

PRENATAL SMOKING EXPOSURE AND NEUROPSYCHOLOGICAL OUTCOMES IN ADHD CHILDREN

Pujals Altés E, Elias Abadias M, Gómez Simon I, Fresno González C, Garriga Climent N, Giménez Fernández E, Casaseca Segura N, Fernández Montero R, Martín López LM
Ciutat Vella Child and Adolescent Mental Health Service. Institute of Neuropsychiatry and Addictions of the Parc de Salut Mar. Barcelona

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder with a pervasive pattern of inattentive, impulsive and/or hyperactive behaviors that lead to impairment of functioning in important areas such as family life, school and peer interaction. Despite high heritability, ADHD has also been associated with numerous environmental factors that may increase the risk for ADHD beyond genetics.

Many studies suggest that smoking during pregnancy is a risk factor affecting the development of attention-deficit/hyperactivity disorder as well as other emotional and behavioral problems, via the neurological changes that smoking produces *in utero*. Prenatal exposure to nicotine results in more nicotine receptors in the fetus's brain that modulates the development of serotonergic and dopaminergic systems in the brain. The nicotinic input to the dopaminergic motivational/reward system during this critical period of development predisposes the brain to subsequent deficits resulting in attention deficits, impulse control and aggression. Prenatal cigarette exposure has also been shown to affect several aspects of cognitive functioning, such as memory, attention and problem solving, and has been associated with worse academic performance.

OBJECTIVE

The aim of this study is to examine the difference in cognitive functioning and attention deficit between the ADHD offspring of smoking mothers and ADHD children unexposed to maternal smoking during pregnancy. Since smoking behavior and ADHD are strongly associated, we hypothesized that ADHD children of mothers who smoked during pregnancy would perform worse in neuropsychological tests assessing attention and impulse-control functions than nicotine unexposed ADHD children.

METHODS

Fifty-five children aged 6-16 with ADHD diagnosis according to DSM-IV-TR criteria were assessed by different neuropsychological tests. Cognitive functioning and attention deficit was assessed by the Wechsler Intelligence Scale for Children-IV, Perception of Differences Test-CARAS (L.L.Thurstone) and D2 Test of Attention (R.Brickenkamp). Information on maternal smoking and other background factors (gestational age, birth weight, race of the child, socio-economical status and psychiatric diagnosis in parents) was obtained. Children with an IQ below 80, a pervasive developmental disorder or those with a diagnosed neurological disorder were excluded.

All the analyses were performed using the Statistical Package for the Social Sciences (SPSS for Windows, version 17.0).

RESULTS

The prevalence of prenatal maternal smoking in our ADHD sample was 38'18 % (n=21).

After controlling for potential confounders (birth weight, gestational age, parental psychopathology and socioeconomic factors), there was no strong evidence of differences in Verbal Comprehension Score (p=0,104), Perceptual Reasoning Score (p=0,267), Working Memory Score (p=0,96), Processing Speed Index (p=0,125), CARAS (p=0,108), D2 TOT (p=0,565), D2 CON (p=0,190) and D2 VAR (p=0,351).

	Mean	Std.Deviation	Sig. (2-tailed)
Verbal Comprehension Score			0.104
prenatal smoking exposed	101.20	7.67	
prenatal smoking unexposed	94.96	14.39	
Perceptual Reasoning Score			0.267
prenatal smoking exposed	96.00	11.71	
prenatal smoking unexposed	102.38	16.28	
Working Memory Score			0.096
prenatal smoking exposed	84.45	8.88	
prenatal smoking unexposed	93.28	15.97	
Processing Speed Index			0.125
prenatal smoking exposed	91.10	9.56	
prenatal smoking unexposed	98.40	17.48	
IQ/ CGI			0.341
prenatal smoking exposed	93.12	12.23	
prenatal smoking unexposed	97.24	14.47	
CARAS			0.108
prenatal smoking exposed	30.20	29.12	
prenatal smoking unexposed	46.50	24.20	
D2 TOT			0.565
prenatal smoking exposed	33.00	17.17	
prenatal smoking unexposed	39.15	26.31	
D2 CON			0.190
prenatal smoking exposed	28.62	14.57	
prenatal smoking unexposed	42.38	26.06	
D2 VAR			0.351
prenatal smoking exposed	19.70	24.13	
prenatal smoking unexposed	37.69	22.43	

DISCUSSION

Prenatal exposure to smoking has been shown to affect various aspects of cognitive functioning. Prenatal nicotine exposure has been associated with deficits in verbal learning and design memory, a slowed responding on a test of eye-hand coordination, a reduced ability for flexible problem solving and more impulsivity (Cornelius et al, 2001), as well as lower attention scores assessed by the continuous performance test (Leech et al, 1999).

Our study showed no difference in cognitive functioning and attention deficit between the ADHD offspring of smoking mothers and ADHD children unexposed to maternal smoking during pregnancy. To our knowledge, there are no epidemiological studies that have investigated the effect in neuropsychological performance in ADHD diagnosed children of smoking, compared with ADHD children of nonsmoking, mothers.

The strongest limitation of the present study was the low sample size. Another limitation of our study included self-report of maternal smoking, which is known to underestimate the true extent of smoking given the stigma of smoking during pregnancy.

Thus, future studies are needed to clarify the relationship between prenatal smoking and ADHD.

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