International Journal of Pharmacognosy and Life Science

E-ISSN: 2707-2835
P-ISSN: 2707-2827
www.pharmacognosyjournal.com
IJPLS 2023; 4(1): 01-12
Received: 01-11-2022
Accepted: 03-12-2022

Siba Pattanaik
Department of Bioinformatics, OUAT, CPGS, Center of Post-Graduation Studies, Bhubaneswar, Odisha, India

Deoraj Sharma
Department of Biotechnology, Trident Academy of Creative Technology, Bhubaneswar, Odisha, India

Corresponding Author:
Siba Pattanaik
Department of Bioinformatics, OUAT, CPGS, Center of Post-Graduation Studies, Bhubaneswar, Odisha, India

Review on ayurvedic plant based compounds to cure the neurological disorders

Siba Pattanaik and Deoraj Sharma

DOI: https://doi.org/10.33545/27072827.2023.v4.i1a.65

Abstract
Nature is a compact of various resources that forms and evolutes different kind of organisms in our surrounding. The biggest resource our natural environment gave us is plants and its product. It is observed that day-to-day our environment gets changed due to pollution, caused by physical or chemical agents. Due to these changes human beings suffer with so many disorders, one of the disorders is neurological disorders. Neurological disorders includes Alzheimer's diseases, Parkinson's diseases, Schizophrenia, Huntington's disease, autism spectrum disorder (ASD). Through this article we want to highlight that there are certain plant's product that play important role in curing such disorders.

Keywords: Plants, disorders, alzheimer's diseases, parkinson's diseases, schizophrenia, huntington's disease, autism spectrum disorder (ASD) and neurological diseases

Introduction
Neurological disorders are the foremost occurring diseases across the globe resulting in progressive dysfunction, loss of neuronal structure ultimately cell death. Therefore, attention has been drawn toward the natural resources for the search of neuroprotective agents. Plant-based food bio actives have emerged as potential neuroprotective agents for the treatment of neurodegenerative disorders. This comprehensive review primarily focuses on various plant food bioactive, mechanisms, therapeutic targets, *in vitro* and *in vivo* studies in the treatment of neurological disorders to explore whether they are boon or bane for neurological disorders. In addition, the clinical perspective of plant food bio actives in neurological disorders is also highlighted. Scientific evidences point toward the enormous therapeutic efficacy of plant food bio actives in the prevention or treatment of neurological disorders. Nevertheless, identification of food bioactive components accountable for the neuroprotective effects, mechanism, clinical trials, and consolidation of information flow are warranted. Plant food bio actives primarily act by mediating through various pathways including oxidative stress, neuron-inflammation, apoptosis, excitotoxicity, specific proteins, mitochondrial dysfunction, and reversing neuro degeneration and can be used for the prevention and therapy of neurodegenerative disorders. In conclusion, the plant-based food bio actives are boon for neurological disorders (Natural Product Research, vol. 27, no. 16, pp. 1463–1467, 2013 [21]. Use of plants for curing human ailments is an ancient practice. Recently there is revival of interest. Ethno botanical field surveys have been done from different parts of developing countries of the world. It reflects concern about the possible loss of valuable information on traditional medicine (International Journal of Pharmacy and Pharmaceutical Sciences, vol. 3, no. 5, pp. 524-528, 2011 [30]). Neurological disorders are often not considered common diseases. They are mental illness like epilepsy which is the most serious chronic disorder affecting millions of people. Other's like Parkinson's, Alzheimer's, Meningitis and Stroke. Nervous disorders also affect speaking, movement, breathing, mood and memory. Herbal medicines are a holistic medium. Growing of these important herbs will add to the terrestrial diversity of the ecosystem and help in conservation of Biodiversity. Centella asiatica, *Avena sativa*, *Lagenaria siceraria*, Cassia tora, Cassia fistula are some of the important plants used in nervous disorders. The different medicinal plant varieties can be studied with biochemical properties and a taxonomic classification can be made based on medicinal uses and on the biochemical relationship drawn.

Tissue Culture studies along with molecular characterization can also be done. Important germplasm of the medicinal plants will add to the terrestrial biodiversity and the most effective medicinal plant used for nervous disorder can be obtained.

Fig 1: Neurological system

Compounds of plant that can use in treatment Withania somnifera (Ashwagandha)

Withania somnifera also known as Ashwagandha is an Ayurvedic medicine which has been used for many decades for its anti-inflammatory, anti-oxidant, anti-stress and neuroprotection, immune boosting and memory power enhancing ability. W. somnifera to evaluate dose related tolerance, safety and activity and suggested that the average tolerance dose concentration was 750-1250 mg/day. The extract also possesses muscle strengthening and lipid lowering ability. The various Withanolides compounds of Ashwagandha was proven for its anti-proliferative activity in lung, central nervous system and breast cancer cell lines, moreover Withanolides when included in diet is said to inhibit tumor growth. Withania somnifera inhibited NADPH-d activity which is induced by stress, the mode of action of W. somnifera on NADPH-d by inhibiting the release of corticosterone and by activating choline acetyltransferase which boost serotonin in hippocampus. The active components of W. somnifera such as withanolide A (first isolated withanolide from W. somnifera), withanolide IV, withanolide VI possess the ability of reconstructing the pre-synapses and post- synapses; and also involves in the regeneration of neuronal axons and dendrites. Many plant species are been used for treating various ailments in humans, the use of extract either as crude or semi-purified form is proved for its therapeutic effect. Bhattacharya and Muruganandam demonstrated the anti-stress activity of W. somnifera extracts treated on Wistar rats and the chronic stress which induced perturbations were inhibited by W. somnifera (International Journal of Mycobacteriology, vol. 4, no. 2, pp. 116-123, 2015 [21]).

