

Air Pollution and Assisted Reproductive Technology

At the end of autumn, each year, we are used to witnessing unhealthy air due to temperature inversion, especially in large cities. This year, Tehran broke its last year's inversion record of 42 days by a surpassing 45-day inversion period. Scientist believes the reason for this phenomenon lies in green house effect due to the accumulation of air pollutant such as CO, CO₂, NO₂, SO₂, O₃ and floating particulate matters or aerosols. Increases in the number of days with air-pollution and red alerts in big cities affects all aspects of health especially those of the children, the elderly and pregnant women (1). Numerous studies have been done on the impact of air-pollution on the cardiovascular and pulmonary functions. A number of studies have evaluated the relationship between the impact of air pollution on human and other mammalian reproductive function. Air pollution increase the rate of abortions, low birth weight or increase in the number of anomalies and congenital defects due to maternal exposure to polluted air during pregnancy. Cigarette smoking is a good example in both men and women as it can harm oogenesis, spermatogenesis, sperm and ovum quality leading to intrauterine growth retardation and increased risk of abortion (2). Interestingly, most of these pollutants may be inactivated by the pregnant mother's physiological systems to effectively minimize fetal exposure to them. Nevertheless, the effects of these pollutants on the health, well-being and growth of embryos have been confirmed in a number of studies. However, in assisted reproductive technologies, embryo is directly exposed to the extrauterine environment and has close contact with particulate matters floating in air, where lack of defense mechanisms in the embryo and absence of maternal protective mechanisms increase embryo vulnerability to environmental hazards, especially to air pollutants (3). Moreover, the limited number of studies in this area is indicative of the harmful effects of air pollutants on embryos development and success rate of assisted reproductive technologies. Studies on the volatile organic compounds (VOC) such as anesthetic gases or in CO₂ containers severely affect the result of in vitro fertilizations (IVF), including the quality of embryos, pregnancy and live birth rates. In a recent study, the impact of other air pollutants on the results of assisted reproductive technologies has been evaluated. The study has examined 7403 IVF cycles in three separate infertility treatment centers or IVF labs over a period of 7 years (4). The researchers simultaneously estimated the daily concentration of pollutants at each corresponding IVF lab. The results showed that a moderate exposure to air pollution is correspond to at least an increase of 1-2 years in the mother's age that accompanied with decrease in success rate of IVF. Moreover, this study showed that increase in nitrogen dioxide (NO₂) in the air due to consumption of fossil fuel could remarkably decrease the success rate of assisted reproductive technologies (4). Therefore, air quality and pollutants are important subjects in the success of assisted reproductive technologies which requires infertility treatment centers be located away from pollutants source, such as gas stations, chemical industries and factories, refineries or places with congested traffic jams in industrial areas and megacities. But even if some of these centers are located in such places, they should be equipped with air filters to remove the particulate matters, volatile compounds, and other pollutants. However the high cost of these facilities may make it impossible for many centers to provide them, but their use for embryology labs and embryo culture incubators is highly recommended. A lot of the aforementioned devices are commercially available for using at house holds and clinics, but confirming their efficiency is an important issue which needs to be scientifically proved. In any way, air and environmental pollutants have important impacts on fertility and infertility treatments, especially in assisted reproductive technologies. Presently, as all researches and efforts are focusing on the increasing success rate of infertility treatments, studies that precisely measure effects of air quality on different stages of reproduction including fetal period, gonadal development and maturation in both sexes, ovarian stimulation cycles, in vitro embryo culture and pregnancy, evaluation of the impact of each pollutant on above stages and methods to reduce or eliminate them are highly recommended.

References

1. Tehran weather achieves a new record. Donya-e-Eqtesad [Internet]. 2010 Dec 5 [cited 2010 Dec 9]; Health: [about 3 screen]. Available from: http://www.donya-e-eqtesad.com/Default_view.asp?@=234816.
2. Ritz B, Wilhelm M, Hoggatt KJ, Ghosh JK. Ambient air pollution and preterm birth in the environment and pregnancy outcomes study at the University of California, Los Angeles. *Am J Epidemiol*. 2007;166(9):1045-52.
3. Perin PM, Maluf M, Czeresnia CE, Nicolosi Foltran Januário DA, Nascimento Saldiva PH. Effects of exposure to high levels of particulate air pollution during the follicular phase of the conception cycle on pregnancy outcome in couples undergoing in vitro fertilization and embryo transfer. *Fertil Steril*. 2010;93(1):301-3.
4. Legro RS, Sauer MV, Mottla GL, Richter KS, Li X, Dodson WC, et al. Effect of air quality on assisted human reproduction. *Hum Reprod*. 2010;25(5):1317-24.

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