WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 5, 405-415. Review Article ISSN 2277– 7105

NATURAL MEMORY ENHANCERS

Dr. Archana Gorle Ingle*, Nikita Gharat, Bhavana Tawde, Jagannath Gaikwad, Dr. Rupesh Pingale

NCRD's Sterling Institute of Pharmacy, plot No 93, Sector -19 Seawoods, Nerul(E) Navi Mumbai- 400706, Maharashtra, India.

Article Received on
28 Feb. 2021,

Revised on 20 March 2021,
Accepted on 09 April 2021

DOI: 10.20959/wjpr20215-20278

***Corresponding Author**
Dr. Archana Gorle Ingle
NCRD's Sterling Institute of Pharmacy, plot No 93, Sector -19 Seawoods, Nerul(E) Navi Mumbai- 400706, Maharashtra, India.

ABSTRACT

Memory is perhaps the most vital of the aspects that differentiates human beings from other animals. The ongoing quest for memory enhancement is one that grows necessary as the global population increasingly ages. The natural system of medicine is exploring tremendous benefits from the herbs which are used in various aspects and one of the aspects include brain function with includes improving memory, improving alertness, improving intelligence, improving mental performance etc. The Indian System of Medicine Ayurveda has a treasury of such memory enhancing drugs, which are today popular all over the world due to their proven effective qualities. This review focuses on Herbs and other natural agents as memory Enhancers.

KEYWORDS: Herbal memory enhancer, Natural cognitive enhancers.

INTRODUCTION

Memory is our ability to encode, store, retain and subsequently recall information and past experiences in the human brain. Memory is the process of taking in information from the world around us, processing it, storing it and later recalling that information, sometimes many years later. The brain is the centre of the nervous system which controls memory, thought, reason judgment, consciousness and emotion. Supporting the brain health is vital for ensuring a successful regulation and coordination of body activities. Brain areas involved in the neuro anatomy of memory such as the hippocampus, the amygdala, the striatum, or the mammillary bodies are thought to be involved in specific types of memory due to certain condition as stress, negative emotions lead to various diseases such as amnesia, memory loss, high blood

pressure, anxiety and some serious life treats in which person is unable to use his mind power as schizophrenia and Alzheimer's diseases.

To overcome these herbs and natural remedies are very useful to promote intelligence. There are a variety of nutritional supplements that are useful in preserving the health of brain. The natural system of medicine is exploring tremendous benefits from the herbs which are used in various aspects and one of the aspects include brain function with includes improving memory, improving alertness, improving intelligence, improving mental performance etc. Cognition enhancement' is the use of various strategies to boost cognitive functions - i.e. mental states that underpin information-processing tasks such as attention, memory, and selective forgetting. Cognitive enhancement may be defined as the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems. Cognitive enhancers are drugs, supplements, nutraceuticals, and functional foods that enhance attentional control and memory. Nootropics are cognitive enhancers that are neuroprotective or extremely nontoxic.

Various mechanisms by which nootropics acts are as follows.

1. Increasing circulation to the brain.
2. Providing precursors to neurotransmitters (chemical messengers in the brain).
3. Improving neuron function.
4. Preventing free radical and oxidative damage to brain cells.
5. Providing usable energy to the brain and so on[1].

The important natural and herbal cognitive enhancers include.

1) Amino acids and Proteins

Adult brains use amino acids, which are typically found in protein rich food, for the production of enzymes that transport molecules, structural material and neurotransmitters, along with other essential molecules. Eating high protein but low calorie meals increases alertness and attentiveness, although too much protein can have a negative effect as well. Some of the amino acids found beneficial in cognitive enhancement include.

A) L-cysteine: The form of L-cysteine used in cognition enhancement is N-acetyl L-cysteine. The amino acid cysteine shows strong scientific evidence in the production and biosynthesis of Brain-Derived Neurotrophic Factor (BDNF). BDNF facilitates the growth of new neurons,

as well as, protect existing neurons from neuronal death. BDNF protein has also shown to be particularly important for long-term memory in the hippocampus region of the brain.[1]

B) L-phenylalanine: It increases mental energy and helps to produce the neurotransmitters Dopamine, Norepinephrine and Epinephrine. It promotes a healthy mood and assists with the neurological processes of learning and memory.[1]

