side effects. It is known that allopathy offers only partial cure, as these drugs are made to mostly cure the symptoms, not the root cause. It is important to note that there is no place for individuality in allopathy

as the same pill is given to the patients suffering from different diseases of similar symptoms. The synthetic drugs for brain related disorders have been studied for harmful side effects and have been covered in a number of documents for psychostimulants, antidepressants, antipsychotics, antianxiety, etc. [30]. Therefore, the adverse effects for all drugs need not be covered in this paper but an example can be cited for the anticonvulsant drugs, as follows. They are used to control the convulsions by inhibiting the discharge and then producing hypnosis. These synthetic drugs, viz. phenytoin (PHT), diazepam, valproate (VPA), levitracetam, etc., are being marketed for the treatment of the epilepsy. Although these agents have new spectrum of efficacy but show alarming adverse effects [31]. On the other hand, the treatment of epilepsy with Ayurvedic herbal drugs as adjuvant seems to be more beneficial and is gaining more popularity due to their negligible side effects (Table 1).

Ayurvedic drugs with negligible side and after effects

Ayurveda follows the fundamental principle of five great elements, which insists that the fault, *tissue* and the impurity should be in perfect harmony with all the five elements used to form the human body, i.e., earth (prithvi), water (jal), fire (agni), air (vayu) and space (akash). According to this, there should be a balance in the three elemental energies, Vata (air+space=wind), Pitta (fire+water=bile) and Kapha (water+earth=phlegm). Ayurveda explains that, when these three energies are in a balanced state or exist in equal proportion, the body will remain healthy otherwise it becomes unhealthy in many ways [32]. Ayurveda is mainly connected with the cures accessible from nature and deals with the root cause of the disease and provides permanent cure in most of the cases. Normally, a patient treated with Ayurvedic medicines, not only gets cured but also achieves the permanent immunity. The main advantage that Ayurveda has over allopathy is that the former uses only the natural means to cure a disease and is the most eco- accommodating approach to get everlasting cure (Table 2).

It is therefore well accepted that the Ayurveda not only treats a patient with mental diseases, but also increases the overall mental capability by strengthening the immunity, thus keeping the mind and the body free from further damages. The consumption of the prescribed Ayurvedic medicines, improve the concentration and other mental capabilities. Popularly, the extracts of *Bacopa monnieri* (*brahmi*), *Acorus calamus* (*vach*), *Celastrus paniculatus* (*gyotismati*) are considered extremely beneficial in strengthening mental condition. Although a detailed list of Ayurvedic plants and their potential to treat brain related disorders are given in Table 1, some specific examples of Ayurvedic treatments for common mental diseases could be discussed. For example, the depression is a feeling of dejection affecting the natural functioning of our mind and body thus tend to become unhappy. It can be treated with herbal medicines rich in ingredients like, *Crataegus oxyacantha* (*hawthorn*), *Eschscholzia californica* (*California poppy*), *Ginkgo biloba*, *Lavandula angustifolia* (*lavender*). Stress and anxiety tend to make us

hyper and unaware about mood swings. Following Ayurvedic plants are effective to counter stress and anxiety, mulungu bark, *Rhodiola rosea*, *ashwagandha*, *lavender*, etc. Similarly, ADHD reduces a mind's capability to pay concentration, to focus or pay attention to anything. Ayurvedic medicines for ADHD is made from natural herbs that cure mental disabilities, for example, *Centella asiatica* (*mandukparni*), *Bacopa monnieri* (*brahmi*), *Withania somnifera* (*ashwagandha*), *Celastrus paniculatus* (*gyotismati*), etc. The bipolar disorder results in an unusual shift in mood, and activities affecting the mental ability of a person to carry out regular day to day activities. To cure this, *brahmi*, *passion flower* and several other Ayurvedic herbs are quite useful [33].

Since Ayurvedic system treats the cause of illness in the body by balancing the act of vata, pitta and kapha, therefore the treatment is long lasting and certainly irreversible. This is the reason that Ayurvedic medicine is almost free from side effects making it more acceptable in the society than the synthetic drugs which focus mainly on the symptoms in the patients leading to the temporary relief but with side effects in most of the cases [30,34]. Apart from this, most of the prescriptions in Ayurveda are in the form of Poly Herbal Formulations (PHF). It has gained its popularity owing to the fact that PHF possesses clear advantages, which is not available in allopathic drugs, by expressing high effectiveness in a vast number of diseases. The therapeutic effect of herbal medicines are exerted due to the presence of different bioactive phytoconstituents and the effects are further potentiated when compatible herbals are formulated together in PHFs. PHFs are usually found to have wide therapeutic range and most of them are effective even at a low dose and safe at high dose, thus exhibiting superior risk to benefit ratio [32].

Conclusion

The allopathic and Ayurvedic systems of medicine work through independent principles. Allopathic drugs are prescribed on symptomatic principle while Ayurvedic through the balance of three

S. No.	Condition	Allopathic treatment	Ayurvedic treatment
1.	Taking up the disease	Allopathy takes the body in pieces, is objective and incomplete in nature.	Ayurveda takes the body as a whole and the physician has knowledge of all the systems of body.
2.	System of treatment	Allopathy is a system of physical health and it believes in the replacing/changing of the systems or organs for treatment and not much worried about the cure.	Ayurveda focuses on the wellness as a complete package, be it physical, psychological, spiritual or social.
3.	Possibility of side effects	Allopathy is mostly a system of internal or external side effects.	Ayurveda is a natural cure in which scope of side effects is very less or mild.
4.	Focus of the treatment	Allopathy focuses on suppressing the signs and symptoms of a disease and never appreciates to remove the disease causing factors, completely.	Ayurveda considers that until a body devoids the disease causing factors, it will keep on relapsing. It considers the detoxification as a primary part of the treatment.
5.	Nature of effect	Allopathic medicines partially cleanse the body.	Ayurvedic medicines decontaminate the whole body by balancing the three energies (vata, pitta and kapha).

Table 2: Main differences between principles of allopathic and Ayurvedic treatments.

energies (vata, pita and kapha) required for maintaining good health. Therefore, direct comparative study on the efficacy of the drugs for brain related illnesses, has not been properly studied yet. However, it is well understood that in most of the cases, the synthetic drugs generally bring relief through a symptomatic treatment and hardly promise permanent cure. Since more than 60 million Indian population suffers from mental disorders and the country lags far behind the world for treatments and spending in the hospitals for mental cure, it is high time to look for the established alternative system of medicine. It was estimated that nearly 1-2% Indians suffer from schizophrenia and bipolar disorder whereas 5% population showed common mental disorders like depression, anxiety, convulsion, etc. The Ayurvedic prescriptions have been proven to be very useful against such disorders. Currently, the world is rightly looking towards brain healing properties of traditional medicines, including Ayurveda, for a reliable cure with no or minimal side effects. The present review clearly explains that the Ayurvedic system of medicine is very well developed for treating most of the brain related disorders. This review has right timely included some of the Ayurvedic treatments, which have been described for mental disorders and are currently part of the Ayurvedic prescriptions. Thus, it could be concluded that the Ayurvedic system of herbal medicine is certainly a treasury of plant drugs which brings back the much sought after hope for the complete and permanent treatment of mental disorders through natural means with minimum side effects as compared to the allopathic drugs.

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