2. LITERATURE REVIEW

1. **Schachter, 2009** has showed that botanicals and herbs have a centuries-old tradition of use by persons with epilepsy, in many cultures around the world. They have reviewed the use of herbal therapies for epilepsy, approach to the scientific assessment of herbal therapies as potential therapies for patients with epilepsy.

2. **Sankari et al., 2010** has reported the anticonvulsant effect of Ethanolic extract from the leaves of *Aegle marmelos* on maximal electroshock (MES) or pentylenetetrazole (PTZ) in male mice examined in this study.

3. **Ribeiro et al., 2003** has studied the anticonvulsant and convulsant profiles of nantenine, an aporphine alkaloid found in several vegetal species. At lower doses (20–50 mg/kg, i.p) the alkaloid proved to be effective in inhibiting pentylenotetrazol- (PTZ 100 mg/kg, s.c) and maximal electroshock- induced seizures (80 mA, 50 pulses/s, 0.2 s), suggesting its potential as an anticonvulsant drug.

4. **Quintans et al., 2008** has perform phytochemical screening and investigate the possible anticonvulsant effects of the essential oil (EO) from fresh leaves of *Cymbopogon winterianus* (Poaceae) in different models of epilepsy. The phytochemical analysis of EO showed presence of geraniol (40.06%), citronellal (27.44%) and citronellol (10.45%) as the main compounds.

5. **Bienvenu et al., 2002** has reported that water extract of *Leonotis leonurus* was tested for anticonvulsant activity against seizures produced in mice by pentylenetetrazole, picrotoxin, bicuculline and N-methyl-DL-aspartic acid (intraperitoneal injections). High performance liquid chromatography (HPLC) and phytochemical tests carried out respectively show a spectrum profile, characteristic of *L. leonurus* and the presence of alkaloids, saponins and tannins in the extract.

6. **Rao et al., 2005** studied Ethanol extract of the roots of *Nardostachys jatamansi* DC, (Valerianaceae) for its anticonvulsant activity and neurotoxicity, alone and in combination with PHE in rats. The study demonstrated a significant increase in the seizure threshold by *Nardostachys jatamansi* root extract against MES model as indicated by a decrease in the extension/flexion ratio. However, the extract was ineffective against PTZ-induced seizures.

7. **Artemisia dracunculus** L. (Asteraceae) has been used orally as an antiepileptic remedy in Iranian folkloric medicine. **Sayyah et al., 2004** examined the anticonvulsant potential and composition of the essential oils obtained from the aerial parts of the plant. The essential
oils exerted dose and time-dependent antiseizure activity in both MES and PTZ models of experimental seizures. It was concluded that anticonvulsant and sedative effects could be related to the presence of monoterpenoids in the EO.

8. Nogueira and Vassilieff, 2000 showed that hexanic fraction of *Rubus brasiliensis* (300 mg / kg) prevented the PTZ (70 mg/kg/ip)- induced seizures. The fraction was found to contain a benzodiazepine like principle and hence indicated possible involvement of GABAA receptors.

9. Murbach Freire et al., 2006 showed that *Ocimum gratissimum* L. (Lamiaceae) and other species of the same genus are used as medicines to treat CNS diseases, commonly encountered in warm regions of the world. The study suggested that these compounds could explain the differences observed in the biological activity in EO obtained in different seasons of the year.

10. *Ferula gummosa* Boiss is a reputed drug in Iranian traditional medicine and has been used as antiepileptic remedy. The evaluation of seed acetone extract carried out by Sayyah et al., 2002 reported its anticonvulsant effect against PTZ- and MES-induced convulsions.

11. Achliya et al., 2004 studied sedative and anticonvulsant activities of Unmadnashak Ghrita. ‘Unmadnashak Ghrita’ is Ayurvedic formulation containing *Ferula narthex* (6 g), *Gardenia gummifera* (6 g), *Ellataria cardamom* (6 g), *Bacopa monneri* (6 g), and cow’s ghee (clarified butter fat) (76 g). The formulation antagonized the behavioral effects of CNS-stimulant drug amphetamine and showed analgesic effect in mice. These studies suggested that Unmadnashak Ghrita has CNS-depressant and anticonvulsant activity in mice.

12. Jager et al., 2005 showed that aqueous and ethanol extracts of six plants, *Acrotome inflata*, *Aptosimum indivisum*, *Asparagus suaveolens*, *Barleria bolusii*, *Commiphora marlothii* and *Sesamum triphyllum*, which constitutes were tested in the GABAA-benzodiazepine receptor binding assay. The ethanol extract of all six plants extracted together was more active than the aqueous extract.

13. Sayyah et al., 2005 examined the anticonvulsant activity of acetone extract of the seeds of *Heracleum persicum* (Umbelliferae) against PTZ- and MES-induced seizures in mice. It was suggested that the observed pharmacological effects could be due to alkaloids, terpenoids and triterpenes present in the plant.

14. *Kalanchoe crenata* Andr. (Crassulaceae) is a fleshy herbaceous plant used in the African traditional medicine as remedies against otitis, headache, inflammations, convulsions and general debility. Nguelefack et al., 2006 has evaluated the analgesic effects of methylene
chloride/methanol (1:1) extract and its hexane, methylene chloride, ethyl acetate, n-butanol fractions and aqueous residue using acetic acid, formalin and pressure test. The study suggested a peripheral and central analgesic activities as well as an anticonvulsant effect of the leaves of *Kalanchoe crenata*. It is proposed that PTZ induces convulsion by either inhibiting GABA pathway in CNS or by increasing the central noradrenergic activity.

