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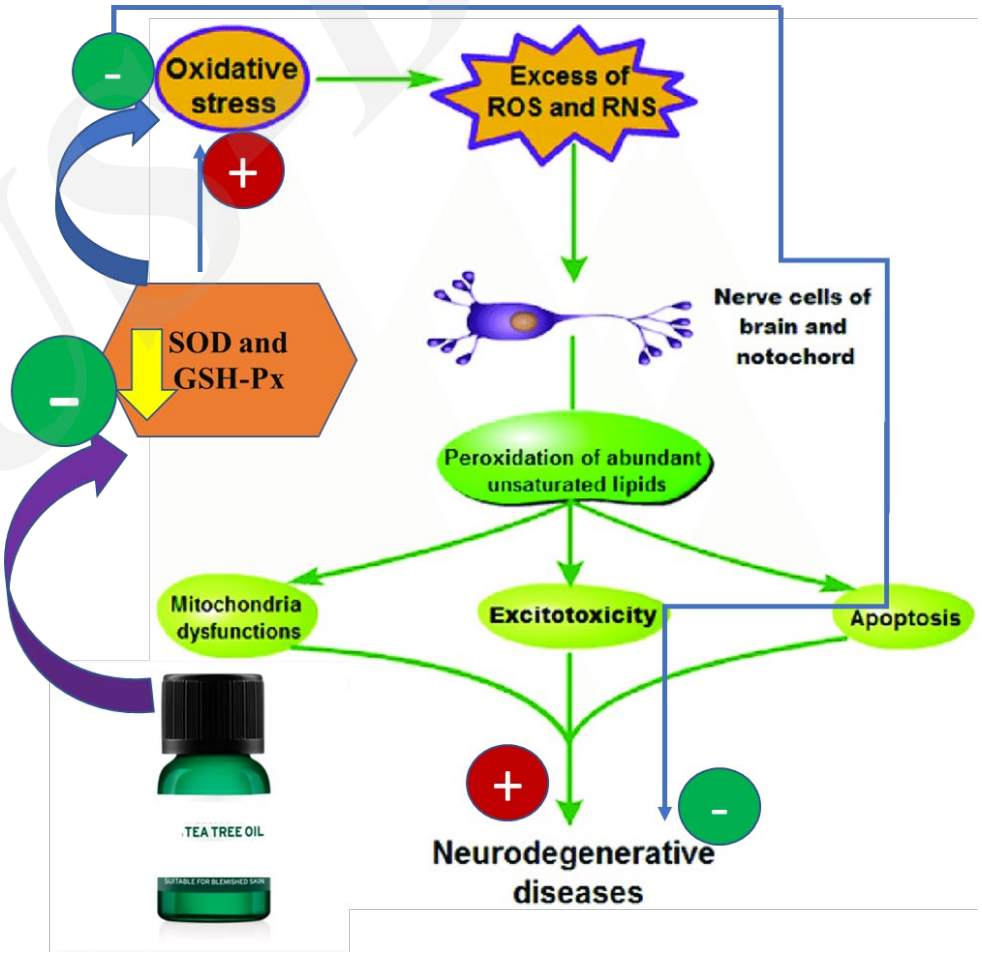
Tea tree oil, a vibrant source of neuroprotection via neuroinflammation inhibition: a critical insight into repurposing *Melaleuca alternifolia* by unfolding its characteristics

Key words: Tea tree oil; anti-inflammatory; anti-viral; antibacterial and *in silico*, terpinen-4-ol; 1,8-cineole; neuroprotective effect

