

Is There Any Relationship Between Attention Deficity Hyperactivity Disorder and Smoking During Pregnancy and Second Hand Smoking?

Cengiz Özge*, Fevziye Toros**

*Assistant Professor of Chest Disease and **Child and Adolescent Psychiatry, Mersin University School of Medicine

Summary

Objective: Attention deficit hyperactivity disorder (ADHD) is the most common psychiatric disorder among children and adolescents. The aim of the this study was to determine relationship between ADHD and mother's smoking during pregnancy, and to evaluate possible relationship with other factors (e.g. smoking of mothers and fathers, second hand smoking, parent's education levels and family income).

Methods: 125 children and adolescents with ADHD, and 75 children and adolescents without any psychiatric disorders aged between 6 to 15 and their parents were included in this study. Sociodemographic factors and characteristics of parent's smoking were obtained with a structured questionnaire.

Results: We found positive correlations between ADHD and smoking by mothers both during the pregnancy and other time and second hand smoking of the children ($p < 0.001$).

Conclusion: It was concluded that smoking is an important risk factor for children and adolescents with ADHD. Archives of Lung: 2006; 7: 49-52

Key Words: ADHD, smoking, parents, family conditions, pregnancy

Özet

Dikkat Eksikliği Hiperaktivite Bozukluğu ile Gebelikte Sigara İçme ve Pasif İçicilik Arasında Bir İlişki Var mı?

Amaç: Dikkat eksikliği hiperaktivite bozukluğu (DEHB) çocuklar ve ergenlerde en sık görülen psikiyatrik bozukluktur. Bu çalışmanın amacı DEHB ile annenin gebelik sırasında sigara içmesi arasındaki ilişkinin ve ilgili diğer faktörlerin (anne babanın sigara içmesi, pasif içicilik, aile eğitim düzeyi ve aile geliri gibi) değerlendirilmesidir.

Metod: Bu çalışmaya yaşları 6-15 arasında, 125 DEHB olan, 75 herhangi bir ruhsal bozukluğu olmayan çocuk ve ergen ile ebeveynleri alınmıştır. Sosyodemografik faktörler ve ebeveynlerin sigara içme özellikleri yapılandırılmış anket formu ile elde edilmiştir.

Bulgular: DEHB ile gebelikte annenin sigara içmesi ve çocuğun sigara dumanına maruz kalması arasında pozitif bir ilişki saptanmıştır ($p < 0.001$).

Sonuç: Çocuk ve ergenlerde sigaranın DEHB için önemli bir risk faktörü olduğu kanaatine varılmıştır. Akciğer Arşivi: 2006; 7: 49-52

Anahtar Kelimeler: Hiperaktivite, gebelik, sigara

Introduction

In the literature, there are lots of the studies about the relationship between smoking and various disorders, especially after the time of spread out of the entire world, same as an outbreak. The results of these studies showed that smoking is an important cause of morbidity and mortality in all over the world (1). With the increasing rate of these studies it can be reached new knowledge and clues. As a health worker, our most important tasks are to submit such clues and knowledge to the population and to offer a solution for this contention.

There are supportive data about pregnancy and increasing carboxyhemoglobin levels of maternal and fetal blood samples that create possible fetal hypoxia (2). Moreover, it has been shown that nicotine freely crossed the placenta, and it is now believed that the human fetus is actually exposed to a higher nicotine concentration than the smoker mother (3). Because of this, low birth weight, intrauterine death ve neonatal death is commonly reported possible side effects of this relationship.

Attention deficit hyperactivity disorder (ADHD) is one of the most common behavioral disorders in child and adolescent

psychiatry. It occurs in 3 and 5 % of children of school age (4). In some recent studies, ADHD has been reported up to 10 % (5). Children with ADHD are characterized by early onset of symptoms of hyperactivity, impulsivity, and difficulties with attention (6). Many hyperactive children (about two-thirds) continue to be disabled into adulthood by one or more initial core symptoms of the syndrome. About one-third are diagnosed as having the full syndrome at 18 years (7). The 1/3 of these patients diagnosed as ADHD at the time of adolescence and other 1/3 of them reported important psychiatric disturbances (e.g. severe personality disturbances, substance abuse). The etiology of ADHD is multifactorial and both genetic and environmental risk factors are involved (8,9).

