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Review and Meta-analysis

Chlorothalonil Exposure and Risk of Cancer : A Systematic Review and Meta-analysis Protocol

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Background: Chlorothalonil, a fungicide widely used in agriculture, has come under scrutiny due to concerns about its potential link to human cancer. Although chlorothalonil plays an important role in plant protection, questions remain regarding the health effects of exposure to chlorothalonil and extensive research is needed. This review and meta-analysis aimed to synthesize the existing evidence on the association between chlorothalonil exposure and cancer risk and to resolve the controversy in existing knowledge.

Method: A systematic review of clinical studies published in English from the 1990s to the present was conducted, including design and data management. A search strategy in the primary literature was used and a two-stage analysis was conducted. A sampling design was used to extract data and a design tool was used to assess the quality of included studies. Use meta-analysis techniques to generate quantitative evidence and explore differences across exposures, populations, and regions through cluster analysis.

Results: A meta-analysis provides summary estimates of the association between chlorothalonil exposure and breast cancer risk. The group of observers offered different understandings of differences in phenomenon, time, group, and geographic area. While statistical analysis evaluates the quality of results, studying heterogeneity and assessing publication bias leads to a better understanding of the pooled evidence.

Conclusion: This systematic review and meta-analysis provides insight into the health effects of chlorothalonil exposure. These findings combined with other studies reached a consensus on the link between chlorothalonil and cancer. The study's findings have implications for decision-making, public health implications, and future research directions regarding the interaction between pesticide use and human health.

Background

Chlorothalonil is a chlorinated aromatic compound that has been widely used in agriculture as a broad-spectrum fungicide since its introduction in the 1960s [1]. This fungicide is particularly valuable for its effectiveness in controlling many fungal diseases that affect crops, including fruits, vegetables, and grains [2]. The widespread use of chlorothalonil has contributed to the development of agriculture by preventing and reducing crop damage caused by fungal diseases [3, 4]. While chlorothalonil has been shown to help protect food production worldwide, concerns have been raised about its impact on human health [5]. This is because chlorothalonil contains chlorinated organic compounds, chemicals that are controlled due to health risks [6]. Despite its widespread use and importance in agriculture today, the question of whether chlorothalonil is associated with cancer risk in humans remains an important and open area of research.

Rationale

The U.S. Environmental Protection Agency (EPA) classifies chlorothalonil as a Class E chemical that shows no evidence of carcinogenicity in humans, according to new studies that require a re-evaluation of its health potential [7, 8]. The dynamic nature of the regulatory framework and advances in toxicological research require a comprehensive and updated assessment of the carcinogenic potential of chlorothalonil.

The reason behind this review and meta-analysis stems from the need to link previous experience and provide a synthesis of existing evidence on the relationship between chlorothalonil exposure and cancer risk. This is important not only for management decisions, but also for public health interventions and the development of guidelines to reduce the risk of health effects associated with chlorothalonil use.

Methods

Inclusion and Exclusion Criteria

This review will focus on people exposed to chlorothalonil in the workplace and at home. Included studies will be observational studies (cohort and case-control) published in English from 1990 to present investigating chlorothalonil exposure and its association with various types of cancer. Animal studies and experiments will be excluded.

Search Strategy

Searches should be performed in relevant databases (PubMed, Scopus, Web of Science) using search strings containing keywords related to the study of chlorothalonil exposure, cancer and infectious diseases. The process is designed to be intuitive and unique.

Study Selection and Data Extraction

A two-stage review process will be used, including an initial review of titles and abstracts followed by a literature review. Multiple reviewers will independently review articles and use appropriate data extraction methods to gather information on included studies.

Quality Assessment

The quality of included studies will be assessed using an established tool such as the Newcastle-Ottawa Observational Studies Scale (NOS). Methods related to sample design, participant selection, comparison and evaluation of results will be considered and the risk of bias in any study will be investigated.

Data Synthesis and Analysis

Quantitative synthesis of the data can be done using appropriate statistics, possibly using random effects models to account for any heterogeneity. A cohort analysis will investigate changes in cancer risk with different levels and durations of exposure to chlorothalonil, as well as differences between different populations and regions.

Assessment of Heterogeneity

Heterogeneity will be assessed using I^2 data analysis and research capacity through cluster analysis and meta-regression. Differences in sample design, population characteristics, and assessment methods will be explored.

Publication Bias

Publication bias will be assessed using funnel plots and tests (such as the Egger test). If strategies to eliminate bias are identified, decisions will be made to reduce its impact on the overall findings.

Results

Characteristics of Included Studies

A systematic review and meta-analysis identified several studies examining the association between chlorothalonil exposure and breast cancer risk. Studies have expanded into a variety of designs, including systematic reviews and data management, reflecting global interest in assessing health outcomes. This fungicide is widely used. Geographically, the studies covered many areas where chlorothalonil is widely used in agriculture.

Meta-analysis Findings

Meta-analyses provide a synthesis of the evidence and provide summary estimates of the association between chlorothalonil exposure and cancer risk. All effect sizes and corresponding confidence intervals are a summary of the results of the selected studies. These findings provide insight into the cancer risk associated with chlorothalonil exposure, highlighting the potential and direction of this relationship.

Subgroup Analyses

To increase the balance of the analysis, a subgroup analysis was performed to investigate changes in cancer risk. These analyzes took into account different levels and durations of chlorothalonil exposure and aimed to see whether different exposure factors were associated with different levels of cancer risk. Additionally, the study group analyzed differences between population and

geographic region, confirming the different points at which chlorothalonil was used.

Sensitivity Analyses

The effectiveness of the results was evaluated by sensitivity analysis, variability of inclusion criteria, and review criteria. The purpose of this approach is to determine the impact of potential biases on overall results and to ensure that the evidence can withstand changes in study design and procedure. Sensitivity analysis increases the reliability and stability of meta-analysis results.

Assessment of Heterogeneity

Heterogeneity, measured by the I^2 statistic, was investigated to understand differences between studies. Cluster analysis and cohort analysis were used to identify sources of heterogeneity, including factors such as exposure, study design, and demographic characteristics. This integrated approach attempts to reveal the complexity that characterizes diversity.

Publication Bias

Publication bias was assessed using statistical measures such as funnel plots and Egger's test to identify potential asymmetries in study outcome distributions. If strategies to address bias are identified, consideration should be given to reducing its impact on overall results. Recognizing and investigating publication bias leads to expanding the evidence pool.

In conclusion, the results of this review and meta-analysis provide a detailed and comprehensive overview of the relationship between chlorothalonil exposure and cancer risk. The results of the meta-analysis, derived from the combination of several studies, provide a better understanding of the health benefits associated with chlorothalonil. Cohort and sensitivity analyzes increased the robustness and validity of the results, including changes in incidence, population, and study methods.

Investigating differences and assessing reporting bias leads to misinterpretation of evidence and recognition of problems and limitations. Overall, this study increases our understanding of the potential health effects of chlorothalonil, provides information that can inform decision-making, demonstrates that consumption impacts public health, and informs future research on the intersection of evidence on pesticide use and human health.

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