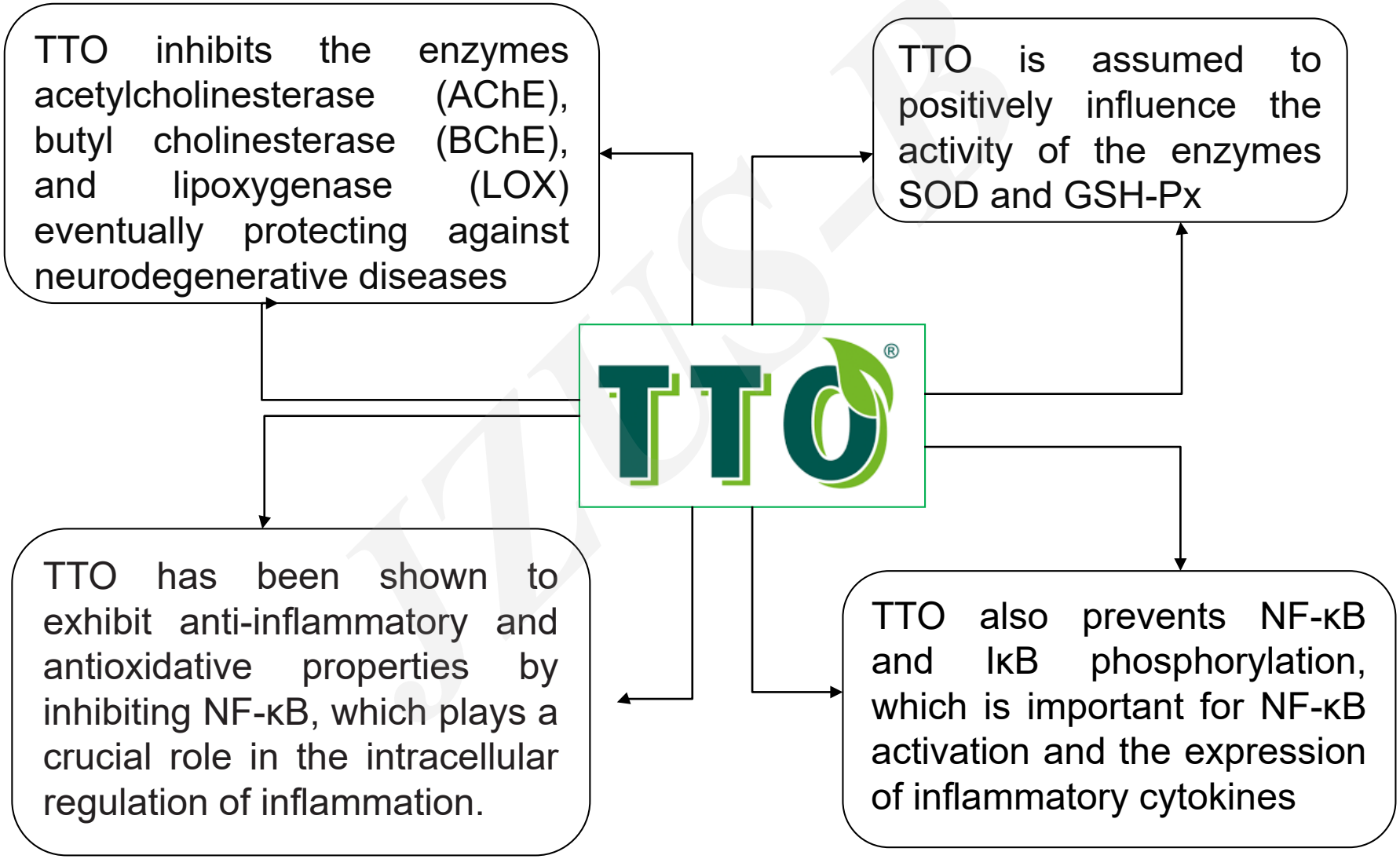
Research Summary

This review mainly focused on the therapeutic prospect of Tea tree oil to be a neuroprotective target through the inhibition of neuroinflammation

- The mechanistic approach to how anti-inflammatory and immunomodulatory functions help support the prospective neuroprotection
- The impact of antioxidative potential of TTO is connected to justify the major focus
- The role of major components of TTO is linked with its effects



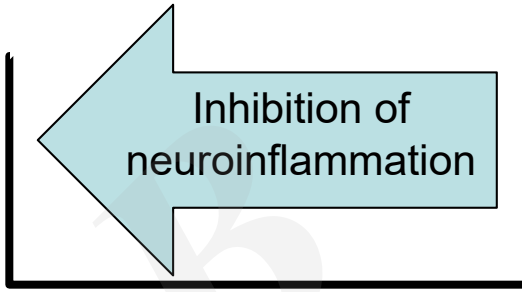
Innovation points



Innovation points

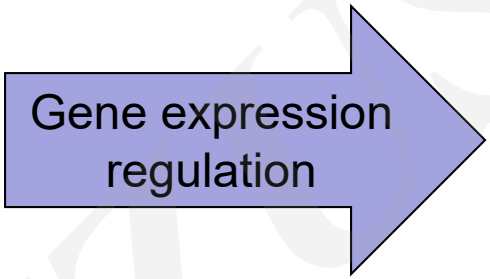
TTO plays significant immunomodulatory role via reducing the production of

- tumor necrosis factor-α (TNF-α)
- interleukin (IL)-1b, IL-6, IL-10, and prostaglandin E_2 ($PGE_{2)}$ in lipopolysaccharide (LPS)-stimulated macrophages
- Preventing neuroinflammation



TTO regulates a set of genes such as

- SREBP1c, *ACC1* and *FAS* are found to be necessary for fatty acid synthesis and deposition.
- TTO also upregulates the downstream targets (*CPT1A* and *CPT2*) of PPARα



TTO escalated the mRNA expression of

- Growth acceleration hormone (GH),
- Insulin-like growth factors-I (IGFs-I)
- Heart fatty acid-binding protein (H-FABP)

TTO decreased the mRNA expression of calpain-1 (CAST) and myostatin gene (MSTN)