C) L-glutamine: It is another example of an amino acid with substantial benefits to mental functioning. Glutamic acid (a stimulatory neurotransmitter) can be used as an energy source by the brain. Glutamic acid, which is sometimes called a 'brain food', is derived from dietary L-glutamine. The conversion of glutamine to glutamic acid is made in the brain itself after successfully passing the blood-brain barrier. Glutamic acid is thought to play a role in mental alertness and perhaps even memory enhancement. Evidence shows that glutamic acid does not readily pass through the blood-brain barrier, while glutamine passes through very easily and vitamin-B6 is needed for its utilization.[1]

D) L-tryptophan: It is an important amino acid especially found in the proteins contained in dairy products. It helps to improve decision-making, stabilizes mood and influences the cognitive process, specifically learning and memory.[1]

E) L-tyrosine: It is an essential amino acid which supports brain function. It helps to produce the catecholamines (Dopamine, Norepinephrine and Epinephrine), hormones which are depleted by stress, excessive work and certain drugs. By replenishing catecholamines, mental energy levels are enhanced and a feeling of contentment often occurs. L tyrosine boosts neurotransmitter production in the brain thereby helping to create alertness.[1]

2) Antioxidants

a) Alpha Lipoic Acid (ALA)

b) Anthocyanins, Flavonoids, Tannins, Phenolic acids and Stilbenoids

c) Polyphenolics

c) Isoflavones.[2]

3) Glucose

Glucose is essential for the proper functioning of brain. The constant supply of glucose to the brain operates it properly. Optimal brainpower is reached when blood glucose is stable. Simple sugars can spike blood glucose and their glucose supply does not last long, so they should be avoided. Too high blood glucose can also inhibit mental functions.[3]

4) Hormones

a) Dehydroepiandrosterone (DHEA)

It is a steroid hormone produced naturally by the adrenal gland, and is the most abundant steroid found in the human blood stream. It has a significant cognitive enhancement effect.[4] It improves brain cell activity and enhances memory. It helps to maintain the brain cells ability to store and retrieve information in short-term memory. DHEA levels naturally decline, as one gets older, and there is strong reason to think that DHEA supplements may extend life span and make one more youthful. It is involved in protecting brain neurons from senility-associated degenerative conditions like Alzheimer's disease.[2]

b) Vasopressin

Improves attention, concentration, memory retention, and recall (both short-term and long-term). It facilitates more effective learning by helping to "imprint" new information in the memory centers of the brain, a function which cannot be achieved without the action of vasopressin. It usually comes in a nasal spray bottle and produces a noticeable effect within seconds.[5]

c) Pregnenolone

It is a naturally occurring steroid hormone and the most powerful intelligence enhancing agent ever. Pregnenolone helps in balancing overall hormone levels and have benefits in enhancing memory 34. It is converted into DHEA in the body and helps to maintain the brain cells ability to store and retrieve information in short-term memory and to improve memory retention.[2]

5) Iron

Iron is involved in many fundamental biological processes in the brain including oxygen transportation, DNA synthesis, mitochondrial respiration, myelin synthesis, and neurotransmitter synthesis and metabolism. Iron homoeostasis is needed to maintain normal physiological brain function, whereas misregulation of iron homoeostasis can cause neurotoxicity through different mechanisms.[6]

6) Omega-3 Fatty acid

A) Docosahexaenoic acid (DHA)

Docosahexaenoic acid (DHA) is essential for the growth and functional development of the brain in infants. DHA is also required for maintenance of normal brain function in adults. The

inclusion of plentiful DHA in the diet improves learning ability, whereas deficiencies of DHA are associated with deficits in learning.[7]

B) a-linolenic acid

Linoleic acid (LA, 18:2n-6) is an essential n-6 polyunsaturated fatty acid (PUFA)1 required for normal growth and development at 1 to 2% of daily energy. increase in dietary LA affects the brain. It is mainly viewed as an essential precursor to AA, which is important for neurodevelopment and other physiological processes.[8]

It has also been linked to help in retaining brain functions. When eaten during pregnancy it helps to produce a more intelligent child. Increasing the content of a linolenic acid in the diet has been shown to lower risk of depression, much better than depression medication. It can be found in cold-water fish, such as salmon, as well as almonds, avocadoes, walnuts and flaxseed[2]

7) Vitamins[2]

The B group of vitamins is vital in cognitive function, but not all of them play a role in brain function. Vitamins which have a significant influence in brain function include:

a) Vitamin-B1 (Thiamine)

It aids in nerve cell function and helps the body to convert food, specifically carbohydrates, into glucose.

b) Vitamin-B12 (Cyanocobalamine / Methylcobalamine)

There are two types of vitamin-B12, cyanocobalamine and methylcobalamine. Both of them are used to make neurotransmitters. One of their primary functions is the formation of blood cells. They also maintain the nervous system by helping to metabolize fatty acids, which are essential for the maintenance of myelin that surrounds nerves.

c) Vitamin-B3 (Niacinamide): It leads to the production of NADH coenzyme 1, for optimal functioning of the brain. It is used for medical conditions such as schizophrenia, anxiety and against HIV

d) Folic acid: It is a type of B-vitamin that has a multiple effect on the human body and is very much required for brain functions. Without it dementia problems occur. Elderly people require higher amounts to maintain cognitive abilities as well as memory retention.

