INTERNATIONAL JOURNAL OF CURRENT MEDICAL AND PHARMACEUTICAL RESEARCH
ISSN: 2395-6429, Impact Factor: 4.656
Available Online at www.journalcmpr.com
Volume 7; Issue 04(A); April 2021; Page No.5720-5722
DOI: http://dx.doi.org/10.24327/23956429.ijcmpr202104997

Case Report

EXPOSURE TO AIR POLLUTION IN PREGNANCY AND ITS EFFECTS ON THE FETUS- A REVIEW

Vignesh Devaraju

CUNY School of Public Health 55W, 125th Street, New York, NY 10027

ARTICLE INFO

Article History:
Received 06th January, 2021
Received in revised form 14th February, 2021
Accepted 23rd March, 2021
Published online 28th April, 2021

ABSTRACT

Man's adventure into outer space has broadened the concept of air environment. The immediate environment of man comprises of air on which depends all forms of life. Human beings need continuous supply of air to exist. The requirement for air is relatively constant around(10-20m^3/day). Pollution of air by dust, smoke, toxic gases & chemical vapors has resulted in sickness & death. Each organ systems in human body and placenta has different stages of growth rates and development during fetal growth and development with changing metabolic capabilities creating biological sensitive periods (critical windows) of susceptibility to toxic environmental exposures.[1] Pregnant women may be exposed to toxic pollutants through variety of sources and routes. Inhalation of pollutants from indoor and outdoor air is the most common route of exposure. Outdoor air contains a mixture of many potential toxins. Sulfur dioxide, nitrogen dioxide, carbon monoxide, suspended particulate matter, ozone, and lead are the major pollutants in air effecting the entire ecosystem.[1] Hence the review article focuses on the association between exposure to air pollution and adverse pregnancy outcomes.

INTRODUCTION

In the last two decades there is an increase of the number of scientific reports about a proven influence of air pollution on an occurrence of negative health effects, connected with births. They are: preterm births, stillbirths, intrauterine fetus growth retardation, births of newborns with low birth weight and a risk of newborns death because of respiratory system disorders. Birth weight, gestational age, and fetal growth are important indicators of prenatal health. Low birth weight (LBW), preterm birth, or intrauterine growth retardation (IUGR) are strongly association with infant mortality and morbidity. Long term study shows that low birth weight (LBW) is a risk factor for developing in adulthood coronary health diseases, hypertension and type 2 diabetes. It was observed up to 20% increase in risk of LBW and preterm birth in infants born to women leaving in area with high level of air pollution, especially those exposed to higher levels of motor vehicle exhaust pollution coming from heavy-traffic roadways.[2]

Congenital anomalies (CAs), also known as congenital malformations or birth defects can be defined as functional or structural anomalies that occur during intrauterine life. It is estimated that each year 8 million babies – 6% of total births worldwide are born with a severe congenital birth defect. At least 3.3 millions of children aged 0 to 5 years die as a consequence of severe birth defects and each year approximately 300,000 newborns with a diagnosis of birth defect die within the first 28 days of life. In the United States, where over 3.0% of live births present with a congenital defect, CAs represent the leading cause of pediatric hospitalization and infant mortality. In Europe, CAs are the leading cause of perinatal mortality, the European Surveillance of Congenital Anomalies (EUROCAT) network estimated a perinatal mortality associated with CAs of 9.2 per 10,000 births in 2008-2012.[3]

The largest reported effects are associated with prenatal exposure to particulate matter, nitrogen dioxide, and tobacco smoke. The primary effects affect birth weight and other parameters of fetal biometry. There is strong evidence regarding the impact of pollutants on morbidity secondary to respiratory problems. Growing evidence links maternal smoking to childhood asthma and wheezing. Carbon particles/Soot which are released from air pollution reach placenta of pregnant women and harms in development of unborn babies.[4]

Population and Setting

Population in this review article is pregnant women who are exposed to air pollution/pollutants in urban areas and its effects on unborn fetus.

