
SPECIAL ARTICLE

Effects of Cigarette Smoking on Pregnancy Outcomes

Jitti Hanprasertpong, M.D.*,
Tharangrut Hanprasertpong, M.D.**

* Department of Research and Medical Innovation, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand

** Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot University, Nakornnayok, Thailand

ABSTRACT

Cigarette smoking increases several health risks, including maternal and neonatal adverse outcomes if smoking during pregnancy. Ectopic pregnancy, placenta previa, abruptio placenta, preterm premature rupture of membranes, low birthweight (less than 2,500 grams), intrauterine growth restriction, intrauterine fetal death, neonatal respiratory and gastrointestinal disease, need of transfer of newborn to a neonatal intensive care unit (NICU), and more than 7 days NICU admission of the newborn and neonatal infection have been reported to have increased risk in cigarette-smoking pregnant women. Risks of adverse pregnancy outcomes were found to be dose-dependent, with the highest risk found among heavy smokers (more than/equal to 20 cigarettes per day).

Keywords: cigarette, smoking, pregnancy.

Correspondence to: Tharangrut Hanprasertpong, M.D., Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot university, Ongkharak, Nakornnayok 26120, Thailand.
Email: tharangrut@hotmail.com, tharangrut@gmail.com

Received: 30 September 2024, **Revised:** 22 October 2024, **Accepted:** 23 October 2024

Introduction

Smoking is the human action of inhaling and exhaling the fumes of burning material. Several of these burned materials are derived from plants, such as marijuana, tobacco, etc. Most obstetricians are confused about and not familiar with some of these materials. Here, we define them as follows:

1. Marijuana: It is extracted from a plant in the Cannabaceae family. Its scientific name is *Cannabis sativa* and contains addictive chemical derivatives

called cannabinoids, which act on the human body through cannabinoid receptors. It can reduce the occurrence of seizures, vomiting and inflammation, but it also increases risk of harm through both central nervous system stimulation and depression⁽¹⁾.

2. Tobacco: It is a plant whose scientific name is *Nicotiana tabacum*. Its addictive alkaloid derivative is nicotine, which has both a stimulative and tranquilizing psychoactive effect on humans⁽²⁾. Some of its psychoactive effects include improved

concentration and performance, relief of boredom and activated mood⁽³⁾. Tobacco products can be made in forms of cigars, pipe tobacco or chewing tobacco.

3. The cigarette is the most commonly used form of tobacco. It is comprised of tobacco, a filter and paper wrapping. When it is burned, people are exposed to more than 7,000 toxic chemical agents, such as carbon monoxide (CO), nicotine, tar, acetone, acetic acid, benzene, lead, methanol, toluene, etc. Moreover, more than 70 of these chemical agents are carcinogens⁽⁴⁾.

Effect of cigarette smoking on general and reproductive health

Cigarette smoking increases several health risks, including risk of coronary heart disease, stroke, chronic obstructive pulmonary disease (COPD) and malignancy⁽⁴⁾. Blood vessels are narrowed and thickened by cigarette smoking. These changes cause the heart rate to increase and clots to form⁽⁴⁾. Regarding the respiratory system, the airways and alveolar are damaged by cigarette smoking, leading to emphysema and chronic bronchitis. For asthmatic patients, cigarette smoking worsens symptoms and attacks occur more frequently⁽⁵⁾. Cigarette smoking causes an imbalance in bone turnover, leading to a lower bone mass and making bones prone to osteoporosis and fracturing more easily⁽⁶⁾. In terms of reproductive health, smoking makes pregnancy harder to achieve for both male and female smokers⁽⁷⁾. Cigarette smoking is associated with erectile dysfunction accompanied with a reduction in semen volume and total sperm count. Interestingly, semen quality is restored after the cessation of cigarette smoking⁽⁷⁾.

Similarly, cigarette smoking is also associated with sub-fertility in female. More irregular or painful periods, low estrogen level have been reported⁽⁴⁾.

Effect of cigarette smoking on pregnant women

The prevalence of cigarette smoking during

pregnancy has been globally reported as around 1.7%⁽⁸⁾. Pathological harm to pregnant women and their babies from cigarette smoking is complex. It has been postulated that the mechanism occurs through disruption of fundamental processes such as proliferation, apoptosis and trophoblastic invasion during placental development and may also be caused by alteration of the vascularization and placental metabolism⁽⁹⁾.