(www.google.image.in)

Fig 2: Withania somnifera (ashwagandha)

Ginseng

Ginseng/panax inseng is a medicinal herb of Korean and Chinese origin. This herb is known for its medicinal properties for many years. The herb is used for treating diseases such as cancer, neurodegenerative disorder, hypertension and diabetes. Ginseng is also reported for its immune boosting ability and thereby resists illness. Ginseng which has the ability to inhibit voltage dependent Ca^{2+} channels by a receptor linked to G protein which is sensitive to toxin. The study revealed that Ginsenoside a saponin which is found in trace amount helps in modulating neuronal Ca^{2+} channels. Researchers have investigated on the immune modulatory effect of Ginseng. The inhibitory activity of a metabolite of Ginseng (compound K) is to be more potent than commercial anti-allergic drugs. The Ginsenosides (Rb_1 and Rg_3) of Ginseng possess neuroprotective effect thereby making them an excellent compound for treating neurodegenerative diseases. The active compound of *P. ginseng*, is proven for its neuroprotective effect on dopaminergic neurons by inhibiting the elevation of nigral iron level, lowering the expression of DMT1 (divalent metal transporter) and potentially increasing the expression of FP1 (ferroportin) in Parkinson's disease that Rg_1 reduces the ROS (reactive oxygen species) production by dopamine, release of cytochrome c into the cytosol, inhibition of caspase 3 activity, and lowers the NO production by reducing the inducible nitric oxide (NO) synthase protein level. Rg_1 is also reported for its activity in reducing cell injury by hydrogen peroxide by down-regulating NF-$_K$B signaling pathway and activation of Akt and ERK (International Journal of Mental Health Systems, vol. 8, no. 1, p. 16, 2014 [25]).

(www.google.image.in)

Fig 3: Ginseng plant to conversion of syrup

Curcumin

Curcumin or turmeric a commonly used spice in India is known for its cosmetic and medical properties in Ayurveda for many years. The spice is basically a store house of dietary fiber, potassium, magnesium, iron and vitamins. The medical properties of the herb are diverse, some of which include anti-inflammatory, anti-oxidant and it has a high potential in boosting the immune response. Curcumin plays a prominent role in down regulating certain transcription factors, enzymes and cytokines.

Mode of action of curcumin in Alzheimer's disease is by boosting the macrophages. Studies reveal that curcumin helps the macrophage in clearing off the amyloid plaque which is formed in AD. Demonstrated the role of curcumin in clearing amyloid plaque by treating the macrophages of

AD patients with curcumin and later introducing it with amyloid plaque. The result proved that macrophage treated with curcumin had a greater uptake and ingestion of plaque in comparison with non-treated macrophages. Various studies reveal that anti-inflammatory property of curcumin and also have a potent role in preventing Aβ oligomer and fibril formation Curcumin is useful in the regulation of the cerebral microcirculatory function and hypertension. Investigate the therapeutic effect of curcumin on hypertension and its putative mechanisms in the cerebral microcirculation. Curcumin treated mice showed reduced blood pressure compared to the irrespective controls. It helped to increase blood velocity and LDF flow in hypertensive and normotensive rats, it also altered the circulating endothelial cells and open capillaries. These research groups suggests that the curcumin exerts its therapeutic effect in male albino rats by regulating vasomotion function, increasing blood perfusion, releasing the peripheral resistance and opening efficiently capillaries. Curcumin is a potent compound acting against the depression in the male albino rats that curcumin significantly reduced olfactory bulbectomy-induced behavioral abnormalities including deficits instep-down passive avoidance, increased activity in the open area and immobility time. Chronic administration of curcumin reversed the levels of 3, 4-dihydroxyphenylacetic acid, noradrenaline, serotonin and 5-hydroxyindoleacetic acid in the hippocampus region of male albino rats. Curcumin helps to normalize the levels of dopamine, noradrenaline, and 5-hydroxyindoleacetic acid in the frontal cortex of rats. Conducted 6-month randomized, placebo-controlled, double-blind pilot clinical trial of curcumin in patients with Alzheimer Disease. 22 patients randomized to 4 or 1 g, 10 patients chosen to take curcumin/placebo as 10 capsules to swallow after a meal; and 12 patients, as a packet of powder to mix with food. It was observed that curcumin raised vitamin E, the antioxidant activity of curcuminoids decreased the need for and depletion of the antioxidant vitamin E. It was also observed that curcumin slows AD progression. The serum A[beta]$_{40}$ levels did not differ significantly among doses, serum A[beta]$_{40}$ tended to rise on curcumin, reflecting on the ability of curcumin to disaggregate A[beta] deposits in the brain, releasing the A[beta] for circulation and disposal. It was also observed that curcumin did not seem to cause side effects in AD patients (rather, there was a tendency toward fewer adverse events on 4 g).

(www.google.image.in)

Fig 4: Curcumin or turmeric and its compound

Resveratrol

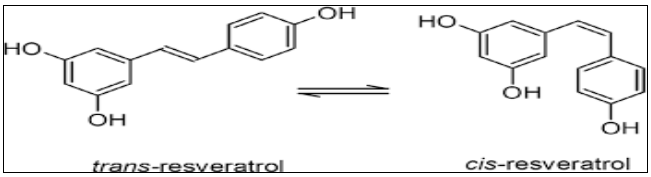
Resveratrol (3, 4′, 5-trihydroxystilbene), is a type of natural phenol; grape, raspberries, blue berries and mulberries are the rich source of Resveratrol. This polyphenolic compound has multiple beneficial effect in disease such as cardiovascular, Alzheimer's disease the effect of immune modulation at low dose of Resveratrol administration and suggested that low dose of Resveratrol lead to the enhancement of cell-mediated immune response by inducing the production of cytokine and by influencing macrophage function. The ability of Resveratrol in protecting the neurons from β-amyloid induced cell death (Journal of Natural Medicines, vol. 67, no. 1, pp. 107-112, 2013[27]).

The active compound Piceatannol (monohydroxylated derivative) in Resveratrol is said to block the accumulation of ROS induced by Aβ. Resveratrol has also been proven for its anti-inflammatory effect. Studies prove that compounds such as Tyrosol and Caffeic acid of Resveratrol inhibit the effect of tumor necrosis factor α, interleukin-1β and interleukin 6 productions. Dasgupta and Milbrandt demonstrated the neuroprotective effect of Resveratrol, in which Resveratrol helps in stimulating AMP kinase and thereby affect neuronal homeostasis. That combined treatment with Mouse bone marrow mesenchymal stem cells (mBM-MSCs) and Resveratrol enhanced the

immunomodulatory effects, suppressed proinflammatory cytokines (IFN-γ, TNF- α) and increased anti-inflammatory cytokines (IL-4, IL-10) in experimental autoimmune encephalitis was induced in C57BL/6 mice. The combination of mBM-MSCs and Resveratrol provides a novel potential experimental protocol for alleviating EAE symptoms. Investigated on whether Shh (Sonic hedgehog) pathway mediates Resveratrol to decrease cerebral ischemic injury and improve neurological function after stroke. The study suggests that pretreatment with Resveratrol significantly improved neurological function, decreased the volume of infarct, enhanced vitality, and reduced apoptosis of neurons *in vivo* and *in vitro* after stroke. Moreover the expression levels of Shh, patched (Ptc) and Smoothened (Smo) receptors, Gli transcription factors 1 (Gli-1) mRNAs was upregulated and Gli-1 was relocated to the nucleus. Under *in vivo* and *in vitro* condition, a Smo inhibitor reversed the effects of Resveratrol. Hence, the overall study suggests that decreased cerebral ischemic injury and improved neurological function by Resveratrol is mediated by the SHH signaling pathway.

