Examining a Link between Paraquat, Alpha-Synuclein Fibrillation and Neurodegeneration: A Review

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Parkinson's disease is a progressive and chronic disorder that causes motor system dysfunction due to a lack of dopamine in the central nervous system. Although this disorder has been researched extensively, the etiology of Parkinson's disease remains unknown. Paraquat, an herbicide commonly used in agriculture since the 1930s, is associated with neurotoxicity and neurodegeneration. To conduct this review, I analyzed epidemiological studies on the correlation between pesticides and Parkinson’s disease, research on the link between pesticides and the protein alpha-synuclein, and examined the link between alpha-synuclein and Parkinson's disease.

From this review, I found that areas that are exposed to high levels of paraquat experience elevated rates of Parkinson's disease in their populations, that paraquat is positively correlated with the aggregation of alpha-synuclein, and that an increase in alpha-synuclein causes neurodegeneration due to an imposed neurotoxicity or through an oxidative stress pathway. This review clearly points to a strong correlation between paraquat exposure and the pathogenesis of Parkinson's disease. This review leads to the recommendation of future research that solely tests the effect of paraquat on alpha-synuclein fibrillation and neurodegeneration in mice. This work would clarify the definitive link between paraquat and the pathogenesis of Parkinson's disease thus informing the practices of those who use pesticides.

Results/Discussion

- According to epidemiological research, there is a positive correlation between pesticide exposure and the pathogenesis of Parkinson’s Disease.
- A specific pesticide, paraquat, is associated to neurodegeneration based on its ability to increase alpha-synuclein fibrillation and oxidative stress.
- Alpha-synuclein fibrillation and oxidative stress have been linked to the molecular mechanisms of Parkinson’s Disease based on their abilities to degenerate dopaminergic neurons.
- Therefore, paraquat is a cause for the pathogenesis of Parkinson’s Disease and is a key component in the environmental etiology of Parkinson's Disease.

A call for new studies is necessary to further support the claims stated in this research; experiments should be conducted to directly examine paraquat exposure on the degeneration of dopaminergic neurons.

Conclusion

- Epidemiological research correlates pesticide exposure to elevated rates of Parkinson’s disease in various populations around the world. Research on paraquat and pesticides associates paraquat to neurodegeneration because of its ability to remain unbound to flavin. In addition, research on alpha-synuclein shows that alpha-synuclein is the primary mechanism for Parkinson’s disease development at the molecular level. As a result, paraquat is a cause for the pathogenesis of Parkinson's disease. As a result, paraquat is a cause for the pathogenesis of Parkinson's disease and is a key component in the environmental etiology of Parkinson's disease.

- Although a conclusion has been made about the environmental etiology of Parkinson's disease, a call for new studies is necessary to further support the claims stated in this research study. An experiment should be conducted to directly test paraquat exposure on the degeneration of dopaminergic neurons. This can be done by exposing mice to water, which would simulate contaminated well water exposure, that varies in paraquat concentrations and then measuring both alpha-synuclein fibrillation and neurodegeneration in the central nervous system of mice. The experimental groups would also be compared to a control group, which consists of mice that are not exposed to paraquat. In this experiment, quantitative data would show paraquat’s ability to cause the molecular mechanisms of Parkinson’s disease and qualitative data would show the onset of external Parkinson’s disease symptoms such as motor dysfunction in the mice. This type of future research would advance Parkinson's disease research to a point where paraquat is widely accepted to be a component in the environmental etiology of Parkinson’s disease and thus similar substances to paraquat may come under review because of their potential to cause Parkinson's disease.

Works Cited