CO is an odourless and colourless gas. When pregnant women inhale and absorb it into their circulatory system, CO binds to haemoglobin instead of oxygen, forming carboxyhaemoglobin, which has a greater affinity than oxygen. In smokers, the level of carboxyhaemoglobin is higher than in non-smokers. The increased carboxyhaemoglobin concentration causes a shift to the left of the oxygen-haemoglobin dissociation curve. This shift to the left deprives the uterus, myometrium and fetoplacental unit of oxygen⁽¹⁰⁾. A chronic shift to the left of the oxygen-haemoglobin dissociation curve tends to result in chronic hypoxia, followed by fetal growth restriction and preterm birth⁽¹¹⁾.

It has been documented that the risks of many adverse pregnancy outcomes are linked to cigarette smoking, including ectopic pregnancy (odds ratio (OR) 1.77; 95% confidence interval (CI) 1.31, 2.22), placenta previa (OR 1.58; 95% CI 1.04, 2.12), abruptio placenta (OR 1.62; 95% CI 1.46, 1.77), preterm premature rupture of membranes (OR 1.7; 95% CI 1.18, 2.25), low birthweight (less than 2,500 grams) (OR 1.78; 95% CI 1.53, 2.08), intrauterine growth restriction (OR 1.83; 95% CI 1.64, 2.05), intrauterine fetal death (OR 1.98, 95% CI 1.01, 3.89), neonatal respiratory (OR 1.32; 95% CI 1.13, 1.56) and gastrointestinal disease (OR 1.63; 95% CI 1.11, 2.42), need of transfer of newborn to a neonatal intensive care unit (NICU) (OR 1.44; 95% CI 1.26, 1.63) and more than 7 days NICU admission of the newborn (OR 1.64, 95% CI 1.42, 1.90).^(12,13) Risks of adverse pregnancy outcomes were found to be dose-dependent, with the highest risk found among heavy smokers (more than/equal to 20 cigarettes per day)⁽¹²⁾.

In contrast, cigarette smoking has been shown to reduce preeclampsia risk^(14,15). Its protective role is explained by the reduction in anti-angiogenic protein production by the CO. Known anti-angiogenic proteins have been found to be linked to the pathogenesis of preeclampsia, including soluble fms-like tyrosine kinase-1 (sFlt-1) and soluble endoglin (sEng)⁽¹²⁾. However, the benefit of pre-eclampsia risk reduction should be balanced with the teratogenic effect.

Effect of smoking on the fetus

Nicotine stimulates the parasympathetic nervous system. It has effects on maternal and placental vessels and also passes through the placenta to affect fetal circulation. There are significant concerns regarding its effect on the fetal brain as the nicotine acts as neuroteratogen by binding to the nicotinic acetylcholine receptors in the fetal brain and interfering with fetal brain development. Some studies have postulated that it leads to cognitive, behavioural and emotional abnormalities during the childhood period⁽¹⁶⁾. The teratogenic effect of nicotine alone is difficult determined because cigarette smoking contains more than 4800 different components. In utero smoking has been associated with some forms of birth defects, including limb reduction, gastroschisis, and oral clefts⁽¹⁷⁾.

Particles of tar are contained in the burned cigarette smoke. This tar usually remains in the smoker's body. When it accumulates in the respiratory tract, it acts as a carcinogen. Moreover, heavy metals such as cadmium are also contained in the cigarette smoke. Cadmium passes through and accumulates in the placenta and has been reported to be associated with fetal growth restriction⁽¹¹⁾. Mothers exposed to second hand smoking during pregnancy had significantly lower mean fetal birth weight, length, head circumference comparing to unexposed mothers⁽¹⁸⁾.

Cigarette smoking cessation

All pregnant women should be asked about all types of tobacco or nicotine use at the preconception

visit, the first prenatal visit, or subsequent visits. Pregnant smokers should be encouraged to stop smoking cigarettes and any forms of tobacco products as soon as possible. Cessation of cigarette smoking at any point in gestation improves maternal and fetal pregnancy outcomes. The greatest benefit has reported when cessation occurs before 15 weeks of gestation⁽¹⁹⁾. All types of tobacco, including e-cigarettes, vaping products, hookahs, lozenges, patches and gums should be avoided during pregnancy⁽¹⁹⁾. Psychological, behavioural and pharmacotherapy modality should be individually applied with pregnant women aiming for cigarette smoking cessation⁽²⁰⁾. Nicotine replacement therapy is still controversial in regard to its efficacy and safety in cigarette smoking cessation usage⁽²¹⁾.

Conclusion

In conclusion, awareness of cigarette smoking status during pregnancy should be raised, and cigarette smoking cessation should be encouraged among pregnant women, with the aim of reducing adverse pregnancy outcomes.

