INFERTILITY & PESTICIDE EXPOSURE

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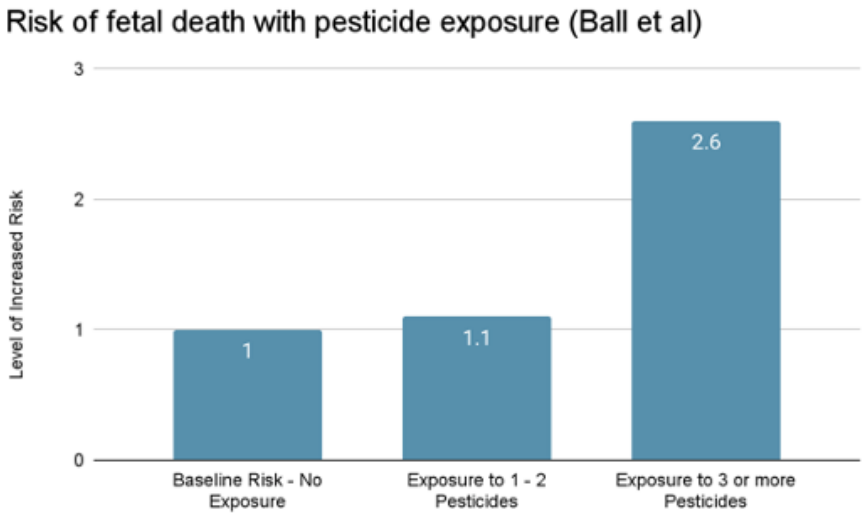
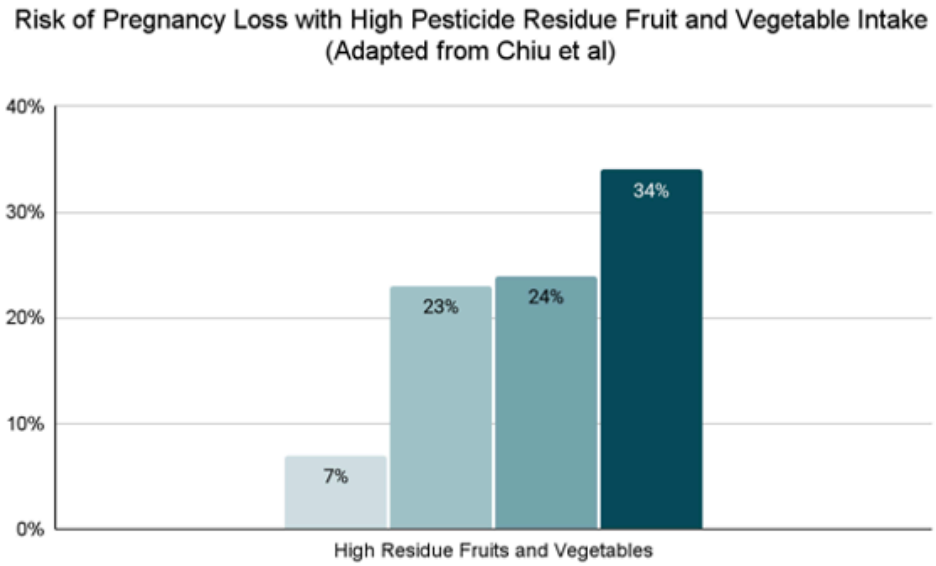
Key Takeaway Notes

- Research points towards a pattern of infertility and fetal demise in couples who are exposed to pesticides during conception and while carrying the fetus
- One article found that women who self-reported three or more exposures to pesticides during gestation had a 2.6x high risk of losing their pregnancy
- A second article demonstrated a 2x greater risk of fetal death in women exposed to three or more pesticides during gestation
- While more research needs to be done, risk reduction is a commonsense approach:
  - Avoid multiple pesticide exposures
  - Wear personal protective equipment if an exposure is unavoidable
- Discuss known and/or potential pesticides exposures with your fertility expert





Background

Infertility is defined by professional societies and reproductive health communities as a condition where a woman of childbearing age is unable to conceive after one year of unprotected sex. There are several causes for this condition that broadly include the anatomical, physiological, genetic, endogenous, and exogenous factors.(Johns Hopkins Medicine) Treatment will vary depending on the cause with cost varying from inexpensive lifestyle adjustments to more expensive hormonal management and then in vitro fertilization / intrauterine insemination.