(www.google.image.in)

Fig 5: Resveratrol (berries)



(www.google.image.in)

Fig 6: Chemical structure of resveratol both Trans and cis.

Bacopa monnieri

Bacopa monnieri otherwise known as Brahmi is well known for its medical properties in Ayurveda. *Bacopa monnieri* is commonly found in India and Australia. It has a potential to rejuvenate nerve cells and also has a great ability in improving memory power. The two saponins of Brahmi are Bacoside A and B which are made up of Sapogenins-Bacogenins A_1–A_4, Betulic acid and various alkaloids. Among the two main saponins Bacoside A is said to improve the memory power. Apart from memory boosting ability B. monnieri is also used as anti-oxidant, anti-stress, anti-inflammatory, anti-microbial and smooth muscle relaxant that the hallmark properties of B. monnieri namely anti-oxidant effect and effect against stress mediated dysfunction of nerve cells are key factors for HD treatment. the availability of GSH (Glutathion) and the activity of GR (Glutathion reductase) play a critical role in B. monnieri to fight against oxidative stress caused by metal and the ability to detoxify them (International Journal of Applied and Basic Medical Research, vol. 3, no. 1, p. 37, 2013 [26]).

The antistress activity of the saponins (Bacoside A and B) of B. monnieri was studied by Chowdhuri in Sprague–Dawley rats. The results suggested that B. monnieri has immense ability to activate Hsp70, P450 and superoxide dismutase which thereby help the brain to fight against adverse stress condition.

(www.google.image.in)

Fig 8: *Bacopa monnieri*

Ginkgo biloba

Ginkgo biloba is an ancient Chinese medicine which is otherwise known as living fossil. The leaf contains various chemical compounds such as trilactonic diterpenes (ginkgolide A-C, ginkgolide J-M), trilactonic sesquiterpene (Bilobalide) and various flavanoids. The leaf extract of G. biloba contains active ingredient which is known for its antioxidant properties and it has a potent ability to inhibit aggregation of blood platelets (International Journal of Mycobacteriology, vol. 4, no. 2, pp. 116–123, 2015. [21])

This Chinese medicine is also known to improve the congnitive function and blood flow investigated that the leaf extract of Ginkgo has the ability to inhibit the formation of Aβ from β amyloid precursor protein in Alzheimer's disease. It has been reported that the chemical compounds of the extract compete with free cholesterol in order to interact with the Aβ and in turn decrease the aggregation. Neuronal apoptosis which is the root cause for neurodegenerative disease is said to be reduced by Ginkgo; moreover it has the ability to inhibit the ROS accumulation by Aβ suggested that bilobalide in G. biloba extract is a potent constituent with neuroprotective and anti-apoptotic activities. Proved that co-administration of G. biloba and/or Trifolium pretense with sodium arsenite thereby minimized its neurological damages against sodium arsenite-induced neurotoxicity in different parts of brain (Cerebral cortex, Hippocampus, Striatum and Hind brain) and also spinal cord of the rats. Investigated on the neuroprotective mechanism of Ginkgolides or Ginkgo flavonoids on the TNF-α induced apoptosis of cultured rat hippocampal neurons. In-order to induce apoptosis primary hippocampal neurons isolated from rat brains were cultured with or without addition of Tumor necrosis factor-α (TNF-α) (Journal of Ethno pharmacology, vol. 127, no. 1, pp. 130-136, 2010 [15]).

TNF-α induced cultures were divided into model group, Ginkgolides pre-treatment group and Ginkgo flavonoids pre-treatment group. The results suggests that Ginkgolides or Ginkgo flavonoids helps in increasing the cell viability and Apoptotic neurons were significantly less in Ginkgolides pre-treatment. The clinical efficacy of the G. biloba special extract EGb 761 in dementia of the Alzheimer type and multi-infarct dementia was investigated by in which the group studied on the efficacy of the G.

biloba special extract EGb 761 in outpatients with presenile and senile primary degenerative dementia of the Alzheimer type (DAT) and multi-infarct dementia (MID). The study was conducted in a prospective, randomized, double-blind, placebo-controlled, multi-center study. 216 patients received either a daily oral dose of 240 mg EGb 761 or placebo. Clinical efficacy was evaluated by means of responder analysis, with therapy response being defined as response at least in two of the three primary variables. The frequency of therapy response in the treatment group differed significantly in favor of EGb 761, with $p<0.005$ in Fisher's Exact Test. The intent-to-treat analysis of 205 patients led to similar efficacy results (WHO, What Are Neurological Disorders, World Health Organization, 2016 [31]).