8) Amla (Emblica Officinalis)

Emblica officinalis, the Indian gooseberry, or aamla', is a deciduous tree of the Phyllanthaceae family. It is known for its edible fruit of the same name. Anwala churna is an ayuvedic preparation of amla which possesses memory enhancing action and has been proved to be a useful remedy in the management of Alzheimer's disease. This memory enhancing activity of amla has been attributed to its property of reducing brain cholinesterase activity and total cholesterol levels.[9]

9) Brahmi (Bacopa monniera)

The active constituents responsible for Bacopa monniera's cognitive effects are bacosides A and B. Brahmi, most importantly used for therapeutic means, is to enhance cognitive function, most research has focused on the mechanism behind these properties. The triterpenoid saponins and their bacosides are responsible for Brahmi's ability to enhance nerve impulse transmission. The bacosides also aid in repair of damaged neurons by enhancing kinase activity, neuronal synthesis, and restoration of synaptic activity, and nerve impulse transmission. A 2012 research on elderly people demonstrated that Bacopa monnieri suppresses AChE activity resulting in enhanced cholinergic function, which in turn enhances attention and memory processing and increases working memory. Similarly, the research were done on children where a 12 week Brahmi treatment revealed significant benefits with improvement in sentence repetition, logical memory, and paired associate learning tasks.[10]

10) Guggul (Commiphora wightii)

In Family Burseraceae, Commiphora wightii is known as Guggal, Guggul or Mukul myrrh tree is a flowering plant. It has a maximum 4 m height with thin papery bark. Steroid Guggulsterone is active ingredients in Commiphora which work as an antagonist of the farnesoid X receptor. For improving memory, Guggulipid showed potential cognitive enhancer in scopolamine-induced memory deficits. choline actyltransferase is decreased by acting on in learning and memory by Commiphora Wightii acting on impairment in learning and memory in hippocampus.[11]

11) Caffeine (Coffea Arabica)

Caffeine is the most widely used stimulant. Caffeine is an efficient drug, crossing the blood-brain barrier quickly to block adenosine receptors that are distributed widely throughout cortical regions. Even at low doses, caffeine results in significant increases in firing rates in regions mediating sleep and mood, such as the dorsal and medial raphe nuclei and the locus

coeruleus. This amplified cortical activity likely underlies the increase in subjective reports of alertness as well as increases in sustained attention and faster reaction times. Surprisingly few studies, however, have shown that caffeine actually improves memory performance.[12]

12) Ginger (Zingiber officinale)

Zingiber Officinale (Zingiberaccae) rhizomes posses potent memory enhancement in scopolamine induced memory impairment by significantly increasing whole brain acetyl cholinesterase inhibition activity. Zingiber Officinale significantly improves learning and memory. Its major active constituents are gingerin, gingerol, shogaol and zingerone. A scientific study has demonstrated beneficial effect of ginger rhizome to protect against focal cerebral ischemia. The cognitive enhancing effect and neuroprotective effect of Ginger is partly due to its antioxidant activity.[2]

13) Ginkgo (Ginkgo biloba)

The leaves of this plant are known for increasing blood flow to the brain and greater amounts of oxygen to the tissues. This herb improves brain glucose metabolism while affecting levels of amine neurotransmitter substances in the brain. An extract of ginkgo containing 24% flavone glycosides (the herb's active flavonoids) has been found to enhance mental functioning both in the young and old. There are several mechanisms by which ginkgo exert its beneficial effect on mental functioning. Ginkgo is known to improve circulation to the brain. It appears to initiate vasodilatation (opening of the blood vessels) in the capillaries, which accounts for the increased blood flow and thus an increased level of oxygen and nutrients to the brain cells. Ginkgo extracts enhance nerve transmission in the brain and improve the production and usage of neurotransmitters within the brain. Ginkgo components are known to act as powerful antioxidants in the brain, thereby scavenging free radicals which otherwise would cause premature death of cells. In addition, ginkgo biloba promotes the more efficient metabolism of glucose, the brain's major source of energy. The result of these actions means an improvement in the performance of the brain. Ginkgo biloba has shown preventive action in corticosterone induced neuronal atrophy and cell death in the hippocampus.[13]

