

Discussion and Conclusion:

Discussion

In this study, I confirmed that *Drosophila* with the *rdl* mutation, which leads to reduced GABA levels, exhibit behaviors that are consistent with catatonia-like symptoms. The GABA-deficient flies exhibited reduced locomotion, a major indicator of motor impairment typical in catatonia. The lack of adequate motor function and inability to respond to sensory stimuli, like movement or sucrose attraction, is in line with the major symptoms of catatonia. As a result, these flies with the *rdl* mutation serve as an appropriate model for testing potential therapeutic interventions aimed at improving catatonia-related motor and sensory deficits.

Having established that *rdl* mutant flies express catatonia-like behavior, the study focused on testing whether different concentrations of Ashwagandha could improve these symptoms. The results demonstrated a clear pattern: as the concentration of Ashwagandha was increased, the motor activity of the flies, including negative geotaxis climbing ability, was augmented. Greater levels of Ashwagandha led to higher levels of activity and attraction towards sucrose, indicating some of the catatonia-like features of the *rdl* mutant flies were reversed. ANOVA test demonstrated that the difference in motor function and chemosensory response with Ashwagandha levels was statistically significant, demonstrating that Ashwagandha supplementation exerts a modulatory effect on catatonia symptoms. The improvement in sensory as well as motor functions supports the hypothesis that Ashwagandha is therapeutically effective in the management of GABAergic dysfunction and thus catatonia. The findings of this study provide valuable insight into the possible use of Ashwagandha as a therapeutic intervention for catatonia-related diseases and warrant further investigation into its mechanisms of action.

Future Investigation

Expanding the investigation into GABAergic dysfunction in catatonia can provide a deeper understanding of the neurobiological mechanisms involved in this condition. Future studies can include investigating the interaction between GABA and dopamine, two neurotransmitter systems that have already been implicated in catatonia. Research on how these two systems interact with one another may reveal new information about the pathophysiology of catatonia and guide the development of more specifically targeted treatments. Furthermore, the examination of the action of other GABAergic antagonists and other interventions would constitute a more thorough exploration of the potential therapeutic agents to restore GABAergic function and alleviate the symptoms of catatonia. In addition to further exploring the genetic underpinnings of GABAergic dysfunction, future research may employ specific mutant *Drosophila* lines bearing identified genetic mutations in the GABA system and employ techniques such as quantitative PCR (qPCR) to analyze gene expression modulation following these mutations. This may determine the key genes participating in GABAergic signaling and the contribution of such genes to neuropsychiatric disease. Finally, extending these findings to mammalian models, including rodents, would be necessary to validate the involvement of GABAergic dysfunction in catatonia and assess the therapeutic potential of Ashwagandha and other treatments in a more sophisticated, vertebrate system. By bridging the gap between *Drosophila* and mammalian models, these experiments could provide a gateway to new therapeutic strategies in the treatment of catatonia and other associated disorders in humans.

Conclusion

This study successfully demonstrated that GABA-deficient *Drosophila* experiences sensory and motor impairments consistent with catatonia-like symptoms and that Ashwagandha supplementation can significantly improve these deficits. Results from the chemosensory assay and the negative geotaxis assay offer compelling evidence that Ashwagandha has the potential to restore sensory and motor function in a GABA-deficient model. By showing the therapeutic effects of Ashwagandha in both assays, this research not only highlights the utility of *Drosophila*

as a catatonia and GABA disorder model but also suggests that Ashwagandha may be a novel therapeutic drug for treating motor and sensory dysfunction. Further studies investigating the mechanisms and testing Ashwagandha in other neurological models will be critical in establishing its therapeutic significance.