(www.google.image.in)

Fig 9: *Ginkgo biloba*

Wolfberry

Wolfberry/Lycium barbarum (LB) is a commonly used Chinese medicine. The medicinal property of the fruit, such as anti-ageing property, is known for many years in Asian countries. Wolfberry is known as "tonic herb" in Chinese medicine because of its anti-ageing potential. The fruit has diverse medicinal properties. Wolfberry is also used for treating diseases such as diabetes and glaucoma. Dried wolfberry fruit is used as a food supplement in recent years. The fruit is made up of water soluble polysaccharides *L. barbarum* which constitute about 40% of wolfberry content. investigated on the neuroprotective activity of *L. barbarum* extract on Alzheimer's diseases. Pretreatment of rat cortical neuron with *L. barbarum* prior to Aβ peptide exposure reduced the lactate dehydrogenase release. The extract also blocked the activity of β amyloid peptide activated caspases-3.the activity of wolfberry on neural damage induced by plasma homocysteine (Hcy). The extract Lycium barbarum is said to block the tau phosphorylation which is induced by Hcy, and is also involved in the cleavage of tau. Lycium barbarum extract is well known for its activity against ocular hypertension. *L. barbarum* polysaccharides possess an active role in modulating the immune cells in retina (North American Journal of Medical Sciences, vol. 3, no. 1, pp. 48–54, 2011 [30]). Demonstrated that LB plays an active role in inhibiting glutamate induced cell death and phosphorylation of c-jan N-terminal Kinase (JNK). Lycium barbarum plays a prominent role in inhibiting secondary degeneration of retinal ganglion cells and blocking the elevation of p-ERK and p-JNK that active component of wolfberry- Zeaxanthin and Lutein is specifically involved in the retinal protection in diabetic mice model. Other natural compounds which possess neuroprotective effect are Centella asiatica extract, Celastrol Trehalose, Lycopene, Sesamum indicum, Coffee beans extracts, Convolvulus pluricaulis extract and various flavonoids like naringin, hesperidin, kaempferol, EGCG.

(www.wikipidia.com)

Fig 10: Wolfberry tree

(www.wikipidia.com)

Fig 11: Wolfberry fruit

***Rauwolfia serpentina* L (Benth) ex Kurz:** In Rauwolfia the root is used in humans to treat hypertension and insanity. It is also used for relief of central nervous disorder including anxiety and excitement (Journal of Ethno pharmacology, vol. 71, no. 1-2, pp. 179-186, 2000 [28]). It is used for insomnia, mental disorders and aggressive behavior. It calms the central nervous system and reduces anxiety, irritability and aggression. It can be used for the treatment of schizophrenia, epilepsy, psychosis and other mental disorders. It is found in the Eastern and Western Ghats. The important compounds present in the plant are desperpidine, indobine, reserpine and serpentine. Rauvolfia serpentina has immense therapeutic properties.

(www.wikipidia.com)

Fig 13: *Rauwolfia serpentina* L (Benth) ex Kurz

***Aegle marmelos* L:** In *Aegle marmelos* various studies have shown the presence of flavonoids in phytochemical screening which are responsible for anxiolytic effect through benzodiazepine receptors. Therefore, flavonoids present in *Aegle marmelos* may be responsible for the anti-anxiety activity. Various studies on *Aegle marmelos* have shown presence of phyto constituents other than flavonoids like tannic acid, phenols, marmesinin, ascorbic acid, eugenol, skimmianine and saponin etc which may possess anxiolytic properties. *Aegle marmelos* can be a safe and effective drug for the treatment of number of anxiety

disorders. The fruit contains ethanolic extracts. These are used to care fatigue, anxiety, depression. The fruit has steroids, coumarin and alkaloids. The country of location of this plant is Sri Lanka. The leaves also contain active compounds. Some of the active compounds are aegeline, furocoumarins, marmelosine. It has huge pharmaceutical potential.

(www.wikipidia.com)

Fig 14: *Aegle marmelos* L

***Rosmarinus officinalis* L:** *Rosmarinus officinalis* L. has several therapeutic applications in folk medicine in curing or managing a wide range of diseases including depression. The model for this plant is that the extract of R. officinalis produced an antidepressant like effect, since the acute treatment of mice with the extract reduced the immobility time swimmining test and tail suspension testins mice as compared to a control. The results which show the mode of action suggest that the anti-depressant action of R. officinalis is mediated by an interaction with the monoaminergic system and that this plant should be further investigated as an alternative therapeutic approach for the treatment of depression. (Daniele Rosemary diterpenes have been shown in recent years to inhibit neuronal cell death induced by a variety of agents both *in vitro* and *in vivo*. The multifunctional nature of the compounds from the general antioxidant-mediated neuronal protection to other specific mechanisms including brain inflammation and amyloid beta formation is discussed. It is found in Africa. The active compounds include rosmarinic acid, betulinic acid and carnosic acid. Leaves of *Rosmarinus officinalis* and the flowers of Lavandula officinalis have been used as medicine for treatment of nervous disorders, in traditional Moroccan medicine. We evaluate the central nervous system psychotropic effects of the essential oil from the leaves of R. officinalis and the flowers of *L. officinalis* using a battery of comportamental psychopharmacology tests. The essential oil extracted by hydrodistillation were characterized by means of GCMS. R. officinalis contained α-pinene (15.82%), camphene (6.80%), β-pinene (4.75%), myrcene (1.70%), p-cymene (2.16%), 1,8-cineole (50.49%), camphor (11.6%), borneol (2.58%), and borneol acetate (2.08%). However, lavender oil contains nine constituents, among which 1,8-cineole (5.30%), linalool (44.67%), camphor (6.02%) and linalyl acetate (42.00%) were identified. The intraperitoneal administration in mice of essential oil from *L. officinalis* at 300 and 600 mg/kg i.p. induces strong sedative effects compared to reference substance diazepam in mice, and a hypnotic effects at doses 1000 and 1500mg/kg. However, the essential oil extracted from R. officinalis at the doses 50 and 100mg/kg, produced no sedative activity significant on the central nervous system.

(www.wikipidia.com)

Fig 15: *Rosmarinus officinalis* L

***Evolvulus alsinoides* L.:** Bioactivity guided purification of n-BuoH solube fraction from two new compounds, 2,3,4-trihydroxy3methylbutyl 3-2 propeonate and 1,3-di-O-caffeoyl quinic acid methyl ester along with 6 known compounds, caffeic acid, 6-methoxy-7-O-beta-glucopyranoside coumarine, 2-C-methyl erythritol, kaemferol-7-O-beta-glucopyranoside.The structure of new compounds were elucidated by spectroscopic analysis, while known compounds were confirmed by direct comparison of their NMR data with those reported in literature. This is the first report of the presence of phenolic constituents in *Evolvulus alsinoides*. Evolvulus is effective nootropic agent, it is mainly indicated in loss of memory, sleeplessness, treatment of epilepsy. The isolated compounds were screened for anti-stress activity in acute stress induced biochemical changes in adult male Sprague-Dawley rats. Stress exposure has resulted in significant increase of plasma glucose, adrenal gland weight, plasma creatine kinase and corticosterone levels. The compounds displayed most promosing antistress effect by normalizing hyperglycemia, plasma corticosterone and adrenal hypertrophy. It is found in East asia. The whole plant is used for medicinal purpose. The compounds present in it arescopoletin, umbelliferone and scopolin. The chemical structure is 2 methyl-1,2,3,4-butanetetrol. *Evolvulus alsinoides* (EAE) extract exhibited a positive stimulatory effect on the cholinergic system in all groups of rats in general and AD-induced rats in particular.

