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Interrelationship between paraquat poisoning and Parkinson's disease: a systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

Support - The author(s) received no financial support for the research.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 April 2024 and was last updated on 26 April 2024.

INTRODUCTION

Review question / Objective Prior research has indicated that paraquat (PQ) facilitates the initiation and advancement of Parkinson's disease (PD). Conversely, conflicting findings from other studies suggest that PQ exhibits no association with the progression of PD. This meta-analysis sought to examine the impact of PQ on the incidence of PD.

Condition being studied In recent years, pesticide (e.g., PQ) residues in drinking water and food have been recognized as an important PD-inducing factor. Despite ongoing enhancements in pesticide types and application methods, coupled with a reduction in their usage and residual levels, the diverse array of pesticide residues found in agricultural products and processed foods remains a potential challenge to food safety.

Epidemiological research has revealed a significant increase in the incidence of PD among farmers frequently exposed to pesticides and herbicides (e.g., PQ), as well as among residents who consume water from contaminated rivers and wells. Presently, clinical studies are being conducted to examine the association between PQ poisoning and PD.

METHODS

Search strategy A computerized search was executed on Pubmed, Embase, Cochrane, WebScience, and Scopus for relevant literature from the time of their inception to October 3, 2024. The English search terms included Parkinson's Disease, Pesticide, and PQ, and the subject was limited to Humans. Moreover, a manual search of references from the included studies and related

reviews was conducted to obtain additional relevant literature.

Participant or population A cumulative total of 13,671 studies were obtained from the database search. Subsequently, 13,490 studies were excluded by deduplication and reading titles and abstracts. Further screening by reading the full text of the 181 initially included articles resulted in the exclusion of 33 reviews, 17 abstracts, 4 animal studies, 28 studies without a control group, 27 studies without PD patients in the population, 47 studies without PQ exposure data, 3 studies of children or pregnant women, and 8 studies with duplicated data. Ultimately, 14 studies were incorporated into the meta-analysis, encompassing 4,732 cases of PD and 227,507 controls. Of these, 7 were from the United States, 3 were from Canada, 1 was from China, 1 was from New Zealand, 1 was from France, and 1 was from Finland.

Intervention Reduce indirect or direct contact with paraquat.

Comparator Paraquat group: able to indirectly or directly contact paraquat; Control group: No indirect or direct contact with paraquat.

Study designs to be included The inclusion criteria for this research were as follows: (1) Adults. (2) Observational study. (3) Study on the relationship between PD and PQ. (4) Extractable relevant data.

Eligibility criteria The inclusion criteria for this research were as follows: (1) Adults. (2) Observational study. (3) Study on the relationship between PD and PQ. (4) Extractable relevant data. The exclusion criteria for this research were as follows: (1) Reviews, case reports, abstracts, and other types of literature. (2) Non-human studies. (3) Absence of control group. (4) Duplicate data. (5) Children or pregnant women.

Information sources A computerized search was executed on Pubmed, Embase, Cochrane, Webfscience, and Scopus for relevant literature from the time of their inception to October 3, 2024. The English search terms included Parkinson's Disease, Pesticide, and PQ, and the subject was limited to Humans.

Main outcome(s) This meta-analysis sought to examine the impact of PQ on the incidence of PD.

Quality assessment / Risk of bias analysis Cohort studies and case-control studies were

assessed utilizing the Newcastle-Ottawa Scale (NOS) evaluation scale. Specifically, cohort studies were evaluated regarding study population selection, group comparability, and outcome measures. Case-control studies were assessed in terms of study population selection, group comparability, and measurement of exposure factors.

Strategy of data synthesis Statistical analysis was carried out by utilizing STATA 17.0 and RevMan 5.4 software. ORs were employed as statistical effect sizes for dichotomous variables. Q-test and chi-square test were employed to assess the heterogeneity of the study. In addition, the random effects model was employed for statistical analysis. By utilizing funnel plots and the begg test, publication bias was assessed. Differences were deemed statistically significant at a value of $P < 0.05$.

Subgroup analysis Exposure to PQ has been identified as a factor contributing to the increased incidence of PD. Nevertheless, it is crucial to recognize that variables such as gender, exposure conditions, and regional disparities may introduce variations in the PQ-induced PD incidence. Therefore, based on gender, exposure conditions, and regional divisions, subgroup analyses was used to effect of variables on exposure PQ contributing to the increased incidence of PD.

Sensitivity analysis Sensitivity was measure by STATA 17.0 software.

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Keywords Paraquat; Parkinson's disease; Systematic reviews; Meta-analysis; Evidence-based medicine.

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