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Native medicinal plants of Iran effective on Memory and Learning: A Review

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Abstract : Memory and learning are considered as the most important functional levels of central nervous system (CNS) which helps to encode, store, retain, and recall information in the brain. Since the role of medicinal plants in learning and memory has attracted the attention of many researchers. Therefore, the aim of this review article is to report the native medicinal plants of Iran that are used for memory and learning. According to the findings, *Rosmarinus officinale*, *Ficus carica*, *Melissa officinalis*, *Silybum marianum*, *Glycine max*, *Nigella sativa*, *Cannabis sativa*, *Origanum vulgare* L., and *Boswellia spp.* are some of the native medicinal plants of Iran that are used to improve memory and learning. The mechanism actions of these plants are not fully understood but they could be effective on learning and memory due to their phytochemical compounds and antioxidant activities.

Key words: Memory, Learning, Native medicinal plants, Iran.

Introduction

Learning and memory are closely associated at both cell and behavioral levels [1]. Memory is caused by changes in synaptic conductivity from one neuron to another one, leading to emergence of new or facilitating pathways to control messages in the neural circuit of the brain [2]. Memory and learning are the most important functional levels of central nervous system (CNS). The CNS helps to encode, store, retain, and recall information in the brain. Ageing and stressors are the most important causes of disturbed memory and poor learning. Cholinergic drugs have positive effects on memory and anti-cholinergics, antipsychotics, and anesthetics have negative effects on memory [3, 4].

Human beings have long discovered the values of medicinal plants and used them to treat any pains and diseases [5-20]. The documents in medicine and pharmacy written thousands of years ago contain valuable experiences and information about medicinal plants and phytotherapy [21-32, 101-116]. Medicinal plants are particularly important in different communities' health care systems [33-38], because they could be effective for prevention and treatment of different disorders and diseases such as pediatric diseases, neurological dysfunctions, digestive disorders, hormonal imbalances etc [39-45]. Also the role of the medicinal plants in learning and memory has recently attracted the attention of many researchers [46-49]. In this review article, we are going to report the native medicinal plants of Iran used for memory and learning.

In this review articles, relevant articles were searched for using the relevant search terms including memory, learning, spatial memory, medicinal plants, extract, essence, and Iran in the databases, Scopus, Google Scholar, SID, etc. Then, the findings of selected articles were analyzed.

According to the findings of different studies, *Rosmarinus officinale*, *Ficus carica*, *Melissa officinalis*, *Silybum marianum*, *Glycine max*, *Nigella sativa*, *Cannabis sativa*, *Origanum vulgare* L., and *Boswellia spp.* are some of the native medicinal plants of Iran that are used to improve memory and learning. Table 1 gives further information in this regard.

Alpha-pinene, limonene, camphone, camphor, and 1,8-cineol are some of the compounds of *R. officinale* [59]. Furacoumarines, flavonoids, phenolic acids, and phytosterols are some of the compounds of *F. carica* [60]. *M. officinalis* contains citril, citronel, geraniol, phenolic acids, triterpenes, tannins, and flavonoids [61-63]. *S. marianum* contains bioactive compounds such as silymarin, silydianin, silychristin, dihydrosilibine [64]. Thymoquinone is a main compound of *N. sativa* which many of the therapeutic effects of this plant have been attributed [65, 66]. The main compounds of *O. vulgare* L. include cis-sabinene hydrate, trans-sabinene hydrate acetate, cis-sabinene hydrate acetate, gamma-terpinene, alpha-terpinene, limonene, and terpeneols [67]. Alpha-pinene, limonene, camphone, camphor, 1,8-cineol, furanocoumarins, flavonoids, phenyl acids, citril, citronel, geraniol, triterpenes, tannins, flavonoids, silymarin and silydianin, silychrystin, dihydrosilibine, thymoquinone, tetrahydrocannabinol, cis-sabinene hydrate, trans-sabinene hydrate acetate, cis-sabinene hydrate acetate, gamma-terpinene, alpha-terpinene, and terpeneols are some of the effective compounds of these medicinal plants that are effective in improving memory and learning.

The mechanism actions of these plants are not fully understood. It has been shown that the memory functions are impaired after oxidative stress and oxidative stress contributes to learning and memory deficits following oxidative brain damage [68]. Furthermore antioxidants are effective in enhancement of learning and memory [46, 47].

Conclusion

The medicinal plants introduced in this paper also have antioxidant activity. Therefore, they might, at least in part, act on memory by enhancing antioxidant capacity of the body. If this hypothesis is reliable, hence other plants which have high antioxidant property [69-84] may also ameliorate learning and memory functions. It should be noted that in aging the memory is substantially impaired. On the other hand, aging is, in general, associated with increase in various diseases including diabetes mellitus, atherosclerosis, cancer and impaired immune system. Therefore, medicinal plants with antioxidant activity which are effective in these diseases [85-100] may be more beneficial in patients who are suffered from multiple diseases.

Conflict of Interests

There is no any conflict of interest.

Table 1. Native medicinal plants of Iran effective on spatial memory and learning

Row	Scientific name	Family	Persian name	Descriptions
1	<i>Rosmarinus officinale</i>	Lamiaceae	Aklil-Kohi	500 mg/kg of <i>R. officinale</i> caused decrease in motor activity of mice. Therefore, this plant can increase the ability of healthy and destroyed memory [50].
2	<i>Ficus carica</i>	Moraceae	Anjeer	A study on mice demonstrated that 400 mg/kg of <i>F. carica</i> extract caused a significant decrease in short-term memory compared to control group on the day 10 [51].
3	<i>Melissa officinalis</i>	Lamiaceae	Badranjb ooyeh	The first probe experiment demonstrated the positive effect of low dose (25 mg/kg) of <i>M. officinalis</i> on memory [52].
4	<i>Silybum marianum</i>	Asteraceae	Khar-maryam	Two hundreds mg/kg of <i>S. marianum</i> improved spatial memory on the days 7 and 28 in treatment group compared to lesion group [53].

5	<i>Glycine max</i>	Fabaceae	Soya	Daily intake of 60 mg/kg total extract of <i>G. max</i> for six weeks had a positive effect on learning and spatial memory of ovariectomized rats [54]
6	<i>Nigella sativa</i>	Ranunculaceae	Syahdan eh	A study demonstrated that 400 mg/kg of <i>N. sativa</i> extract improved learning and spatial memory of the mice significantly [55].
7	<i>Cannabis sativa</i>	Cannabaceae	Shahdan eh	A study demonstrated that in all experimental groups treated with 50, 100, and 150 mg/kg of <i>C. sativa</i> extract, the time needed to find hidden platform decreased significantly. Long-term strengthening of memory is done by the mechanism of inhibitory and stimulatory synaptic depolarization in CA1 region of the hippocampus dentate gyrus [56].
8	<i>Origanum vulgare</i> L.	Lamiaceae	Marzanj oosh	Intrahippocampal administration of aqueous extract of <i>O. vulgare</i> L. (0.3, 0.03, and 0.003 µg/kg) can decrease the total traveled distance and elapsed time needed to find the hidden platform in Morris water maze within the days of training [57].
9	<i>Boswellia spp.</i>	Burseraceae	Kondor	Aqueous extract of <i>B. spp.</i> (50 and 100 mg/kg) administered for four weeks caused a significant decrease in the elapsed time and traveled distance and led to learning and development of spatial memory [58].

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