14) Siberian Ginseng (Eleutherococcus sentiocosus)

This herb has an anti-stress effect by exerting antioxidant and steroid me tabolism activity on the hypothalamus-pituitaryadrenal endocrine function. It stimulates activity in the brain to cause a more economical release of body energy, resulting in increased work output.[14]

15) Green Tea (Camellia sinensis)

One of the main ingredients in green tea is caffeine. Caffeine can block a chemical messenger in the brain called adenosine, which controls when you feel sleepy or awake. Blocking adenosine can prevent drowsiness, which is why so many people use caffeine to stay awake and mentally sharp. An overproduction of adenosine in the brain has also been linked to cognitive conditions like Alzheimer's and Parkinson's. Research shows that regular consumption of caffeine may reduce the risk of developing these conditions. The amount of caffeine in green tea is much lower than in coffee, so you can get some of the benefits of caffeine without the unpleasant side effects, like jitteriness. Green tea also contains an amino acid called L-theanine, which has been found to help reduce stress and boost your mood. Research shows that the combination of caffeine and L-theanine improves brain function by strengthening working memory and attention, and reducing anxiety. A small 2019 study observed the effects of drinking green tea on brain function, concluding that regular tea drinkers have higher cognitive functions and better-organized brain regions, as compared to non-tea drinkers. A 2017 review of 21 studies on the benefits of green tea also determined that drinking green tea is beneficial to cognition and brain function .

16) Guduchi (Tinospora cordifolia)

It is an herbaceous vine of the family Menispermaceae indigenous to the tropical areas of India, Myanmar and Sri Lanka. Guduchi has been shown to enhance cognition (learning and memory) in normal rats and reverse cyclosporine-induced memory deficit.[2]

17) Liquorice (Glycyrrhiza glabra)

Liquorice or licorice is the root of Glycyrrhiza glabra. The roots and rhizomes rhizomes of Glycyrrhiza glabra (Fabaceae) is an efficient brain tonic, it increases the circulation into the CNS and balances the sugar levels in the blood. Liquorice has been reported to improve learning and memory on scopolamine induced dementia. The main constituent of Glycyrrhiza glabra is glycyrrhizin. The protective effect of liquorice may be attributed to its antioxidant property which results in reduced brain damage and improved neuronal function and hence enhancing memory.[15]

18) Shankhpushpi (Evolvulus alsinoides)

Evolvulus alsinoides (Convolvulaceae) is used as noortopic or brain tonic in traditional systems of medicines. In the Ayurvedic system of medicine, the whole herb of ‘Shankhpushpi’ has been employed clinically for centuries for its memory potentiating,

anxiolytic and tranquilizing properties. Ethanolic, aqueous and ethyl acetate extracts of Evolvulus alsinoides have been seen to improve learning and memory in rats.[16]

19) Vinpocetine

It is a derivative of vincamine (a phytonootropic from periwinkle) and a less potent mental stimulant than vincamine. Vinpocetine is the preferred nootropic for enhancing blood flow to the brain, eyes and ears. Its effects on cerebral blood flow far exceed all other cognitive enhancers. It enhances brain metabolism by increasing glucose utilization, blood & oxygen flow. It boosts mental energy & cerebral circulation, stimulates the locus coeruleus (specialized neurons involved in information processing, attention, cortical/ behavioural arousal, learning and memory), inhibits platelet aggregation (reduces abnormal blood clots) and has a significant antioxidant effect.[2]

20) Maca

Maca (Lipidium meyenii) Lipidium meyenni (Brassicaceae) known commonly as maca, is an herbaceous biennial plant or annual plant native to the high Andes of Peru and Bolivia. It has showed beneficial improvement on memory and learning. Aqueous and hydroalcoholic extracts of Black Maca have significantly ameliorated the scopolamine-induced memory impairment in mice.[17]

21) St John's Wort

St John's Wort (Hypericum perforatum) It is a perennial plant with extensive, creeping rhizomes. It is a highly valued herb that has been used in healing for more than two thousand years. It shows MAOI activity, treats mild depression and helps to elevate mood and restore mental balance is common for many people.[18]

CONCLUSION

There are a number of promising avenues in the field of memory enhancement, some of which have been discussed in this review. There is now a significant amount of information regarding molecular pathways that are likely to be among the most important targets for enhancing memories; however, much remains to be understood to translate this knowledge into clinical trials.