(www.wikipidia.com)

Fig 16: *Evolvulus alsinoides* L

***Avena sativa* L.:** *Avena sativa* is mainly used for spasmodic and nervous disorders with exhaustion. Cardiac weakness,

spermatorrhea problem, the nervous debility of convalescence is common symptoms of homeopathic *Avena sativa*. (Shastho Totho) In male function neurasthenia, homeopathic *Avena sativa* has a selective influence upon the nerve system of the genitor-urinary apparatus. Because of its selective power upon the total nervous structure which supplies the reproductive organs. Nervous palpitation of the heart, insomnia, nervous excitement and mental weakness or failure and general debility caused by masturbation can be easily removed using this remedy. It is found in Europe. The whole plant and seed is important. The chemical constituents are alkaloids, amino acid and ascorbic acid.

(www.wikipidia.com)

Fig 17: *Avena sativa* L

***Datura metel* L.:** Producing and selecting interspecific hybrids of Datura for high scopolamine production was successfully done. The leaves of *Datura metel* contain 0.2-0.5% tropane alkaloids, the flowers 0.1-1.0% and the seeds 0.2-0.5%.Scopolamine is major constituent in mature leaves. Other alkaloids are hyoscyamine, norhyoscyamine, norscopolamine, hydroxyl-6-hyoscyamine and metelodine. They increase the heart rate, induce relaxation and motor inhibition in smooth muscles, decreade secretions and induce dilation of the pupils of the eyes. *In vitro* production of scopolamine and hyoscyamine is feasible though uneconomical. Cultures of hairy roots of *Datura metel* are the most productive. (Plant Resouces of Tropical Africa).It is found in India. The leaf is used for medicinal purpose. It contains tropane alkaloids, hyoscyamine and atropine.

(www.wikipidia.com)

Fig 18: *Datura metel* L white and purple

***Annona squamosa* L.:** Some neuro pharmacological are there in effects of the ethanol extract of the leaves of Annona diversifolia. Intraperitoneal administration of the extract delayed the onset of clonic seizures induced by petylenetetrazole and delayed the time in the rota-red and swimmimng test. In sddition the extract augmented the duration of sleeping time induced by sodium pentobarbital. These results indicate that the ethanol extract of the leaves of A. diversifoloia has depressant activity on the central nervous system. It is found in Cuba. The active constituent is annonacin.

(www.wikipidia.com)

Fig 19: Plant of *Annona squamosa* L

***Acorus calamus* L.:** Chewing the rootstock of *Acorus calamus* plant can cause visual hallucinations, possibly because of the presence of alpha-asarone or beta-asarone. *Acorus calamus* shows neuroprotective effect against stroke and chemically induced neurodegenaration in rats. Specifically, it has protective effect against acrylamide-induced neurotoxicity. Both roots and leaves of *Acorus calamus* have shown antioxidant properties. *Acorus calamus* roots and rhizomes have been used in Indian system of traditional medicine for hundreds of years and it is highly valued as a rejuvenator for the brain and nervous system. *Acorus calamus* rhizome constituents, particularly alpha and beta asarone possess a wide range of pharmacological activities such as sedative, CNS depressant, behavior modifying, anticonvulsant, acetyl cholinesterase inhibitory and memory enhancing. It is found in Central Asia. The leaves stem and roots are used. The chemical constituents are alpha asarone, beta asarone and eugenol.

(www.googles.images.com)

Fig 20: *Acorus calamus* L

***Bacopa monnieri* L (Pennel):** Several studies have suggested that *Bacopa monnieri* extracts have protective effects in animal models of neuro degeneration. The herbal supplement and extract has effect on memory, anxiety and brain health. It is also used for epilepsy, nootropic substances, Alzheimer's disease and memory improvement. It helps in anxiety reduction, attention deficit hyperactivity

disorders. The whole plant standardized dry extract has role on cognitive function and affects its safety and tolerability in healthy elderly study participants. The study provides further evidence that it has potential for safely enhancing cognitive performance in the aging. It increases the cerebral blood flow. It is found in Eastern India. The active constituents are triterpenoid, saponins and bacosides (International Journal of Mental Health Systems, vol. 8, no. 1, p. 16, 201 [28]).


(www.googles.images.com)

Fig 21: *Bacopa monnieri* L (Pennel)

***Ferula asafoetida* L.:** The oleo gum resin of *Ferula asafoetida* has recently found to have neuroprotective properties in animal models and humans. Asafoetida has been used as a sedative and stimulant. It is widely used in Indian system of medicine like Ayurveda. Asafoetida has been held in great esteem among indigenous medicines, particularly in Unani system. It is found in Nepal and Saudi Arabia. The dried latex, rhizome and root is used. It was tested orally on albino rats and mice and increased life span by 52.9%. The active constituents are carbohydrate and ferulic acid (Y. Adusi-Poku, L. K.-N. Okine, F. K. Hlortsi-Akakpo *et al*. [32]).


(www.googles.images.com)

Fig 22: *Ferula asafoetida* L.

***Emblica officinalis* L.:** *Emblica officinalis* is helpful in the following health conditions: Memory loss, mental fatigue, anxiety with mental irritability and restlessness, depression with aggressive reactions, attention deficit hyperactivity disorder. Amla is helpful in following health conditions; Brain and nerves-headache with burning sensation, migraine with pulsing and throbbing pain, memory loss, mental fatigue, vertigo (Journal of Ethno pharmacology, vol. 132, no. 1, pp. 334–339, 2010 [29]).Psychological diseases anxiety with mental irritability and restlessness, depression with aggressive reactions, insomnia, violent mental agitation. The dried and fresh fruit is used. It enhances intellect. The active compounds are embillicannin, ascorbic acid, polyphenols and gallic acid.