Especially, recent studies reported that genetic influences play an important role in the development of ADHD (10), a great deal of environmental factor has an important role on this condition. In the issue of relationship between maternal smoking and ADHD, there are reported supportive studies (11). On the other hand, some pitfalls of these studies (e.g. not including data about psychopathology of family, retrospective design, weak statistical power) require new prospective studies. The aim of the this study was to determine relationship between ADHD and smoking by mothers during pregnancy, and to evaluate possible relationship with other factors (e.g. smoking of mothers and fathers, second hand smoking, parent's education levels and family income).

Study Design

This study was performed from July 2003 to January 2004. The study sample was composed of 125 children and adolescents with ADHD according to DSM-IV criteria (12). 75 children and adolescents without any psychiatric disorders age matched children as a control group. Cases having mental retardation, psychosis, pervasive developmental disorders or other comorbid psychiatric disorder, neurologic disorder (e.g., seizure disorders), any known metabolic disease (e.g., hyperthyroid), complications during pregnancy, natal, and postnatal period (e.g., low birth weight), divorced parents, taking alcohol and drug during pregnancy, taking of any medication (e.g., thyroxin) were excluded from this study. The subjects who had important comorbid psychiatric diagnoses in first degree family members, separate family members, severe incompatibility in their homes, important disorder, severe psychologic trauma during pregnancy and children with low birth weight, excluded from this study. During the interview, all parents were administered a detailed, structured questionnaire was prepared by child and adolescent psychiatrist. This questionnaire included the detailed sociodemographic factors of subjects (e.g. age, gender, average family income, mother education level, smoking habitations of mother's and father's, pregnancy smoking history, and a possible history of passive smoking) and clinical characteristics of subjects.

The parents who had a smoking habitation 1 cigarette per day, accepted as "smoking parents". The mothers who reported at least 3 month smoking history during their pregnancy accepted smoking mother also.

Statistical Analysis

General statistical analyses were performed with SPSS 11.0 software (SPSS Inc. Chicago, IL, USA). Descriptive statistics of variables were computed as a mean \pm SD and frequencies (count and percentages). Independent t-test was used to compare the general continuous characteristics (student age, mother age, father age, mother and father's education etc) between two groups. Pearson Chi-square test was used to determine the relation between general categorical characteristics (sex, mother and father smoking and alcohol status, etc) of the two groups. We also evaluated possibly important factors on having ADHD using Binary Logistic Regression Analysis by Enter method. Off all variables, differences below 5% were accepted as significant.

Results

Demographic features of 125 ADHD children and 75 healthy controls were homogenous. Children with ADHD did not show any significant difference with respect to mother's education and family income did not show any significant difference also. Social and demographic features of study groups were shown at table I.

The mother's of children with ADHD had significantly higher ratio of smoking during pregnancy compared to controls ($p < 0.001$). There were no significant differences between the patients and the control group with respect to mother and father's smoking habits. However, in the aspect of second hand smoking, the ratio of mother's smoking and second hand smoking was significantly higher in children with ADHD compared to healthy ones, whereas father's smoking was not. The relationship between smoking habits of parents and ADHD was shown in table II.

Second hand smoking, family income and mother's education level did not show any significant difference between the study and control groups (see table III).

Binary Logistic Regression Analysis show that mother education, mother smoking, smoking during pregnancy and second hand smoking had significant effect on having ADHD (for details please see table IV). The most important factor was pregnancy smoking according to this model (General significant of model was $p = 0.000$ and Exp B = 0.600).

