



Biotechnology 2015: Natural products for the treatment of epilepsy

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Abstract

Epilepsy is a neuropsychological disorder caused due to sudden surge of electrical activity in brain. It initiates from mild unawareness and then leads to violent synchronous convulsions. In this disorder nerve cell activity in the brain becomes disrupted and causes episodes of seizures and is also responsible for the unusual behaviour, sensations and sometimes loss of consciousness of the person affected. Conventional pharmacological drugs in the market are not reported to be efficient enough and have also known for various side-effects. There is only about 60-67% success rate for these conventional drugs, which have made the research to shift towards adopting medications primarily comprising of natural plant products having no or less side-effects. Different varieties of plants like, Brahmi harita, Cissus sicyoides, Passion flower and Butea monosporic etc have been reported to have anti-convulsant activities. Many of the active phyto-constituents of these plants are reported to have target oriented and activity. Present study describes beneficial effects of few medicinal plants in the treatment of epilepsy. Epilepsy is a chronic disease that can cause temporary brain dysfunction as a result of sudden abnormal discharge of the brain neurons. The seizure mechanism of epilepsy is closely related to the neurotransmitter imbalance, synaptic recombination, and glial cell proliferation. In addition, epileptic seizures can lead to mitochondrial damage, oxidative stress, and the disorder of sugar degradation. Although the mechanism of epilepsy research has reached up to the genetic level, the presently available treatment and recovery records of epilepsy does not seem promising. Recently, natural medicines have attracted more researches owing to their low toxicity and side-effects as well as the excellent efficacy, especially in chronic diseases. In this study, the antiepileptic mechanism of the bioactive components of natural drugs was reviewed so as to provide a reference for the development of potential antiepileptic drugs. Based on the different treatment mechanisms of natural drugs considered in this review, it is possible to select drugs clinically. Improving the accuracy of medication and the cure rate is expected to compensate for the shortage of the conventional epilepsy treatment drugs.

Epilepsy, which is also commonly known as “goatopathy,” was first recognized in 1997, since when the global campaign against epilepsy (GCAE) has been working on the strategy of “improving access, treatment, services, and prevention of epilepsy worldwide” (Saxena and Li, 2017). As per the World Health Organization data on epilepsy for 2006–2015, the number of people with epilepsy continues to remain high. Epilepsy is a common, severe, chronic neurological disease that affects >70 million people across the world. In fact, it affects individuals irrespective of their ages, gender, ethnic background, or the geographic location (Khan et al., 2020).

The known causes of epilepsy has been reclassified as hereditary, structural, infectious, immunological, metabolic, or unknown (Singh and Trevick, 2016). Increasing attention is being paid to the treatment of epilepsy, and the combination of Chinese and western medicine treatment may be more favored (Li, 2012). On one hand, Western medicine treatment for epilepsy can be mainly categorized as etiological treatment, drug treatment, or surgical treatment (Fu and Qu, 2019), example, levetiracetam and phenytoin sodium carbamazepine. On the other hand, natural drugs have been reported to play an important role in the clinical treatment of epilepsy (Piazzini and Berio, 2015). The effect of natural drugs on epilepsy treatment through different mechanisms has been reported in many articles, and the improvement effect is better.

Presently, the conventional drugs that are commonly used for the treatment of epilepsy include carbamazepine, valproate sodium, phenobarbital sodium, phenytoin sodium, and prelamprone, among others (Fu and Qu, 2019). These drugs also regulate excitatory and inhibitory discharge in the brain and indirectly regulate the excitatory and inhibitory discharge by regulating the ion concentration. Among these, phenytoin sodium has an outstanding curative effect; however, after treatment, adverse reactions such as anemia after reproduction and acute cerebellar ataxia may occur. Carbamazepine treatment is likely to cause rashes, neurotoxic side effects, diplopia, dermatomyositis, blood and respiratory system damage, and other different types of adverse syndromes. In the recent years, new drugs have been proposed to treat epilepsy, including topiramate, lamotrigine, levetiracetam, and gabapentin. When compared with the conventional drugs, the advantages of these natural drugs include a broad spectrum of antiepileptic, involving less adverse reactions, higher safety, and lesser drug interaction. However, for some refractory epilepsy and epilepsy patients with other comorbidities, the use of these drugs obviously cannot meet their needs. Natural medicines retain the natural and biological activities of their constituents (Guo et al., 2015). Natural drugs have limited or no toxic side-effects. In addition, animals do not possess the advantages of drug resistance, hence the use of natural drugs in animals generally leave no drug residue and causes no health hazards. When compared with the conventional medicine used for the treatment of epilepsy, the composition of natural drugs is complex. Although the use of a single drug may not produce outstanding cure rate, it induces slight toxic side-effects, which can reduce a patient's level of discomfort. The combination of natural and conventional medicines may not only reduce the resultant adverse reactions but also improve the overall comprehensive efficacy (Yuan et al., 2019). Therefore, the present study reviewed the active components of natural drugs and the conventional antiepileptic drugs.

The use of Western medicine alone to treat epilepsy has been reported to induce more adverse reactions. For instance, the use of phenytoin sodium alone can cause gastrointestinal irritation, and its long-term use can cause gingival hyperplasia, nervous system dysfunction, and hematopoietic system disorders. The use of carbamazepine alone may induce dizziness, nausea, vomiting, and ataxia as well as occasional aplastic anemia and granulocytopenia. Valproate alone can cause nausea, vomiting, lethargy, tremor, hair loss, and hepatotoxicity. The use of an antiepileptic alone may induce anorexia, nausea, dizziness, and drowsiness.

The present paper reviewed the effects of active components of natural drugs on epilepsy, including flavonoids, alkaloids, glycosides, coumarins, and terpenoids. Among the monomer components, flavonoids, alkaloids, and terpenoids demonstrated significant activity against epilepsy. We have summarized the methods for the prevention and treatment of epilepsy by balancing excitatory and inhibitory neurotransmitters and inhibiting neuroinflammation, oxidative stress, and mitochondrial dysfunction. In addition, we innovatively summarized the combined methods of natural drug monomer compounds and natural drug compound as well as conventional antiepileptic drugs, expecting to bring hope to epileptic patients and provide them with a credible reference for improving the epilepsy cure rate.

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