Ozone air pollution could harm women's fertility

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Many urban and suburban areas have high levels of ground-level ozone, an air pollutant that can adversely affect lung and heart health. New research in mice suggests breathing high levels of ozone could also affect women's ability to conceive.

In some areas, ozone can reach high levels in the summer because the bright sunlight and heat combine with compounds from industrial emissions, car exhaust, and gasoline vapors to form the air pollutant. The U.S. Environmental Protection Agency uses the color-coded air quality index to communicate daily levels of air pollutants including ozone. Groups considered most vulnerable during high-pollution days currently include children, the elderly and people with asthma. If the new research findings hold up in people, it might be necessary to add women of reproductive age to that list of vulnerable groups.

"It is important that we know what is in the air we breathe and understand how it can affect our health," said Patricia Silveyra, Ph.D., assistant professor in the Pennsylvania State University College of Medicine and leader of the research team. "We don't know a lot about the damaging effects of ozone, but since it does increase inflammation in the lungs, it is possible that this inflammation could affect more than one system in the human body."

Silveyra and her team were studying sex differences in the effects of ozone on lung inflammation in mice when they discovered that short exposures to ozone affected female levels of progesterone, a major

reproductive hormone involved in ovulation and pregnancy. To examine this further, they designed an experiment in which female mice were exposed to 2 parts per million (ppm) of ozone for 3 hours on the day the mice were expected to ovulate. Other studies have shown that this level of exposure in mice is roughly analogous to a person breathing high levels of ozone in a city.

"We found that breathing ozone on the day of ovulation not only decreased progesterone levels in female mice, but also reduced the number of ovulated eggs," explained Carla R. Caruso, M.D, a resident physician at the Pennsylvania State University College of Medicine who will present this research at the American Society for Investigative Pathology (ASIP) Annual Meeting during the Experimental Biology 2015 meeting. "In addition, this acute exposure to ozone affected important brain and ovarian signaling events that are key for the ovulation process."

The levels of progesterone in the blood of female mice on the day of ovulation decreased from a normal value of 8 nanograms per milliliter (ng/ml) in females breathing filtered air, to an average of 2 ng/ml in mice breathing ozone. When the investigators compared the number of ovulated eggs the following morning, they found a statistically significant reduction of 30 percent in females exposed to ozone. Moreover, expression of key enzymes involved in the progesterone synthesis pathway was also significantly reduced in the ovaries of ozone-exposed female mice.

Based on their findings, the researchers postulate that women in large cities could experience fertility issues from inhaling high concentrations of ground-level ozone. However, they caution that their findings are preliminary and that the research involved only mice, not people.

"Population studies evaluating fertility complications in geographical

areas with high and low ozone pollution levels, as well as clinical studies conducted in women of reproductive age can help elucidate these concerns," Silveyra said.

The researchers are now working to understand the mechanisms of ozone's effects on ovulation in mice.

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