(www.googles.images.com)

Fig 23: *Emblica officinalis* L (Amala)

Valeriana: Valerian extract can cause sedation by increasing brain's GABA level. GABA is an inhibitory neurotransmitter, and in large enough quantities it can cause a sedative effect. Results from an *in vitro* study suggest that Valerian extract may cause GABA to be released from brain nerve endings and then block GABA from being taken back into nerve cells. In addition Valeran's valerenic acid inhibits an enzyme that destroys GABA another way that Valerian can improve your GABA levels and promote a great night's rest. Scientists have found that Valerian root increases the amount of a chemical called gamma amino butyric acid (GABA) in the brain. GABA helps regulate nerve cells and calms anxiety. Drugs such as alpazolam and diazepam also work by increasing the amount of GABA in the brain. The valerenic acid and valerenol contained in Valerian root extract act as anti-anxiety agents (*Cell*, vol. 146, no. 6, pp. 855–858, 2011. [22]). It's pretty amazing that a herbal remedy like Valerian root can have the same anti-anxiety effects of prescription drugs without all the serious side effects of psychotropic drugs. Valeriana root have sedative and anxiolytic effects. The root is used. It is found in North America. It stimulates serotonin receptors. The active compounds are Isovaleric acid and hesperidins.


(www.googles.images.com)

Fig 24: Flowers of Valeriana

***Cassia occidentalis* L. (Link):** Study evaluated the effect of Cassia fistula on sleeping time and level of anxiety in male albino mice. The aqueous extract of fruit increased sleeping time and decreased levels of anxiety in mice. Investigations have revealed several biological activities such as

antidepressant activities of Cassia occidentalis. Leaf poultices of Cassia fistula are also used for fascial massage in affections of the brain and applied externally in paralysis, rheumatism and gout. It is found in East Asia. The buds and dried unripe fruits are used.

(www.googles.images.com)

Fig 25: Cassia occidentalis

***Papaver somniferum* L.:** *Papaver somniferum* is the species of plant from which opium and poppy seeds are derived. It is the source of natural and semi synthetic narcotics. It is the source of several pharmaceutical benzylisoquinoline alkaloids including morphine, codeine and sanguinarine (BMC Complementary and Alternative Medicine, vol. 16, no. 1, 2016. [23]). The hairy root cultures accumulated three times more codeine than intact roots. Narcotics are used therapeutically to treat pain but they alter mood and behavior significantly. 2 enzymes and their genes are involved in mode of action. It is found in Mediterranean region. The active compounds are papaverine, noscapine and oripavine.

(www.ayuraveda.com)

Fig 26: *Papaver somniferum* L

***Strychnos Nux-Vomica* L:** Nux vomica is a plant. The seed is used to make medicine. It is used for nerve conditions and depression. Nux vomica dried seeds contains two principles alkaloids-Strychnia and Brucia. It is useful for people doing mental work or under stress. It is found in South East Asia. The bark is used. The active compound is brucine.

(www.ayuraveda.com)

Fig 27: Tree to tablets of *strychnos nux vomica*

***Hyoscyamus Niger* L.:** The Application areas of *Hyoscyamus niger* are epilepsy, meningitis and dementia. Hyoscyamus is a remedy with some common mental and emotional themes running through all its various expressions. It is found in Europe. It is a sedative and analgesic. The active compounds are hyoscyamine, scopolamine and tropane alkaloids (Biopharmaceuticals, vol. 14, pp. 273–278, 2006 [24]).

(www.googles.images.com)

Fig 28: *Hyoscyamus Niger*l

Panax Ginseng Oken: The root of Panax ginseng has been a popular medicine. Ginsenosides are neuroprotective. This review considers publications dealing with the various actions of P.ginseng that are indicative of possible neurotherapeutic efficacies in neurodegenerative diseases and neurological disorders such as Parkinsons disease, Alzhemirs disease, Huntingtons disease and amyotrophic lateral sclerosis and multiple sclerosis. Ginseng has been used as a traditional modern medicine for over 2000 years and is recrded to have antianxiety, antidepressant and cognition enhancing properties. The molecular mechanisms of the neuroprotective effects of ginseng in Alzheimer's disease including beta amyloid formation, major depression and Parkinson's disease is discussed. It is found in Russia and Korea. It has multivitamins.

(www.ayuraveda.com)

Fig 29: Panax Ginseng Oken

***Aconitum*:** Aconite is one of the best remedies for waves of fear or outright panic. It is wild in alpine Himalayas of Kashmir and Nepal at an altitude of about 3600m. Root is used for nervous disorders, neuralgins, dropsy and as sedative. Pure roots contain the alkaloids pseudaconitinine, chasmaconitine, indaconitine and bikhaconitine. The efficacy of the drug is based on the di-ester alkaloids-aconitin, mesaconitin and hypaconitin.

(www.ayuraveda.com)

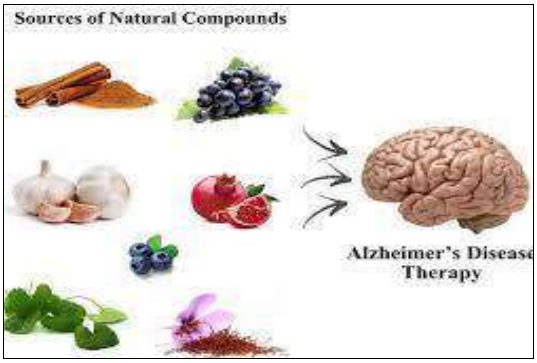
Fig 30: *Aconitum*

Loranthus Longifolia Jacq: Loranthus longifolia protects central nervous system against electromagnetic radiation on rat. It has been widely used for the treatment of brain diseases, particularly in South West China. Hence, the present neuroprotection model was designed to investigate its neuroprotective properties against hydrogen peroxide induced oxidative stress in NG-108-15 cells. The aqueous extract exerts marked neuroprotective activity. It has steroids, alkaloids, flavonoids and phytochemicals. It is found in Africa. Loranthus on scopolamine induced memory impairment in mice.

(www.ayuraveda.com)

Fig 31: Loranthus Longifolia Jacq

Descriptions on the Mechinisms of plant compounds to cure neurological disorders with its graphical representation.