The study of memory enhancement holds the potential for great progress in the treatment of numerous diseases of the mind, and for developing strategies for more efficient learning and cognitive functions.

Our findings offer many possible applications in the treatment of and care for patients with Alzheimer's diseases.

Many different drugs are classified as cognitive enhancers or nootropics so it is important to find the right one for ones condition.

REFERENCES

1. Nahida Tabassum et al. / Journal of Pharmacy Research, 2012; 5(1): 153-160, Natural Cognitive Enhancers Drpasswater.com [Internet]. Barcelona: Richard Passwater, Ph.D; c1995 [cited 1995]. Available from: http://www.drpasswater.com/ nutrition_library/mental_enhancement.html.
2. Pranav C. Joshi, A review on natural memory enhancer, Unique Journal Of Engineering And Advanced Science, 2013; 8-18.
3. Meikle A, Riby LM, Stollery B. The impact of glucose ingestion and glucoregulatory control on cognitive performance: a comparison of younger and middle aged adults. Hum Psychopharmacol, 2004; 19: 523-35.
4. Flood JF, Morley JE, Roberts E. Memory-enhancing effects in male mice of pregnenolone and steroids metabolically derived from it. Proc Natl Acad Sci, 1992; 89: 1567-71.
5. Nat Rev Neurosci. Author manuscript; available in PMC 2010 Jan 12. Published in final edited form as: Nat Rev Neurosci, 2008 Jul; 9(7): 568–578. New study cites veggies as brain food. Environmental Nutrition, 2009; 32: 6
6. Roberta J Ward, Fabio A Zucca, Jeff H Duyn, Robert R Crichton, and Luigi Zecca, The role of iron in brain ageing and neurodegenerative disorders, Lancet Neurol. Author manuscript; available in PMC 2017 Nov 6. Published in final edited form as: Lancet Neurol, 2014 Oct; 13(10): 1045–1060.
7. Lloyd A. Horrocks Young K.Yeo Pharmacological Research, September 1999; 40(3): 211-225 Regular Article HEALTH BENEFITS OF DOCOSAHEXAENOIC ACID (DHA).
8. Ameer Y. Taha, npj Science of Food, Linoleic acid–good or bad for the brain? , Published 02 January 2020.

9. Vasudevan M, Parle M. Memory enhancing activity of Anwala churna (Emblica officinalis Gaertn.): an Ayurvedic preparation. Physiol Behav, 2007; 91: 46-54.
10. Srithi Srinath /J. Pharm. Sci. & Res, 2014; 6(10): 331-333, Memory Enhancing Medicinal Herbs, Journal of Pharmaceutical Science And Research.
11. Bharti Goel and Neelesh Kumar Maurya, Memory booster herb (natural cognitive enhancers): An overview, International Journal of Physiology, Nutrition and Physical Education, 2019; 4(1): 975-979
12. Stephanie M. Sherman, Timothy P. Buckley, Elsa Baena and Lee Ryan, Frontiers in Psychology, Caffeine Enhances Memory Performance in Young Adults during Their Non-optimal Time of Day, Front Psychol, 2016; 7: 1764. Published online 2016 Nov 14.
13. Walesiuk A, Braszko JJ. Preventive action of Ginkgo biloba in stressand corticosterone-induced impairment of spatial memory in rats. Phytomedicine, 2009; 16: 40-6.
14. Lee D, Park J, Yoon J, Kim MY, Choi HY, Kim H. Neuroprotective effects of Eleutherococcus senticosus bark on transient global cerebral ischemia in rats. J Ethnopharmacol, 6 January 2012; 139(1): 6-11.
15. Dhingra D, Parle M, Kulkarni SK. Memory enhancing activity of Glycyrrhiza glabra in mice. J Ethnopharmacol, 2004; 91: 361-5.
16. Nahata A, Patil UK, Dixit VK. Effect of Evolvulus alsinoides Linn. on learning behavior and memory enhancement activity in rodents. Phytother Res, 2010; 24: 486-93.
17. Rubio J, Dang H, Gong M, Liu X, Chen SL, Gonzales GF. Aqueous and hydroalcoholic extracts of Black Maca (Lepidium meyenii) improve scopolamine-induced memory impairment in mice. Food Chem Toxicol, 2007; 45: 1882-90.
18. 2003, 669-74. 56. Ellis KA, Stough C, Vitetta L, Heinrich K, Nathan PJ. An investigation into the acute nootropic effects of Hypericum perforatum L. (St. John's Wort) in healthy human volunteers. Behav Pharmacol, 12, 2001, 173-82.