

Occupational Exposure to Organophosphate Pesticides and its Effects on Human Sperm Parameters: A Systematic Review

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Public Health

Abstract

Objectives: To identify relevant studies evaluating the relationship of occupational exposure to Organophosphate pesticides and the decrease of human sperm quality parameters.

Methods: PubMed, Scopus, Himmelfarb, and Agriculture Environmental Science databases were searched for all studies in English. Cross-sectional peer-reviewed articles were selected between the years 2008 and 2016. Risk of bias was assessed according to the Navigation Guide a Systematic Review Methodology. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) was utilized to rate the quality of evidence of each study.

Results: Five Studies were identified, reviewed, and analyzed according to inclusion criteria. Selected studies were rated "low, probably low, not applicable, probably high risk, and high risk" for risk of bias. Studies were assigned a "low quality" rating for strength of evidence. Grey literature was excluded.

Conclusion: There is sufficient information that supports a positive association between occupational organophosphate exposure and a decrease in sperm parameters in agriculture workers, pesticide sprayers, and farmworkers worldwide but further research is needed.

Introduction



- Over 1 billion pounds of pesticides are utilized in the United States
- It is estimated that 5.6 billion pounds are utilized worldwide
- Programs to control exposure are limited or do not exist in countries outside of the United States

➤ Organophosphates are the most common used in crops, gardens, and homes. They have been classified as toxic for bees, wildlife, and humans by the EPA

➤ A few reports have associated occupational pesticide exposure to the decrease in sperm quality in men. Due to Organophosphates being endocrine disrupting chemicals (EDCs) leading to infertility in men

➤ Men's reproductive health is understudied due to technological methods available but the root of the problem is not addressed

Research Question: Does organophosphate pesticide exposure decrease sperm quality parameters in agriculture workers, pesticide sprayers, and farm workers compared to unexposed or low exposed men worldwide?

PECO Statement

POPULATION	Agriculture workers, pesticide sprayers, farmworkers
EXPOSURE	Organophosphate pesticides
COMPARATOR	Unexposed or low exposed men
OUTCOME	Decreased sperm quality parameters

Methods

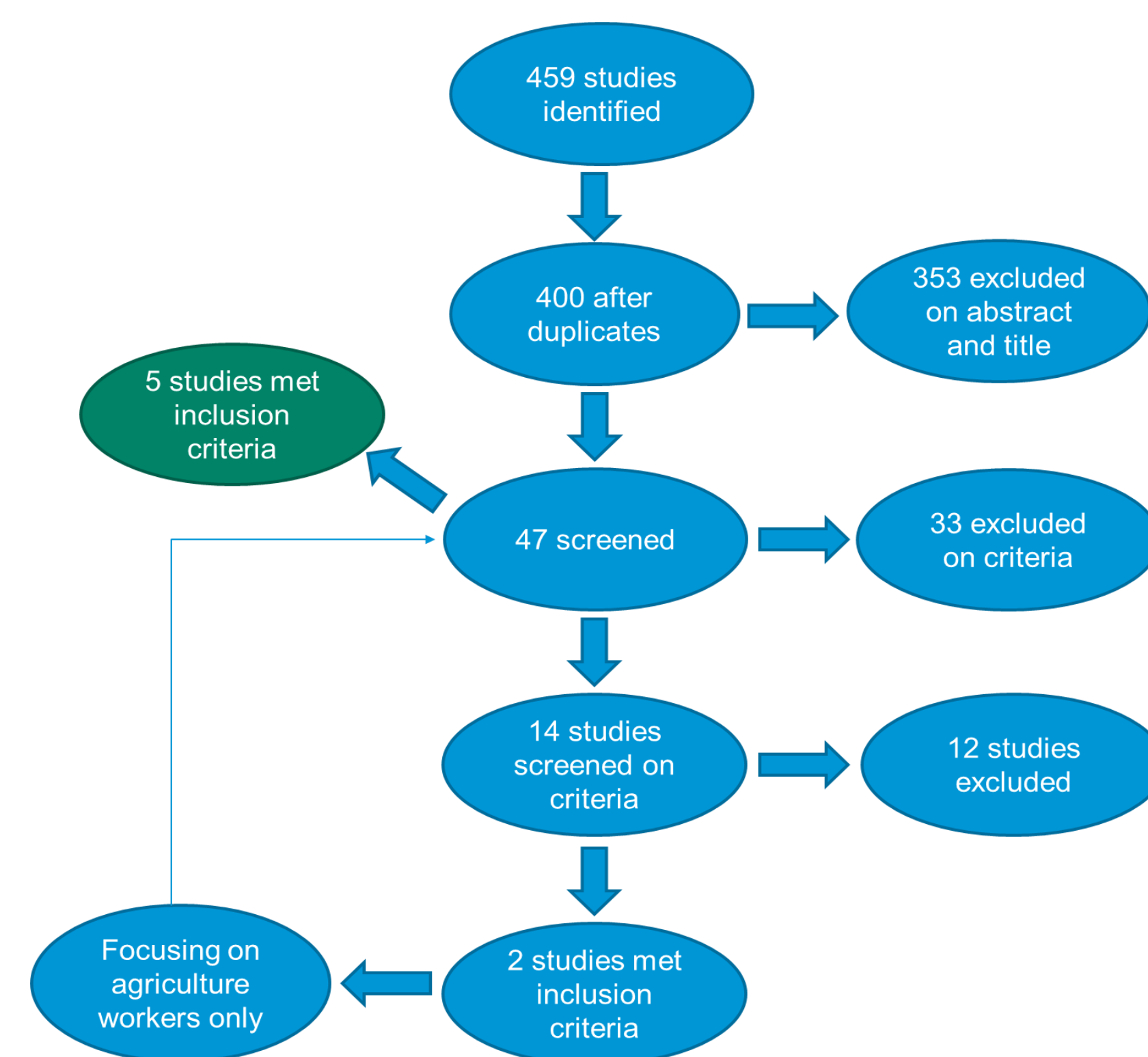
Search Strategy:

- Electronic databases: PubMed, Scopus, Himmelfarb library, and Agriculture Environmental Science
- Electronic databases only
- Peer-reviewed articles published in the last 20 years worldwide
- Combination of various search terms.

Keywords	Search Terms
Exposure terms	Pesticides OR pesticide exposure OR organophosphate OR organophosphate pesticides OR occupational exposure
Targeted Population	Agriculture OR agriculture workers OR global health OR pesticide sprayers OR farmers OR pesticide applicators OR globally
Sperm Parameters	Human sperm health OR human sperm parameters OR sperm quality OR spermatozoa OR semen characters OR sperm health OR sperm characteristics OR male reproductive health OR reproductive health

Inclusion Criteria:

- English language
- Cross-sectional studies
- Organophosphate pesticides
- Agriculture workers, farmworkers, and pesticide sprayers
- Animal studies were excluded

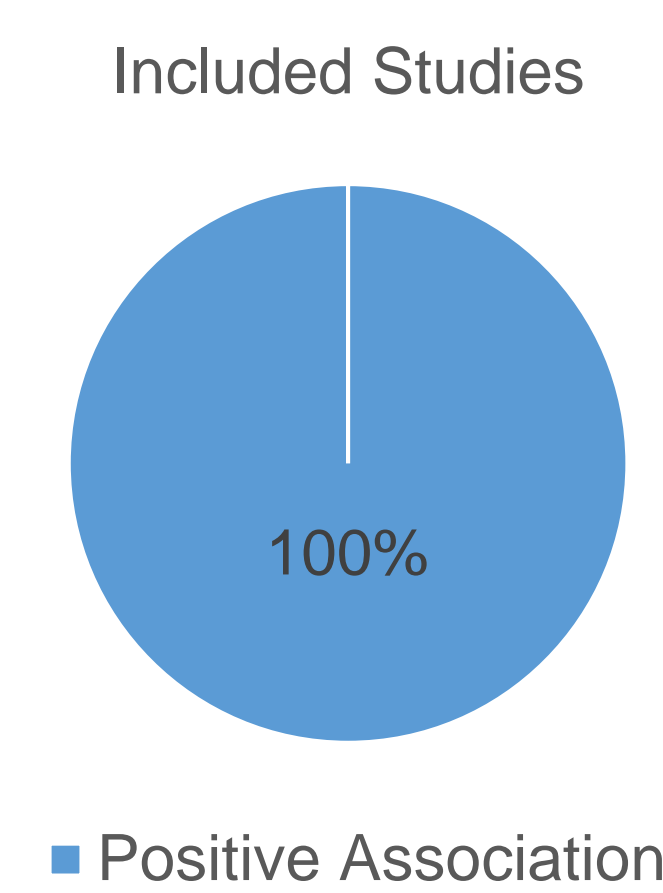


- Navigation Guide Systematic Review Methodology was utilized to assess risk of bias and quality of evidence for each study

Risk of bias	Quality of Evidence Downgrade Factors
Recruitment strategy	Risk of bias across studies
Blinding	Indirectness
Confounding	Imprecision
Exposure assessment	Publication bias
Incomplete outcome data	Upgrade Factors
Selective outcome reporting	Large magnitude of effect
Conflict of interest	Dose Response
Other bias	Confounding minimizes effect