Existing Research:

The Mayo Clinic's online resources provide a set of useful definitions to consider. Primary infertility applies to a woman who cannot conceive after one year of regular unprotected sexual intercourse or six months if over 35 years old. Secondary infertility applies to a woman who cannot get pregnant after at least one time before. Unexplained infertility is self-explanatory. Infertility is common and affects both men and women. The website cites ~20% of women experience primary infertility while 5% of women struggle with secondary infertility. (The Cleveland Clinic)

Research from the Harvard T.H. Chan School of Public Health published in JAMA looked at 325 women in the Environment and Reproductive Health (EARTH) study. These were women who were undergoing fertility treatment who had intake of "high-pesticide residue fruits and vegetables" (FV). These patients who had the highest intake of high pesticide residue FVs were associated with an 18% lower probability of clinical pregnancy and a 26% lower probability of live birth. The assessment of high or low pesticide intake was based on a self-assessment survey taken by the participants. (Yu-Han, MD, ScD et al.) This was cross referenced against annual reports from the US Department of Agriculture Pesticide Data Program (PDP) to classify FVs according to their mean pesticide residue status in the US food supply. (US Department of Agriculture)

Ball et al studied the relationship between pesticide exposure during the important 3rd through 8th weeks of pregnancy and fetal demise in ten California agricultural counties. 73 cases were identified and 611 controls were selected for the analysis.

They studied the exposure potential by associating a maternal address with a township, range, and section mapping provided by the government. This allows for exposure to be quantified in ~1 square mile areas in a central narrow definition. A broader metric measured the central home exposure and the surrounding 8 square miles. They mapped out conception dates and the application of pesticides as documented by the California state database for pesticide application. Confounding factors are acknowledged and fetal demise may be worsened by non-pesticide related risk factors.

Researchers studied lab animals to characterize the effect of pesticides on male reproductive tissues. They were able to describe metabolic pathways, tissues and cell types that negatively affected cellular level activity needed for spermatogenesis, testicular metabolism, testicular tissue, and other cell lines important for male fertility. The article does acknowledge that there are other factors to consider in male infertility. (Moreira et al.)

In the International Journal of Environmental Research and Public Health researchers summarized the collective knowledge to clarify the mechanisms associated with pesticides and infertility, abnormal sexual maturation, and pregnancy complications that were associated with occupational, environmental, and transplacental exposures. The research looked at the accumulated knowledge from 2000 to 2020 through PubMed and Scopus databases with search terms relevant to the topic. The research demonstrated statistically significant associations between reproductive disturbances and exposure to pesticides. The researchers will need to further study the impact of complex pesticide mixtures and interactions arising from other endocrine disrupting chemicals. Increased surveillance and monitoring is recommended in order to understand the exposure(s), impact and to provide a holistic view into family level exposure and the impact on fertility. (Fucic et al.)

Research from the two departments at Kyungpook National University in South Korea asserts that there is a strong linkage between male infertility and pesticides. They assert that pesticides can mimic hormones. Examination of reproductive tissues from lab animals exposed to endocrine disruptors demonstrated reduced

testicular weight and damage; reductions in important cell lines needed for fertility; significantly reduced sperm count; reductions in follicle and corpora lutea number; a dose dependent deterioration in corpora lutea; edematous seminiferous tubules; reduced number of sperm across several pesticides and reduced testosterone blood levels. (Uwamahoro et al.)

An article published in Sage Journals Human & Experimental Toxicology summarized the available information for 15 most commonly used pesticides and the effect on male reproductive physiology. They assert that there are known mechanisms whereby exposure to these pesticides damage spermatozoa, Sertoli / Leydig cell function in both lab and living conditions. They describe the chemical structures with their ability to mimic natural endogenous hormones and chemicals. They also noted the persistence of these organic pollutants which have been found in the living spaces removed from the pesticide application site in both time and distance. Readers can review Table #4 in their publication which provides a wide range of specific pesticides and the receptor level mechanisms of action. They conclude stating that pesticide exposure lowers sperm levels well below the limit for male fertility. (Sengupta and Banerjee)