(www.googles.images.com)

Fig 32: Graphical representation of alzheimer's therapy

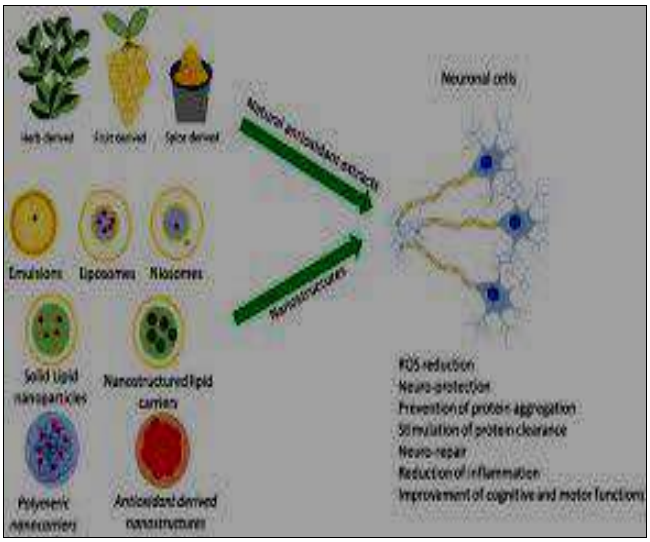
In this representation we can define different therapy by natural plant compounds and its benefits for Alzheimer disease preventions. The plant factors and photochemical elements helps in the mechanism and also rules the species with materials, curing the site of nerve and help to make the neuron system smooth as works and mechanized (World Health Organization, 2005 [31]).

.

(www.googles.images.com)

Fig 33: Description of anti-AD-therapy

Pathways like secretion of physiochemical of plant's components and its nutrition helps the cell to grow alike nerve cell and brain cells of a human body. Vital properties of curumin, aswagandha, pomegranate, etc.



(www.pubmed.com)

Fig 34: Graphical representation of plants physiochemical properties and advantages

This representation show you how the natural compounds help to secrete proper protein and prevent inflammation in nervous system and help to prevent from neurological disorder.

Discussions

Mental and neurological disorders remain a major public health concern. The disease burden is even more prominent in the developing world, including Ghana. Recent discoveries and clinical usage of the anticancer agent taxol and the antimalarial artemisinin derived from plants have boosted interest in natural products as templates for the development of novel drug scaffolds. TAMs are widely

accepted in African communities and there appears to be an increasing reliance on these products. In Ghana, TAMs are used as the main treatment paradigm for a variety of diseases, but they are also used as complements to other medicines or as dietary supplements. However, thorough examination and documentation of the medicinal properties of these products against mental and neurological disorders is lacking.

In the present study, several plant species (32 species) used by local TMPs to treat mental and neurological disorders were reported, with most species belonging to the families Asteraceae, Apocynaceae, and Meliaceae. These are large and widespread plant families with several species. In particular, the Asteraceae family is of great importance due to its high numbers of medicinal species used in the treatment of a wide array of diseases including tuberculosis, malaria, and inflammatory disorders. Members of the Asteraceae family are also known for their wide range of economically important products including cooking oils and phytochemicals such as sesquiterpene lactones, alkaloids, and tannins. The family Apocynaceae also has a wide range of species that are of pharmacological importance, with some members synthesizing alkaloids useful against high blood pressure and inflammation and others synthesizing cardiac glycosides that affect heart function. The family Meliaceae, on the other hand, is known for its species that are processed into important products including vegetable oil, as well as phytochemicals with anti-inflammatory, antioxidant, hepatoprotective, and cognitive-enhancing properties.

Conclusion

The natural products identified in this study are a valuable collection of resources that may provide leads for drug discovery and development. However, a potential criticism of the traditional approach being employed by the TMPs in relation to the pharmaceutical industry approach to drug discovery is that whole plant extracts may contain several bioactive components, making it difficult to attribute therapeutic benefits and mechanism(s) of action to particular compounds. Moreover, some plant extract components may be negative modulators of active drug ingredients, with adverse implications for drug potential. A feasible means to refine, extend, and enhance the beneficial effects of the plant products identified in this study is to isolate, screen, and characterize bioactive compounds responsible for the positive disease-modifying effects reported. On the other hand, it is possible that components of the different plant extracts used in combination may produce positive interactions leading to complementarity in observed therapeutic effects that are more effective than single components administered at equal doses. In such a case, plant extracts whose benefits are observed when used as combinations by the traditional healers should be explored further to identify their possible synergistic activities. For example, the antimalarial drugs Quinimax (a combination of quinone, cinchonine, and quinidine) and Malarone (proguanil and avoquone) are produced and marketed as synergistic complementary drugs. Further drug discovery and development research should be conducted on the reported plant products to identify lead compounds whose *in vivo* therapeutic capacities would be revealed in preclinical and clinical studies. This would enable the industrial-scale production and marketing of successful drug candidates following drug authority approval. The high cost of the drug discovery and development process would, however, require strengthening academia-industry collaborative research and better provision of research funding and infrastructure. The cause of many neurodegenerative diseases still remains a mystery. The use of herbal medicine has gained a lot of interest for their therapeutic potential for many decades. In future, the use of phytochemicals will be a promising approach for neurodegenerative disorders due to their anti-inflammatory, anti-oxidative and anticholinesterase activities. The neurodegenerative disorders such as AD, PD, Huntington's, and others share common features at cellular and subcellular levels as well as sharing mostly common molecular signaling pathways that may lead to apoptosis, necroptosis, and inflammation. Overall use of herbal medicine provides promising alternatives to current therapies for neurodegenerative disorders. However, the potential of herbal medicine/natural compounds is immensely hindered by its poor pharmacokinetic properties. In order to overcome these limitations, the herbal medicine has been incorporated into various drug delivery formulations. Natural components have the answers of neurological disorder prevention and control up to stable health conditions.

