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Passive smoking as an independent risk factor for gestational diabetes that synergizes with prepregnancy obesity in urban Chinese women

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Abstract

There are high-priority public health and legislative efforts around the world to reduce smoking and to reduce the spaces where smoking is allowable. These efforts are aimed at minimizing not only the adverse health effects of active smoking but also the adverse health effects of passive cigarette smoke exposure. While many cultures and societies make protection of a pregnant woman and her about-to-be-born-newborn a priority, the importance of protecting them from passive smoking that is prevalent in many modern societies has not been reported. The article by Leng et al, "Passive smoking increased risk of gestational diabetes mellitus independently and synergistically with prepregnancy obesity in Tianjin, China," newly published in *Diabetes Metabolism Research and Reviews*, provides evidence that passive smoke inhalation during pregnancy makes gestational diabetes more likely, bringing with it negative health consequences for the mother and her baby. This study will hopefully add support to public health officials' efforts to curb cigarette use, especially in public domains.

Keywords

cigarette smoke; GDM; insulin resistance; nicotine

Cigarette smoke exposure increases risk for type 2 diabetes (T2DM).¹⁻³ Active smoking increases risk for gestational diabetes mellitus (GDM).³⁻⁵ Even passive smoking increases the risk for T2DM.⁶⁻⁹ However, it was not known whether passive smoking increases the risk for GDM. Exposure to second-hand tobacco smoke in China is common, especially in heavily populated urban locations; passive smoking affects up to 70% of women through exposures in the home, indoor workplaces, and outdoor spaces.¹⁰ Obesity increases the risk for T2DM¹¹⁻¹³ and for GDM.¹⁴ The study by Leng et al¹⁵ showed that passive smoking and

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CONFLICT OF INTERESTS

There are no conflicts of interest to report.

ETHICS STATEMENT

The study protocol of Leng et al¹⁵ was approved by the Ethics Committee for Clinical Research of Tianjin Women and Children's Health Centre, and written informed consent was obtained from all women.

obesity each have independent effects to increase risk for GDM but, interestingly, synergize to increase risk for GDM.

Smoking prevalence is high among Chinese men (62.4% according to a 2010 survey) and much higher than among Chinese women (3.4%).^{16,17} The prevalence of active smoking among pregnant women may be even lower because women smokers may stop during pregnancy. However, the prevalence of active smoking by men makes passive exposure during pregnancy difficult to avoid both inside and outside of the home. Additionally, the risk for T2DM, as well as GDM, is influenced by ethnic background and occurs at a leaner body mass index among eastern Asians than among individuals of European descent.^{18–21} This raises the question whether the “threshold” for induction of GDM by either passive smoking or obesity is lower in this particular study population, or whether these findings may be more widely applicable to other ethnic background geographic locations. Of concern, these findings may indicate that there is a higher risk for GDM that has not been recognized in populations in which both smoking (active or passive) exposure and obesity rates are high.

The mechanisms for independent and synergistic effects of passive smoking and obesity are not known. Cigarette smoke and environmental pollutants induce inflammatory responses, as does obesity-induced insulin resistance.^{22–27} However, the specific inflammatory markers associated with smoking and insulin resistance may differ, as well as the tissues affected by inflammation. In the rat, it has been shown that blood samples of rats exposed to tobacco smoke exhibit high levels of DNA damage, altered lipid and lipoprotein profiles, and reduced superoxide dismutase activity; furthermore, smoke exposure accelerates the appearances of these metabolic disturbances in obese rats.²⁸ Further research will be necessary to investigate the cellular mechanisms of independent and synergistic effects of passive smoking pollutants and obesity on maternal tissues and placenta and whether there is a dependence on dose or timing of exposure to passive smoking pollutants during pregnancy on development of GDM.

The study has some limitations that could affect the significance of the conclusions. For example, the study design is cross-sectional and does not consider the possibility of reverse causation. That is, the association of passive smoking with GDM may not be because passive smoking is causing GDM, but because women at risk for GDM are more likely to spend significant time in and outside of the home exposed to passive smoking than the general population. Or, women who are exposed to passive smoking are themselves former smokers who continue to associate with active smokers, and there could be residual effects of prior smoking and accumulated exposure on their respiratory and circulatory systems. Or, women who were former smokers may have gained weight after quitting smoking. The sample size is limited and was taken from a restricted geographic location with a relatively ethnic homogeneous background. There were some inconsistencies with study execution. For example, as explained by the authors, there were 781 of 18,589 eligible women who had a positive 50 g 1 hour glucose challenge test but who were not followed with a 75 g 2 hour oral glucose tolerance test and so were excluded from analysis. Furthermore, there were 4859 (of 17,808) women from which passive smoking information was not obtained and so were also excluded from analysis. In most cases, the investigators did not have access to

prepregnancy weight but used first antenatal care visit weight instead, assuming that any weight changes because conception was insignificant. Finally, passive smoking exposure was assessed by subjects' response to a single question on a questionnaire, with no independent validation of exposure. Thus, this could cause misclassification, possibly underestimating the association between passive smoking and GDM risk.

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