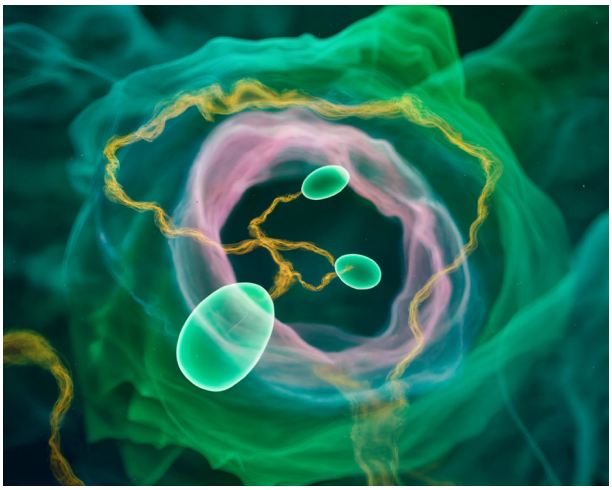
Pesticides may interfere with female hormonal production, also known as endocrine disrupting chemicals, and lead to negative reproductive effects by disrupting hormonal: synthesis, release and storage, transport and clearance, receptor recognition and binding, post-receptor activation, along with thyroid and central nervous system function. The authors describe the disruption of the female reproductive system and menstrual cycle physiology. They describe the negative impacts to both cellular and systems mechanisms needed for normal fertility. This research was performed on laboratory animal and cell culture which means it may have a different impact on human physiology. (Bretveld et al.)

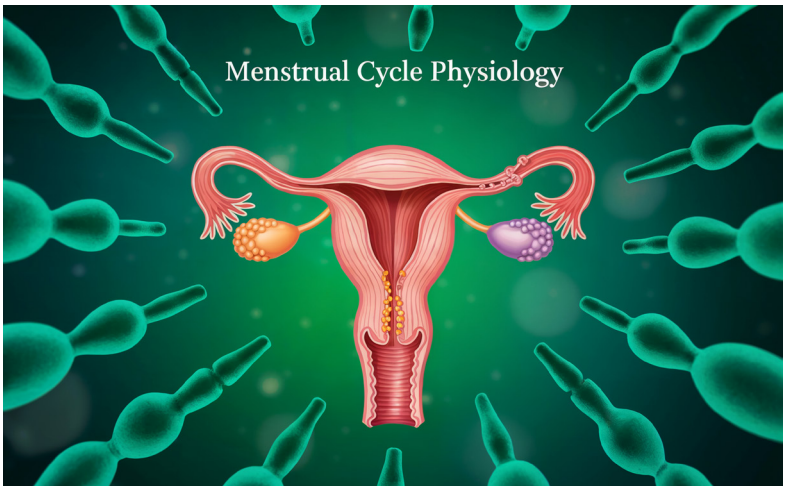
Farr et al. attempted to better understand the association between pesticide exposure and menstrual cycle characteristics in two cohorts of women from Iowa and North Carolina in childbearing years and are not on hormone therapy. They observed that women who worked with pesticides suspected of being hormonally active had a 60–100% increased odds of experiencing long cycles, missed periods, and intermenstrual

bleeding compared with women who had never worked with pesticides. (Farr et al.)

A study attempted to better understand the effects of pesticides and plasticizers on female fertility. The authors conducted a review of available relevant literature asserting that most of the current literature is epidemiological in nature and little research has been conducted to further definitively explain any cause-and-effect mechanism. They do state that the data overwhelmingly shows a negative effect of endocrine disrupting chemicals on female fertility. (Vessa et al.) Other publications did not show the relationship demonstrated by DDT and glyphosate. The research methodologies use different populations, baseline fertility, and the degree of environmental exposures. (Lavin - Williams et al.) (Jirsova et al.)

The CDC states on their website that exposure to pesticides can affect hormones and fertility in people. In addition, they state that there is linkage between exposure during pregnancy and miscarriages, reduced fertility, birth defects, and learning or developmental disabilities in children. They advocate for women, where possible, to reduce all possible exposures during pregnancy and strictly follow all labeling instructions for use and application. (National Institute for Occupational Safety and Health (NIOSH) Reproductive Health and The Workplace)





Summary Statement

The evidence available is concerning and merits reasonable cautionary risk reduction as provided above. Expert guidance from the CDC and other resources recommend a simple, common sense approach to minimize pesticide exposure for the individuals before and during conception and pregnancy. Should there be concerns about exposures and risks, the reader should seek advice from their medical professional.

Have questions about infertility and pesticide exposure?
Schedule an appointment with us here: https://bit.ly/44Ec1CZ

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