[Archived] Consumption of Tobacco During Pregnancy and Its Impact on Child Development

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Introduction

Although the prevalence of smoking in the general population is declining, the rate of diminution is slowest among women of childbearing age. Further, national surveys conducted in the mid and late 1990s in both Canada and the United States have found that, among pregnant women, approximately 20 percent smoked cigarettes during pregnancy. As approximately 4 to 5 million live births occur each year in North America, the number of unborn children exposed to the constituents of smoke via maternal smoking habits (not to mention second-hand smoke exposure, even if the mother-to-be does not smoke) is enormous and has extensive, wide-ranging repercussions for a large number of children. In this brief, condensed review, I will touch upon findings in the study of tobacco consumption during pregnancy with respect to growth, cognitive functions and behaviour in child development. Most of the references provided will direct the interested reader to a large body of literature on this topic.

Subject

Since its recognition in 1957,[1] the most consistently reported effect of cigarette smoking on pregnancy has been the lowered birth weight in offspring. The two key ingredients of cigarette smoke that impact upon foetal growth are carbon monoxide and nicotine. Both reduce the amount of oxygen available to the foetus. Furthermore, nicotine can cross the placenta and affect the foetal cardiovascular and central nervous system (CNS). It is generally accepted that smoking during pregnancy reduces foetal growth (birth weight, birth length and head circumference) in a dose-response fashion.[2] Thus, the average reduction in birth weight associated with smoking one pack of cigarettes a day is approximately 200 grams. Among pregnant teenagers (who are more likely to smoke than older pregnant women) the reduction in birth measures is more pronounced than in a similar cohort of adult women.[3]

Problems, research context and key research questions

The effect of prenatal cigarette exposure on growth in older children is not as definitive as the effects of exposure on infants. However, recent studies have shown that negative early growth effects are overcome within the first few years.[4,2,5] In fact, by age six, the children of heavy smokers have been found to be heavier but not taller than control subjects,[7] with increased skinfold thickness[2] (a measure of percentage body fat). The choice of bottle-feeding or a shorter duration of breast-feeding by women who smoked during pregnancy appeared to play an important positive role in the catch-up observed among the infants of smokers. This finding is consistent with the literature showing that children who were bottle-fed grew faster than children who were breast-fed.[6]

Moving from growth effects to possible cognitive relationships with prenatal tobacco exposure, *in utero* exposure has been associated with poorer auditory orientation and responsiveness and increased tremors and startles[7] in infants. In preschool and school-aged children, several investigators have reported lower scores on tests of general cognitive performance in children born to women who smoked cigarettes, with the effects being dose-related.[8-11] In one of these tests,[12] cognitive functioning at age three was higher among the children of mothers who quit smoking during pregnancy than among the children whose mothers smoked throughout pregnancy. In most studies, the primary discriminating variables between the children of smokers compared to children of non-smokers or women who quit smoking were subtests in the verbal domain, including language development,[8,9] verbal IQ,[13] and the auditory aspects of reading.[14] It is noteworthy that a recent study using animals found that nicotine had a marked disruptive effect upon synaptic development in the auditory cortex.[15]

Investigators have also reported associations between prenatal tobacco exposure and increased activity, inattention and impulsivity in subjects ranging from 4 to 16 years of age.[16] Their reports have also shown an apparent link between *in utero* cigarette exposure and behavioural and psychological problems: in toddlers, who were identified as being more likely to display oppositional and aggressive behaviour,[17, 18] in school-aged children, who exhibited behavioural problems,[19] and in adolescents, who presented adolescent conduct disorder, substance use and depression.[20, 21] Lastly, several workers have found that prenatal tobacco exposure increased the likelihood of cigarette smoking among offspring[21–23] — an observation that, based on animal findings, may be partially attributable to physiological changes resulting from prenatal nicotine exposure.[24, 25]

Conclusion

In sum, the scientific evidence suggests that smoking during pregnancy is associated with a number of adverse effects on the growth, cognitive development and behaviour of exposed offspring. This association is likely to include a complex interaction between three factors:

1. a direct neurophysiological teratological impact of the constituents of tobacco. Strong support for this finding is derived from the large body of evidence indicating that nicotine targets specific neurotransmitter receptors in the foetal brain[25] with such receptors being present by the fourth week of gestation in the human.[26]
2. the lifestyle environment that is prevalent among women who smoke during pregnancy. This environment may pose an additional risk to their offspring. Indeed, women who smoke during pregnancy are less likely to breast-feed and are more likely to use other drugs, including alcohol.
3. a genetic component. For example, prenatal tobacco exposure may be a causative factor in producing more impulsive children but it is also possible that women who are more impulsive may be more likely to smoke and produce more impulsive children. The complexity of the etiology of the adverse outcomes discussed above makes it very difficult to categorically state that the outcomes are “caused by” prenatal tobacco exposure. However, the evidence from literature on both animals and humans is very convincing: smoking during pregnancy is a contributing factor to a host of short- and long-term effects on the growth and neurobehavioural development of offspring.

Implications

On a number of levels, recognizing and clarifying the effects of maternal smoking will enhance the ability of policy makers and service providers to conduct informed and informative interventions. For example, most obstetricians and paediatricians are aware of the link between cigarette smoking and lowered birth weight, but many are not cognizant of the longer-term risks associated with smoking during pregnancy. Knowing about these risks will facilitate early detection of the adverse consequences of smoking in offspring at risk, thereby increasing the likelihood of successful intervention in the areas of language development and attention disorders.

Last, but certainly not least, being able to specify and publicize the consequences of smoking during pregnancy would add another resource to our consciousness-raising arsenal, the better to convince pregnant women, especially those of the younger generations, to stop or reduce tobacco consumption. It would also reduce the likelihood that women of reproductive age would initiate smoking.

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