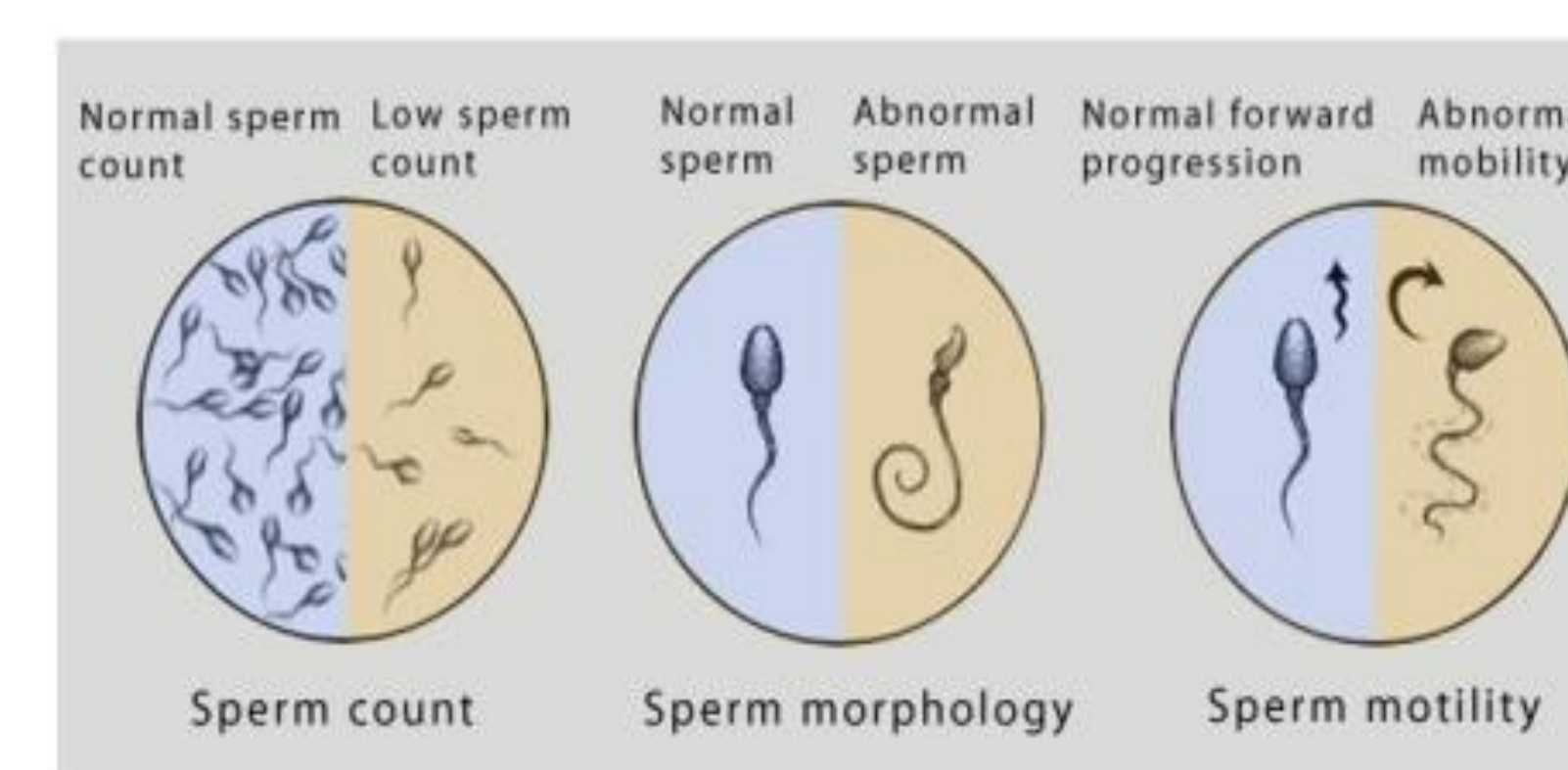
Results

- Five studies met full inclusion criteria and found a positive association between occupational Organophosphate pesticide exposure and a decrease in quality of sperm parameters



Factors with significant impact on quality of sperm parameters:

- DNA damage
- Decrease in seminal volume, motility, morphology
- Increase in sperm PH
- Decrease in luteinizing hormone
- Decrease in testosterone levels



Strength of Evidence:

- Based on quality of evidence factors selected studies were given a low quality rating
- Samples of blood, urine, and semen were collected and analyzed according to WHO guidelines in all studies
- Upgrading factor of dose response was established across studies

Risk of bias of selected studies

	Contreras 2013	Farrukh 2016	Perez-Herrera 2008	Yucra 2006	Yucra 2008
Recruitment	High Risk	High Risk	High Risk	High Risk	High Risk
Blinding	High Risk	High Risk	High Risk	High Risk	High Risk
Confounding	High Risk	High Risk	High Risk	High Risk	High Risk
Exposure Assessment	High Risk	High Risk	High Risk	High Risk	High Risk
Incomplete Outcome Data	High Risk	High Risk	High Risk	High Risk	High Risk
Selective Reporting	High Risk	High Risk	High Risk	High Risk	High Risk
Other Bias	High Risk	High Risk	High Risk	High Risk	High Risk
Conflict of Interest	High Risk	High Risk	High Risk	High Risk	High Risk



Conclusion & Recommendations

Conclusion:

- Sufficient evidence that indicates a positive relationship to address this issue but further research is needed

Recommendations:

- Future studies with large sample size
- Exclude older men from data analysis
- Provide incentives to increase participation and represent general population
- Studies that examine genetic factors that make individuals more susceptible than others
- Provide workers with appropriate safety equipment and education
- Have pesticide labels be translated into several languages

Additional Information

Endocrine disrupting chemicals EDCs:

- Affect the glands that produce and secrete hormones responsible for sexual development and function
- Organophosphates bind to receptors of estrogen and androgen turning receptors off
- Alters levels of reproductive hormones in the body

Increase risk of other reproductive conditions:

- Hypospadias
- Testicular cancer
- Cryptorchidism

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