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Combining Epidemiology and Toxic genomics to Support an Unfocused Investigation of Pesticide Exposure and Parkinson's Disease

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Abstract

In agriculture, pesticides have been used extensively for more than 50 years. The majority of the thousands of presently in use, though, have not been fully evaluated for their impact on Parkinson's disease (PD).

Keywords: Toxic genomics; Pesticides; Parkinson's disease

Introduction

For more than 50 years, pesticides have been used extensively in agriculture all around the world. At this time, the chemical industry had rapid growth, which facilitated the launch and widespread commercial use of numerous goods. For instance, 13,540 pesticide formulations and 1,074 various active chemicals are now approved for usage in the state of California (California Department of Pesticide Regulation, 2021). Modern commercial agriculture relies heavily on pesticides to assist maximise food output. However, because pesticides are deliberately made to kill living things (such as plants, fungus, insects, and rodents), they must be adequately evaluated for any possible negative effects on human health, especially when used on a large basis. The majority of the time, chronic exposures, mixtures, or sequential treatments with different pesticides are not taken into account in the toxicity testing used to register pesticides in the United States. Instead, it is usually based on single-product, single-target assessments using rodents as model organisms [1, 2].

Methods

Classification of herbicides

A set of 70 targeted pesticides, a set of positive and negative control pesticides, and a set each were the three sets of pesticides we started with. In our earlier pesticide-wide association analysis, the 70 specific chemicals of interest were identified by association testing with PD (Paul et al., 2022). In order to conduct this PEWAS, we employed an unbiased approach to look into every pesticide used on farms close to the homes and workplaces of 1,653 study participants who resided in three agricultural counties in Central California (Kern, Fresno, ant Tulare) based on the study population's exposure prevalence [3,4].

Database for comparative toxic genomics

A publicly accessible database called the CTD aims to advance our knowledge of how environmental exposures affect human health. The database links information about chemicals, genes, phenotypes, diseases, and exposures to give contextualised knowledge about chemical exposures and human health through manual curation of peer-reviewed scientific literature. To keep the database complete and up to date, the CTD incorporates new research once a month [5, 6].

High-throughput quantitative screening assay results, tox21

The Environmental Protection Agency (EPA), the National Toxicology Program (NTP) at NIEHS, the National Center for Advancing Translational Sciences (NCATS) at NIH, and the Food and Drug Administration (FDA) are working together as part of the Tox21 project to experimentally evaluate the toxicity of thousands of chemical compounds that may interfere with bodily functions using in vitro biologic assays [7,8].

Discussion

Several epidemiologic studies have shown that pesticides are among the environmental risk factors that are most consistently linked to Parkinson's disease (PD). Epidemiologic studies and experimental investigations, however, have not been able to fully evaluate long-term, low dose exposure related health effects for the majority of agents due to the needs of commercial agriculture for variety in agents that are tailored to emerging and reemerging pests as well as the large number of pesticides currently in use, i.e., 1074 active ingredients alone registered in California.

Conclusions

Overall, a range of specific pesticides have been linked to PD risk by our thorough, pesticide-wide association research and toxicologic/toxicogenomic integration. We were able to link pesticides to specific biologic and molecular targets relevant to the aetiology of Parkinson's disease (PD) thanks to cross-database queries we carried out and presented here. This information can help us better understand the involvement of pesticides in the genesis of Parkinson's disease (PD) and prioritise experimental pesticide research [9,10].

Acknowledgement

None.

Conflict of Interest

None.

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