15. **Yemitan and Adeyemi, 2005** studied the aqueous root extract of *Lecaniodiscus cupanioides* was used to the central nervous system depressant activity pattern of the plant. The data obtained support the hypothesis that the aqueous root extract of *Lecaniodiscus cupanioides* may correlate to both GABAergic and glycine inhibitory mechanisms.

16. **Singh et al., 2008** reported that the BAs elicited significant anti-inflammatory and anti-arthritic activity in rat and mouse models of paw and ear inflammation. The results of the study revealed that the effect observed through this route is in accordance to the study conducted with the systemic route, thus establishing that BAs when used through topical application is as effective as through the systemic route.

17. **Norihiro et al., 2006** reported anti-inflammatory activities of the triterpene acids (BAs) from the resin of *Boswellia carteri*. Although several studies have already been reported on the pharmacological properties especially on the anti-inflammatory activity of *Boswellia carteri* resin and BAs. The ethnomedicinal importance of *Boswellia carteri* and its components (BAs) were investigated for their anti-inflammatory activity.

18. **Safayhi et al., 1992** has reported that Acetyl-11-keto-β-boswellic acid (AKBA) act as a Non-compititive inhibitor of 5-Lipoxygenase (5-LOX). 5-LOX is the key enzyme for the biosynthesis of leukotrienes (LT) which are putative mediators of many hypersensitivity and inflammatory based human diseases. They had concluded that there exists an enzyme directed selective effector site for pentacyclic triterpenes with and without inhibitory activity and that AKBA acts as a noncompetitive inhibitor of the 5-LOX.

19. **Singh et al., 2007** has reported the synergistic effect of BAs and glucosamine for anti-inflammatory and anti-arthritic activities in rats. Two studies were conducted, that is, acute anti-inflammatory by carrageenan edema and chronic anti-arthritic by Mycobacterium-induced developing arthritis. They had concluded that synergistic effect was observed in chronic inflammatory conditions when two chemical entities were administered in combination in preclinical study.
20. Bruno et al., 2008 have evaluated in vitro cytotoxicities of *B. serrata* extract and AKBA on differentiated and undifferentiated keratinocytes (HaCaT and NCTC 2544), and foetal dermal fibroblasts (HFFF2), using neutral red uptake (NRU), MTT, and DNA assays. Comparison between NRU and MTT, and between the extract and AKBA, suggested a relatively higher toxicity of both substances on lysosomes respect to mitochondria.

21. Ruxiang (*Gummi olibanum*), the dried gum resin of *Boswellia carterii* (BC), has been used in traditional Chinese medicine to alleviate pain and inflammation for thousands of years. Fan et al., 2005 has reported in random, blinded study, the anti-arthritic effects of a BC extract compared to vehicle control in a Lewis rat adjuvant arthritis model (n = 8/group). The data show that BC extract has significant anti-arthritic and anti-inflammatory effects and suggest that these effects may be mediated via the suppression of pro-inflammatory cytokines.

22. Gupta et al., 1998. Indian researchers evaluated a formula containing *Boswellia serrata*, *Withania somnifera*, *Curcuma longa* and zinc complex in a study of patients with osteoarthritis. They found that treatment with this formula produced a significant drop in severity of pain and disability score. However, they also observed side effects during the treatments.


24. Wildfeuer A, et al., 1998. Acetyl boswellic acids, pentacyclic triterpenes extracted from the gum resin of *Boswellia serrata* significantly inhibited the ionophore-stimulated release of the leukotrienes B4 and C4 from intact human polymorphonuclear neutrophil leukocytes.

25. Safayhi et al., 1992. Isolated isomers of boswellic acid (BAs), 11-keto-beta-boswellic acid and acetyl derivatives from the gum resin of *Boswellia serrata*. They found that boswellic acids and derivatives decreased the formation of leukotriene B4 in rat peritoneal neutrophils.

27. Gupta, 1998. The gum resin of *Boswellia serrata*, known in Indian Ayurvedic system of medicine as salai guggal, contains boswellic acids, which have been shown to inhibit leukotriene biosynthesis.

28. Y. J. et al., 2006. With very limited studies, Indian researchers proposed that hexane extract of oleo-gum-resin of *Boswellia serrata* might benefit liver injury induced by carbon tetrachloride, paracetamol or thioacetamide.

29. Dennis et al., 1999. The essential oil from the gumoleoresin of *Boswellia serrata* showed juvenomimetic activity when tested at 1:10-1:50 acetone dilution on *Dysdercus similis* V instar nymphs. Its terpene constituents were characterised by GLC and GC-MS analysis.

30. Bikram et al., 2007. The essential oils of *Boswellia serrata* Roxb. ex Colebr. oleo-gum-resin collected from four different locations (samples A–D) were isolated by hydrodistillation and analysed by means of GC and GC–MS. Thirty-five components were identified, comprising 82%, 91%, 77% and 82% of samples A, B, C and D, respectively. α-Thujene was one of the major constituents in all samples, whereas α-pinene was recorded in only one sample. All the oils were dominated by monoterpene hydrocarbons.

31. Babita et al., 1995. Two new triterpenoids, 2α, 3α-dihydroxy-urs-12-ene-24-oic acid and urs-12-ene-3ct, 24-diol, have been isolated from the gum resin of *Boswellia serrata*.

32. Dennisa et al., 1999. The essential oil from the oleo gum resin of *Boswellia serrata* showed juvenomimetic activity when tested at 1:10]1:50 acetone dilution on *Dysdercus similis* V instar nymphs. Its terpene constituents were characterised by GLC and GC-MS analysis.