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Opinion

Effects of Air Pollution on Reproductive Health

Fei Jing Zhou and Yue Zhi Dong*

Reproductive Medicine Centre, China

Plain English Summary

Air pollutant exposure is closely related to many diseases, and its health risks cannot be ignored. Many epidemiological and toxicological studies have confirmed the clear adverse effects of air pollutant exposure on cardiovascular and respiratory system health, while the effects on reproductive health are still inconclusive. This article mainly discusses the effects of air pollution on reproductive health.

Keywords: Air pollution; Reproductive health

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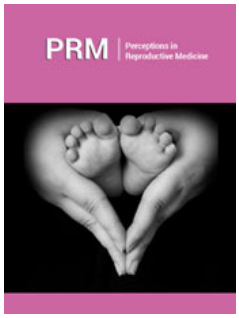

***Corresponding author:** Yue Zhi Dong, Reproductive Medicine Centre, China

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Opinion

With the development of epidemiology and basic research, it is confirmed that air pollutant exposure is closely related to many diseases, and its health risks cannot be ignored. Many epidemiological and toxicological studies have confirmed the clear adverse effects of air pollutant exposure on cardiovascular and respiratory system health, while the effects on reproductive health are still inconclusive. Air Pollution, reactive oxygen species damage, and genetic or epigenetics abnormalities may be responsible for some cases of male infertility. On the one hand, the occurrence of female infertility is related to the change of life style, the decline of ovarian reserve and egg quality caused by the later reproductive age of women, on the other hand, it is also related to the deterioration of living environment [1].

The main harm of air pollution to male fertility is the impact on semen quality. Long-term exposure to high concentrations of air pollutants can result in a decrease in semen quality [2]. *In vitro* experiments have shown that exposure to air pollutants can activate multiple intracellular signaling pathways and initiate inflammatory responses [3]. The inflammation may cause the destruction of the integrity of the blood-testis barrier, which results in:

1. Accelerating the apoptosis of spermatogenic cells, resulting in the decrease of the number of spermatogenic cells.
2. Damaging the cell membrane, resulting in the decrease of sperm motility and fertilization ability.
3. Causing DNA damage of sperm, affect the quality of the resulting embryo, resulting in miscarriage or genetic defects in the offspring [4].

In addition, the epigenetics study found that a variety of air pollutants can affect gene expression in somatic cells by interfering with normal DNA methylation, histone acetylation methylation and miRNA regulation [5]. Epigenetics in spermatogenesis is still in its infancy, and abnormalities in Epigenetics are known to affect sperm quality and offspring development, but whether air pollution affects DNA methylation, genomic imprinting, histone methylation and RNA silencing in sperm remains to be explored. Based on the current research data, the mechanism of the damage of air pollution to male fertility should be multi-faceted, but due to the variety of air pollutants, it is impossible to carry out targeted and in-depth research on each pollutant, it is a more effective way to classify the components of air pollutants and find a common way to affect spermatogenic function. The impact of air pollution on female fertility is mainly on ovarian reserve and pregnancy outcome. There is little evidence that air pollution affects ovarian function and worsening air quality causes a decline in ovarian reserve in women or affects the number of eggs collected during the IVF cycle. However, many epidemiological studies have shown that air pollution is closely related to the occurrence of

multiple adverse pregnancy outcomes, such as preterm birth, low birth weight infants, embryo cessation, abortion, stillbirth, etc. [6,7].

And the effect was seen in both women who had a natural pregnancy and those who had a subsequent pregnancy treated with assisted reproductive technology [8]. The results of animal experiments showed that air pollution could decrease the number of preantral follicles and affect the fertility rate of mice [9]. Oxidative stress and endocrine disruption may be the main mechanisms by which air pollutants affect ovarian reserve. The possible mechanisms by which air pollutants affect pregnancy outcome and offspring development are unclear. The occurrence of abortion, stillbirth, abortion and birth defects may be mainly related to DNA damage of embryo and fetal cells caused by pollutants. Compared with men, women's individual contribution to human fertility lies not only in egg production, but also in the whole process of fertilization, embryo and fetal development. Therefore, the effects of air pollution on female fertility should be longer and more complex, and due to the instability of gametes and early embryos, the effects should focus on oogenesis, fertilization and early embryonic development, but the mechanism remains to be explored. In summary, in the field of reproductive health, most researchers tend to believe that air pollution can cause a decline in human fertility, but there is still a lack of large sample of prospective experiments and in-depth study of the mechanism.

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