References

1. Abena AA, Kintsangoula-Mbaya GS, Diantama J, Bioka D. Analgesic effects of Ageratum conyzoides extract in the rat, L'Encéphale. 1993;19(4):329-332.
2. Adedapo OJ Aremu, Oyagbemi AA. Anti-Oxidant, anti-inflammatory and antinociceptive properties of the acetone leaf extract of Vernonia Amygdalina in some laboratory animals, Advanced Pharmaceutical Bulletin. 2014;4:591-598.
3. Fekadu C, Hanlon E, Gebre-Eyesus *et al*., Burden of mental disorders and unmet needs among street homeless people in Addis Ababa, Ethiopia, BMC Medicine. 2014, 12(1).
4. Olatokunboh AO, Kayode YO, deola OK. Anticonvulsant activity of Rauvolfia Vomitoria (Afzel), African Journal of Pharmacy and Pharmacology. 2009;3(6):319-322.
5. Khanna M Rosenberg, Vail DM. A review of paclitaxel and novel formulations including those suitable for use in dogs, Journal of Veterinary Internal Medicine. 2015;29(4):1006-1012.
6. Dwuma-Badu JSK Ayim, Dabra TT, *et al*., Constituents of West African medicinal plants. XIV. Constituents of Piper guineense Schum. and Thonn, Lloydia. 1976;39(1)60-64.
7. Bemis L, Capodice JL, Gorroochurn P, Katz AE, Buttyan R. Anti-prostate cancer activity of a β-carboline alkaloid enriched extract from Rauwolfia vomitoria, International Journal of Oncology. 2006;29(5):1065-1073.
8. Mamah A Owoso, Mbwayo AW. *et al*., Classes of psychotic experiences in kenyan children and adolescents, Child Psychiatry & Human Development. 2013;44(3):452-459.
9. Quansah, Karikari TK. Neuroscience-related research in ghana: A systematic evaluation of direction and capacity, Metabolic Brain Disease. 2016;31(1):11-24.
10. E. Quansah E Sarpong, Karikari TK. Disregard of neurological impairments associated with neglected

tropical diseases in Africa, eNeurological Sci. 2016;3:11-14.
11. Duah P Owusu, Knapp J, Slatkin D, Schiff P. Constituents of West African Medicinal Plants," Planta Medica. 1981;42:275-278.
12. López-Muñoz F, Bhatara VS, Álamo C, Uenca, E. Historical approach to reserpine discovery and its introduction in psychiatry," Actas Españolas de Psiquiatría. 2004;32(6):387-395.
13. Kweifio-Okai D, Bird B Field, *et al*., Antiinflammatory activity of a Ghanaian antiarthritic herbal preparation: III, Journal of Ethno pharmacology. 1995;46(1):7-15.
14. Nguta R, Appiah-Opong AK. Nyarko, *et al*., *In vitro* antimycobacterial and cytotoxic data on medicinal plants used to treat tuberculosis," Data in Brief. 2016;7:1124-1130.
15. Nguta R, Appiah-Opong AK, Nyarko D Yeboah-Manu, Addo PGA, Medicinal plants used to treat TB in Ghana," International Journal of Mycobacteriology. 2015;4(2):116-123.
16. Tabuti RS, Kukunda CB, Waako PJ. Medicinal plants used by traditional medicine practitioners in the treatment of tuberculosis and related ailments in Uganda, Journal of Ethno pharmacology. 2010;127(1):130-136.
17. Kwofie D, Tung NH, Suzuki-Ohashi M, *et al*., Antitrypanosomal activities and mechanisms of action of novel tetracyclic iridoids from Morinda lucida Benth, Antimicrobial Agents and Chemotherapy. 2016;60(6):3283-3290.
18. Ilango K, Maharajan G, Narasimhan S. Anti-nociceptive and anti-inflammatory activities of Azadirachta indica fruit skin extract and its isolated constituent azadiradione, Natural Product Research. 2013;27(16):1463-1467.
19. Miller H, Su X. Artemisinin: discovery from the Chinese herbal garden, Cell. 2011146(6):855-858.
20. Boateng A, Danso-Appiah BK, Turkson, Tersbøl BP. Integrating biomedical and herbal medicine in Ghana - experiences from the Kumasi South Hospital: A qualitative study, BMC Complementary and Alternative Medicine, 2016, 16(1).
21. Akpanabiatu MI, Umoh IB, Eyong EU, Edet EE, Uboh FE. Influence of Rauwolfia vomitoria root bark on cardiac enzymes o normal Wistar albino rats, Biopharmaceuticals. 2006;14:273-278.
22. Calvo MI, Cavero RY. Medicinal plants used for neurological and mental disorders in Navarra and their validation from official sources, Journal of Ethno pharmacology. 2015;169:263-268.
23. Roberts M, Mogan C, Asare JB. An overview of Ghana's mental health system: results from an assessment using the World Health Organization's Assessment Instrument for Mental Health Systems (WHO-AIMS)," International Journal of Mental Health Systems. 2014;8(1):16.
24. Olajide SO, Awe JM, Makinde, *et al*., Studies on the anti-inflammatory, antipyretic and analgesic properties of Alstonia boonei stem bark," Journal of Ethnopharmacology. 2000;71(1-2):179-186.
25. Maiti R, Kumar S, Acharya S, Raghavendra M. Role of aqueous extract of Azadirachta indica leaves in an experimental model of Alzheimer′s disease in rats," International Journal of Applied and Basic Medical Research. 2013;3(1):37.
26. Bisong SA, Brown R, Osim EE. Comparative effects of Rauwolfia vomitoria and chlorpromazine on locomotor behaviour and anxiety in mice," Journal of Ethno pharmacology. 2010;132(1):334-339.
27. Bisong SA, Brown RE, Osim EE. Comparative extrapyramidal effects of Rauwolfia vomitoria, chlorpromazine and reserpine in mice," Journal of Natural Medicines. 2013;67(1);107-112.
28. Bisong S, Brown R, Osim E. Comparative effects of Rauwolfia vomitoria and chlorpromazine on social behaviour and pain, North American Journal of Medical Sciences. 2011;3(1):48-54.
29. Guenne S, Ouattara N, Hilou A,. Millogo A, Nacoulma OG. Antioxidant, enzyme inhibition activities and polyphenol contents of three Asteraceae species used in Burkina Faso traditionally medicine, International Journal of Pharmacy and Pharmaceutical Sciences. 2011;3(5):524-528.
30. WHO, What Are Neurological Disorders, World Health Organization; c2016. http://www.who.int/features/qa/55/en/.
31. WHO, WHO Global Atlas of Traditional, Complementary and Alternative Medicine, World Health Organization; c2005.
32. Adusi-Poku Y, K.-N. Okine L, Hlortsi-Akakpo FK, *et al*., Assesssing herbal medical practitioners in professional qualifying examination in Ghana, a model, African Journal of Traditional, Complementary and Alternative Medicines. 2010;7(1):85-87.