References

1. Hanprasertpong J, Hanprasertpong T. Marijuana in obstetric patients. *Thai J Obstet Gynaecol* 2023;31: 160-2.
2. Tobacco: Encyclopaedia Britannica. Encyclopaedia Britannica, Inc. Publish 2017 [Available from: <https://www.britannica.comhttps://www.britannica.com/plant/common-tobacco>]
3. Picciotto MR, Lewis AS, van Schalkwyk GI, Mineur YS. Mood and anxiety regulation by nicotinic acetylcholine receptors: A potential pathway to modulate aggression and related behavioral states. *Neuropharmacology* 2015;96(Pt B):235-43.
4. Centers for Disease Control and Prevention. Health effects of cigarette smoking.[Available from:https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm. Accessed August15, 2024.]
5. Centers for disease control and prevention (US); National center for chronic disease prevention and health promotion (US); Office on smoking and health (US). How tobacco smoke causes disease: The

biology and behaviorab basis for smoking-attributable disease: A report of the surgeon general. Atlanta (GA): Centers for disease control and prevention (US); 2010. PMID:21452462.

6. Al-Bashaireh AM, Haddad LG, Weaver M, Chengguo X, Kelly DL, Yoon S. The effect of tobacco smoking on bone mass: An overview of pathophysiologic mechanisms. *J Osteoporos* 2018;1206235.
7. Tang Q, Pan F, Wu X, Nichols CE, Wang X, Xia Y, et al. Semen quality and cigarette smoking in a cohort of healthy fertile men. *Environ Epidemiol* 2019;3:e055.
8. Lange S, Probst C, Rehm J, Popova S. National, regional, and global prevalence of smoking during pregnancy in the general population: a systematic review and meta-analysis. *Lancet Glob Health* 2018;6:e769-76.
9. Morales-Prieto DM, Fuentes-Zacarias P, Murrieta-Coxca JM, Gutierrez-Samudio RN, Favaro RR, et al. Smoking for two- effects of tobacco consumption on placenta. *Mol Aspects Med* 2022;87:101023.
10. Aubard Y, Magne I. Carbon monoxide poisoning in pregnancy. *BJOG* 2000;107:833-8.
11. McDonnell BP, Regan C. Smoking in pregnancy: pathophysiology of harm and current evidence for monitoring and cessation. *Obstet Gynaecol* 2019;21:169-75.
12. Tarasi B, Cornuz J, Clair C, Baud D. Cigarette smoking during pregnancy and adverse perinatal outcomes: a cross-sectional study over 10 years. *BMC Public Health* 2022;22:2403.
13. Castles A, Adams EK, Melvin CL, Kelsch C, Boulton ML. Effects of smoking during pregnancy. Five meta-analyses. *Am J Prev Med* 1999;16:208-15.
14. England L, Zhang J. Smoking and risk of preeclampsia: a systematic review. *Front Biosci* 2007;12:2471-83.
15. Lisonkova S, Joseph KS. Incidence of preeclampsia: risk factors and outcomes associated with early-versus late-onset disease. *Am J Obstet Gynecol* 2013;209:544.e1-12.
16. Navarro HA, Seidler FJ, Eylers JP, Baker FE, Dobbins SS, Lappi SE, et al. Effects of prenatal nicotine exposure on development of central and peripheral cholinergic neurotransmitter systems. Evidence for cholinergic trophic influences in developing brain. *J Pharmacol Exp Ther* 1989;251:894-900.
17. McGrath-Morrow SA, Gorzkoski J, Groner JA, Rule AM, Wilson K, Tanski SE, et al. The effects of nicotine on development. *Pediatrics* 2020;145:e20191346.
18. Prince PM, Umman M, Fathima FN, Johnsons AR. Secondhand smoke exposure during pregnancy and its effect on birth outcomes: evidence from a retrospective cohort study in a tertiary care hospital in Bengaluru. *Indian J Community Med* 2021;46:102-6.
19. Tobacco and nicotine cessation during pregnancy: ACOG Committee Opinion, Number 807. *Obstet Gynecol* 2020;135:e221-e229.
20. Siu AL, U.S. Preventive Services Task Force. Behavioral and pharmacotherapy interventions for tobacco smoking cessation in adults, including pregnant women: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med* 2015;163:622-34.
21. Diamanti A, Papadakis S, Schoretsaniti S, Rovina N, Vivilaki V, Gratziou C, et al. Smoking cessation in pregnancy: An update for maternity care practitioners. *Tob Induc Dis* 2019;17:57.