REVIEW OF LITERATURE

A study was conducted by ***Ashley Martin et al*** in the year 2016 to determine the association between maternal exposure

Corresponding author:* **Vignesh Devaraju
CUNY School of Public Health 55W, 125th Street, New York, NY 10027

to ambient air pollutants and umbilical cord blood concentrations of IgE, TSLP, and IL-33. They observed that maternal NO2 exposure was associated with significantly increased odds of high cord blood IL-33 and TSLP concentrations. They also found maternal air pollution exposure may also stimulate placental production of pro-inflammatory cytokines and subsequently influence fetal immune system development.[5]

Another systematic review done by ***Khader Y et al*** in the year 2016 to determine air pollution exposure and pregnancy outcomes in East Mediterranean region showed there was a pattern of an association between outdoor air pollution and preterm birth and spontaneous abortion; indoor wood fuel smoke and birth weight; and second-hand smoke and birth weight, preterm birth, and spontaneous abortion.[6]

A study was conducted by ***Lin Y et al*** in the year 2016 to investigate the association of air pollution with maternal stress during pregnancy. The results of the study suggested that increasing concentrations of SO2, NO2, and PM10 were associated with increased risks of maternal emotional stress during pregnancy, and the associations between air pollution and maternal stress may be dose-dependent and may be modified by season and complications of pregnancy Because maternal stress during pregnancy is important in the development of offspring.[7]

Another study done involving five pregnant women in London who were scheduled to have C-section deliveries in which none of the pregnant women smoked but were exposed to harmful air pollutants and all had uncomplicated pregnancies which resulted in a healthy baby. After their babies were born, the researchers examined the placenta. The team looked for specific immune cells called placental macrophages, which swallow up harmful particles like bacteria and pollution particles. Overall, the researchers analyzed 3,500 macrophage cells under a high-powered microscope. They found 60 cells that contained a combined total of 72 small black areas, which were thought to be carbon particles. On average, each placenta contained about five square micrometers of this substance. Using an electron microscope, the investigators examined the macrophages from two of the placentas in more detail. They found the same suspected carbon particles from the air. These were the significant findings of the study done on pregnant women in London.[4]

The findings suggest that there is a direct impact on fetal development from toxic pollutants released from air pollution which enters through placenta and harm in growth and development of unborn babies.

Intervention strategies

Some of the planned mitigation strategies include more efficient use of fossil fuels for industrial processes and electricity generation, switching to renewable energy (solar/wind/wave power), increasing the fuel efficiency of vehicles, improving the insulation of buildings, growing new forests, nuclear power and carbon sequestration.[10]

Lowering emissions is one of the major means of improving local air quality in addition to being the most frequent approach to coping with vehicular pollution. This is being done in three main ways: technology and fuel improvement (electric vehicles, bio-fuels, and natural gas), restriction policies such as emission standards, mandatory vehicle inspections, and improvement of road conditions and limitations on allowable travel distances. The choice of fuels is indeed an important tool for policy makers at the local level but also has been considered for contributing to global CO2 target reductions. [10]

Urban planning and governance are also important factors in developing successful policies. For instance, urban planning has been discussed as a crucial issue and an important potential solution for improving transport infrastructure. Urban governance is also reported as a challenge for efficient policymaking in urban cities.[9]

Public policy and individual action are both required to reduce the effects of pollutants on respiratory health. Interventions at the individual level may include the avoidance of exercise or cycling near busy roadways to reduce exposure and improvements in the ventilation of homes in which biomass fuels are used. Moreover, public policies can encourage or mandate engineering solutions that drastically reduce emissions from cooking stoves and vehicles. [10]

Urban forests and green roofs have also been proposed as strategies for reducing pollution in urban areas. Vegetation removes pollutants in several ways by absorbing gaseous pollutants, through interception of Particulate matter by leaves and by breaking down organic compounds such as polycyclic aromatic hydrocarbons. Transpirational cooling also reduces temperatures indirectly which results in a reduction in photochemical reactions that form O3 and other air pollutants in the atmosphere. [10]

DISCUSSION

The relationship between air pollution and health has long been studied by researchers establishing the association between high levels of air pollution and outcomes such as allergies, respiratory disease and cardiovascular disease. This health burden is particularly concentrated in urban centers, where it has led to an increase in mortality rates and reduction of life expectancy. There is now substantial evidence concerning the adverse effects of air pollution on pregnancy outcomes and infant death.[2]

Evidence reporting associations between maternal exposure to ambient air pollutants and adverse fetal development in particular growth restriction, pre-term birth, and infant survival due to postnatal respiratory mortality has been growing rapidly in recent years. The association between maternal exposure to ambient air pollution and the risk of congenital anomalies, which are a significant cause of stillbirth and infant mortality has been less well studied. New evidence is also accumulating on the burden of disease due to indoor air pollution. The air pollutants such as asbestos fibers and dioxins, resulting from waste disposal, has been associated with a multitude of health effects. Asbestos fibers are dangerous to health and practically indestructible. Human exposure to asbestos fiber found in inhaled air can lead to diseases such as chronic bronchitis, asbestosis, lung cancer and mesothelioma.[2]