Discussion

In this study we investigated the relationship between the smoking during pregnancy and ADHD in order to exclude other factors which act on the aethiopathogenesis of the disease such as genetical (study of psychopathology of family) and environmental (e.g. separated parents, severe fractiousness of family, alcohol or drug abuse during pregnancy, severe pregnancy disease, severe psychological disorders during pregnancy, low birth weight) factors as possible. We showed a significant relationship between the maternal smoking and ADHD diagnosis. We also suggested a significant correlation between second hand smoking and ADHD. In a comprehensive clinical study, Mielberg et al (1996) showed that, in 140 children with ADHD mother smoking ratio (22%) was significantly higher than controls (8%) (13). This

Table I: Social and Demographics Features of Study Groups

	Patients n=125	Controls n=75	p
Gender			p>0.05
Boys	87 (69.6%)	59 (78.7%)	
Girls	38 (30.4%)	16 (21.3%)	
Age (year)	10.1±2.3*	9.1±2.4*	p>0.05
Mother's Education			p>0.05
Basic school	49(39.2%)	22(29.3%)	
High school	47(37.6%)	23(30.7%)	
University	29(23.2%)	30(40.0%)	
Family Incomes			p>0.05
Very poor	10(8.0%)	3 (4.0%)	
Poor	57(45.6%)	30 (40.0%)	
Satisfied	32(25.6%)	24 (32.0%)	
Good	14(11.2%)	12 (16.0%)	
Very good	12(9.6%)	6 (8.0%)	

*mean±standard deviation (SD)

Table II: The Relationship between smoking and ADHD

	Patients n=125	Controls n=75	p
Smoker			
Mothers	62 (49.6%)	14 (18.7%)	p=0.000*
Fathers	77 (61.6%)	38 (50.7%)	p>0.05
Smoking during pregnancy	47 (37.6%)	2 (2.7%)	p=0.000*
Second hand smoke	82 (65.6%)	29 (38.7%)	p=0.000*

* p<0.05 as a significant

Table III: The Relationship between Family Incomes, Mother's Education and Second Hand Smoke

	Patients n=125		Controls n=75		p
	Yes n=82	No n=43	Yes n=29	No n=46	
Second hand smoke					
Family Incomes					p>0.05
Very poor	7 (8.5%)	3 (6.9%)	2 (6.9%)	1 (2.2%)	
Poor	32 (39.0%)	25 (58.1%)	11 (37.9%)	19 (41.3%)	
Satisfied	19 (23.2%)	13 (30.3%)	13 (44.8%)	11 (23.9%)	
Good	12(14.6%)	2 (4.7%)	2 (6.9%)	10 (21.7%)	
Very good	12(14.6%)	-	1 (3.5%)	5 (10.9%)	
Mother's Education					p>0.05
Basic school	35 (42.7%)	14 (32.6%)	11 (37.9%)	11 (23.9%)	
High school	27 (32.9%)	20 (46.5%)	7 (24.2%)	16 (34.8%)	
University	20 (24.4%)	9 (20.9%)	11 (37.9%)	19 (41.3%)	

NS= Non significant (p>0.05)

Table IV: The Binary Logistic Regression Analysis Results.

Variables	OR	p	Exp (B)	95% CI	
				Lower	Upper
Age	2.437	0.119	0.900	0.781	1.058
Gender	1.955	0.162	1.261	0.565	2.814
Family Incomes	3.141	0.534	0.412	0.062	2.717
Mother Education	6.415	0.040	0.462	0.172	0.989
Mother Smoking	19.039	0.000	0.893	0.343	0.926
Father Smoking	2.293	0.130	2.701	0.897	8.137
Smoking During Pregnancy	30.925	0.000	0.051	0.010	0.272
Second Hand Smoke	13.769	0.000	0.328	0.105	0.326

Note: Highlighted variables have significant effect on having ADHD

study was reported similar ratios in both of the mother's of ADHD children and other women in the population (27%). Our results showed 8.7 vs 37.9% ratio of smoking in women (14,15). Although it was not explored in detail, it is known that the smoking ratio of women has increased in last years. However our study results (37.6% of smoking ratio) was concordant with the general population data, but the smoking ratio of control group (2.7%) significantly lower than expected. Mick et al reported that the smoking ratio in mothers of children with ADHD was 2.1 fold higher than those of healthy children (16). These authors pointed out that a possible relationship between psychiatric disorders of children including ADHD and maternal co morbidity during pregnancy (e.g. maternal smoking, maternal drug abuse and maternal alcohol use).