Adequate placentation and placental functioning are critical for normal pregnancy. Impairment of these processes are reflected by alterations in markers of placental growth and function has been associated with maternal and fetal complications.[8] Each city must be understood in its particular social and economic timeframe, certain policies implemented in one place might not be the most suitable elsewhere, understanding which

energy choices have been made for mobile sources of air pollution in certain cities can be critical in showing that addressing air pollution is an ally of climate change mitigation. Reducing local air pollution does not harm climate change mitigation, and ignoring climate change mitigation pollutants can harm local air quality. Local air pollution and global climate change policies should work together to maximize the benefits of lowering pollution levels and mitigating climate change.[9]

CONCLUSION

It is well established now that air pollution has significant association with human mortality and morbidity. Fetal period is the most critical period of human life because of rapid cellular proliferation, differentiation and growth. Survival and optimum growth and development of the fetus require complex interactions between the mother, fetus and the placenta which is a programmed dynamic process. Ambient air pollution during pregnancy affect pregnancy outcome and developing fetus.[1]

So, Carbon particles in air pollution has a direct effect on developing fetus which can pass through placenta and cause developmental defects in unborn babies because of the extreme susceptibility of the fetus and the impact of perinatal adverse events on adult health, it is necessary to try and reduce exposure of pregnant women to air pollution throughout the world. In future, additional and in depth researches are required to build the wealth of knowledge, to examine the underlying mechanisms and to explore the maternal and fetal consequences.

References

1. Yurdakök K. Ambient air pollution and the fetus. *Journal of Pediatrics Neonatal Individual Medicine*. 2013;2(2):e020232. doi: 10.7363/020232.
2. Marchwinska-Wyrwal E, Dziubanek G, Hajok I, Rusin M, Oleksiuk K, Kubasiak K. Impact of Air Pollution on Public Health, *The Impact of Air Pollution on Health, Economy, Environment and Agricultural Sources*. Croatia: Intech; 2011: Chapter(1):3-16.
3. Baldacci S, Gorini F, Santaro M. Environmental and individual exposure and the risk of congenital anomalies: a review of recent epidemiological evidence. Epidemiol Prev. 2018 May-Aug ;42(3-4 Suppl 1):1-34. doi: 10.19191/EP18.3-4.S1.P001.057.
4. Air Pollutants reach Placenta, Might harm fetus. Healthday News website. https://consumer. healthday.com/respiratory-and-allergy-information-2/air-pollution-health-news-540/air-pollutants-reach-placenta-might-harm-fetus-study-737744.html. Published on September 17, 2018. Accessed on September 20, 2018.
5. Ashley-Martin J, Lavigne E, Arbuckle TE, *et al*. Air Pollution During Pregnancy and Cord Blood Immune System Biomarkers. *Journal of Occupational and Environmental Medicine*. 2016;58(10):979-986. doi:10.1097/JOM.0000000000000841.
6. Khader Y, Abderlrahman M, Abdo N, *et al*. Exposure to Air Pollution and Pregnancy Outcomes in the East Mediterranean Region: a Systematic Review. *International Journal of Pediatrics*. 2016; 4(1): 1255-71. doi: 10.22038/ijp.2016.6285.
7. Lin Y, Zhou L, Xu J, *et al*. The impacts of air pollution on maternal stress during pregnancy. *Scientific Reports*. 2017;7:40956. doi:10.1038/srep40956.
8. van den Hooven EH, Pierik FH, de Kluizenaar Y, *et al*. Air pollution exposure and markers of placental growth and function: the generation R study. *Environ Health Perspect*. 2012;120(12):1753-9.
9. Slovic AD, de Oliveira MA, Biehl J, Ribeiro H. How Can Urban Policies Improve Air Quality and Help Mitigate Global Climate Change: a Systematic Mapping Review. *J Urban Health*. 2015;93(1):73-95.
10. M P Sierra-Vargas, L M Teran. Air pollution: Impact and prevention. Respirology (2012) 17, 1031–1038 doi: 10.1111/j.1440-1843.2012.02213.x

How to cite this article:

Vignesh Devaraju (2021) 'Exposure to Air Pollution in Pregnancy and Its Effects on the Fetus- A Review', *International Journal of Current Medical and Pharmaceutical Research,* 07(04), pp 5720-5722.

****