Linnet et al (2003) reported a detailed meta-analytic study including 24 papers relating to nicotine from 1973 to 2002 and suggested a possible relationship between maternal smoking and AD/HD. They pointed out to some limitations of these studies especially missing data relating to psychopathology story of the family, socioeconomic status of the family, low or missed control data, low statistical power, ignored data about prenatal and postnatal smoking (11).

In our study, we evaluated all subject individually by a specialist for definitive diagnosis and differential diagnosis. We also took into consideration, not only other psychiatric disturbance of children, but also families. Although we could not confirm point to point relationship, our data suggested a high potential relationship between smoking during pregnancy and development of ADHD in children. We also showed that pregnancy smoking increased the ADHD probabilities 30.925 folds as a high score (df=1).

It was concluded that a possible relationship between AD/HD and maternal smoking other than genetic and other environmental factors. We also believe that second hand smoking can be accepted an additional risk factor in this group.

References

- World Health Organization. Tobacco or Health: A global status report. Genova; World Health Organization (1997) pp 10-18.
- Fielding JE: Smoking: health effect and control. N Engl J Med (1985) 313:491-498.
- Luck W, Nau H, Hansen R, Steldinger R: Extend of nicotine and cotinine transfer to the human fetus, placenta and amniotic fluid of smoking mothers. Dev Pharmacol Ther (1985) 8:384-395.
- Faraone SV, Doyle AE: The nature and heritability of attention-deficit/hyperactivity disorders. Child Adolesc Psychiatr Clin North Am (2001) 10:299-316.
- Rowland AS, Umbach DM, Stallone L, Naftel AJ, Bohlig EM, Sandler DP: Prevalence of medication treatment for attention-deficit/hyperactivity disorder among elementary school children in Johnston County, North Carolina. Am J Public Health (2002) 92:231-234.
- Biederman J, Newcorn j, Sprich S: Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. Am J Psychiatry (1991) 148:564-567.
- Lewis M. Attention Deficit Hyperactivity Disorder, Gabrielle Weiss, Child and Adolescent Psychiatry: A comprehensive Textbook. Second edition, Ed (Melvin Lewis), Williams & Wilkins, USA (Baltimore) (1996) pp 544-563.
- Biederman J, Mielberg S, Faraone SV et al. Family-environment risk factors for attention deficit hyperactivity disorder: a test of Rutter's indicators of adversity. Arc Gen Psychiatry (1995) 52: 464-470.
- Breslau N, Brown G, DelDotto J et al. Psychiatric sequelae of low birth weight at six years of age. J Abnorm Child Psychol (1996) 24: 385-400.
- Faraone SV, Doyle AE: The nature and heritability of attention-deficit/hyperactivity disorder. Child Adolesc Psychiatr Clin N Am (2001) 10:299-316.
- Linnet KM, Dalsgaard S, Obel C, et al. Maternal lifestyle factors in pregnancy risk of attention deficit hyperactivity disorder and associated behaviors: review of the current evidence. Am J Psychiatry (2003) 160:1028-1040.
- DSM IV Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Washington, DC, American Psychiatric Association, (2000)
- Milberger S, Biederman J, Faraone SV, et al. Is Maternal smoking during pregnancy a risk factor for attention deficit hyperactivity disorder in children? Am J Psychiatry (1996) 153:1138-1142.
- Ertem G, Cömert F, Keskin N, et al. Türkiye'de koroner kalp hastalığı risk faktörleri prevalansı: İstanbul çevresinde sigara kullanımı. İstanbul Halk Sağlığı Bülteni (1987) 1(2):12. (The prevalence of coronary hearth disease risk factors in Turkey: Smoking habitatiön around İstanbul. Turkish)
- Özkan H, Uçan S, Meydanlı M, et al. Ankara toplumunun çeşitli kesimlerinde sigara içme sıklığı ve sigara içenlerde dispepsi. T Klin Tıp Bilimleri (1992) 12:258-263.(The frequency of smoking among various sections of Ankara population and dyspepsia in subjects with smoking. Turkish.)
- Mick E, Biederman J, Faraone SV, et al. Case-control study of attention-deficit hyperactivity disorder and maternal smoking, alcohol use, and drug use during pregnancy. J Am Acad Child Adolesc Psychiatry (2002) 41(4):378-385.