

## Original Article

# Associated Factors with Attention Deficit Hyperactivity Disorder (ADHD): A Case-Control Study

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## Abstract

**Background:** The current study attempted to investigate factors associated with attention deficit hyperactivity disorder (ADHD) in children without co-morbidities.

**Methods:** In this case-control study, 164 ADHD children who attended the Child and Adolescent Psychiatric Clinics of Tabriz University of Medical Sciences, Iran were compared with 166 normal children selected in a random-cluster method from primary and secondary schools. Clinical interviews based on DSM-IV-TR using K-SADS were used to diagnose ADHD cases and to select the control group. Participants were matched for age. We used chi-square and binary logistic regression for data analysis.

**Results:** Among the associated factors with ADHD were gender and maternal employment. Boys (OR 0.54; 95% confidence interval: 0.34 – 0.86) and those children with working mothers (OR 0.16; 95% confidence interval: 0.06 – 0.86) suffered more from ADHD. The birth season, family size, birth order, and parental kinship were not among risk factors for ADHD.

**Conclusion:** The results of the study show that maternal employment and male gender are among the associated risk factors for ADHD.

**Keywords:** Attention deficit hyperactivity disorder, children, risk factors

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## Introduction

Childhood is an important life stage regarding the psychological basis of human development of which psychiatric disorders may also occur during this time. According to DSM-IV-TR, attention deficit hyperactivity disorder (ADHD) is one of the most common psychiatric disorders in children and adolescents. There are three types of ADHD: inattentive, hyperactive impulsive, and combined. Some hyperactive, impulsive or inattentive symptoms which may cause impairment manifest before the age of seven years and dysfunction tends to develop in two or more settings (e.g., at school, work or home).<sup>1</sup> Children with ADHD have educational and relationship problems; they are at considerable risk for alcohol and substance abuse, marital disturbances, antisocial behaviors, car accidents, and earlier uncontrolled sexual relationships.<sup>2</sup> Different studies have reported that the rate of ADHD during the prepubertal stage is 3% to 5% in primary school children.<sup>1</sup> The frequency of this disorder in primary school children in Tabriz, Northwest Iran is reported to be 10.12% in public and 8.2% in private schools.<sup>3</sup> Epidemiological studies have shown a prevalence rate of 4% to 12% of children in the general population.<sup>4</sup>

With regards to the high prevalence of ADHD and its psychosocial consequences, it is of great importance to study the underlying etiologies. The causes of ADHD are unknown. Meanwhile according to the literature, causes may be considered to be of biological and behavioral origins.<sup>5-7</sup>

According to various studies, there are contradictory facts about the contributing risk factors for ADHD.<sup>8-12</sup> Studies conducted in Iran note the high frequency of ADHD among boys.<sup>3,13</sup> However, the results of another study<sup>14</sup> has shown no significant difference in core symptoms among boys and girls. While the study carried out by Stormont – Spyrgin et al.<sup>15</sup> refers to ‘birth order’ (i.e., being the first or second child) as a contributing risk factor for ADHD, the results of a study by Moradi A et al.<sup>16</sup> has shown no relationship between birth order and ADHD. In a study conducted by Eddy et al.<sup>17</sup> a high frequency of ADHD among large families has been reported. Another study<sup>16</sup> refers to the relationship between ADHD and birth season, where a high frequency of ADHD is seen in children born during the Spring and less ADHD is found in children born during the Summer. However, the results of a study by Atladóttir et al.<sup>18</sup> do not support this relationship. Another study<sup>19</sup> refers to family features such as consanguinity (parental kinship) and maternal employment as contributing factors for ADHD.

It is believed that geographical and social factors affect personal characteristics and family features. In consideration of the relationship between personal and family factors and ADHD in Iran and other countries, there are either few studies or contradictory results. The purpose of the present study is to investigate the relationship between personal/family factors and ADHD. To meet the proposed objectives such factors as gender, family size, parental kinship, birth order, and birth season are taken into account.

## Materials and Methods

This case-control study was performed in 2009 in Tabriz (Northwest Iran). Sample selection of ADHD children was performed using the convenience method from among the available population during 12 months.

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**Table 1.** Frequency distribution of research variables in ADHD and control groups and result of binary logistic regression.

Variables	ADHD N(%)	Control N(%)	OR (95% CI)	P- value
<b>Gender</b>				
Female	60 (36.6)	82 (49.4)	0.54 (0.34–0.86)	0.01
Male	104 (63.4)	84 (50.6)		
<b>Maternal Employment</b>				
Employed	34(20.7)	7(4.2)	0.16 (0.06–0.38)	<0.001
Not employed	130 (79.3)	159 (95.8)		
<b>Family size</b>				
Small	123(75)	108 (65.1)	1.22 (0.69–2.16)	0.49
Large	41(25)	58 (34.9)		
<b>Birth order</b>				
First and second	146(89)	132 (79.5)	1.53 (0.74–3.16)	0.25
Other	18(11)	34 (20.5)		
<b>Consanguinity</b>				
Consanguineous	34(20.7)	31 (18.7)	0.72 (0.40–1.27)	0.26
Non-consanguineous	130 (79.3)	135 (81.3)		

### Sample population

The study was carried out on two groups of 6 – 12 year-old children. The experimental group included 164 ADHD children referred to the Child and Adolescent Psychiatric Clinics of Tabriz University of Medical Sciences. Taking into account the inclusion and exclusion criteria, 166 students (82 boys and 84 girls) from among students who attended primary and secondary schools in Tabriz were selected using random-cluster sampling method for the control group. Participants were matched for age.

After project approval by the Medical Ethics Committee of the university, the personal/family information of the sample population was collected via an interview with parents conducted by a psychiatrist. The collected demographic information included birth date, birth order, maternal employment, number of family members and parental kinship. Families with four members or less were categorized as small and those with five, six or seven members were considered large families. Families in which the parents were cousins were considered as parental kinship (consanguineous).

### Inclusion and exclusion criteria

Study inclusion required participants to meet DSM-IV-TR criteria for ADHD and to be between the ages of 6 and 12. A written consent form was obtained from parents.

Exclusion criteria for ADHD children were low IQ (less than 70), severe physical disabilities and psychological problems. In the control group, we excluded children with psychological disorders and severe mental/physical deficiencies.

### Diagnostic tool

#### K-SADS semi-structural diagnostic interview

This questionnaire is a semi-structured diagnostic interview designed according to DSM-III-R and DSM-IV which is completed through interviews with parents and children, and conducted by a psychiatrist. K-SADS has a zero to three scaling. The zero score represents a lack of sufficient information, score one shows the presence of symptoms, score two presents sub-threshold symptoms, and score three shows threshold symptoms. The validity of the Persian translation of the K-SADS questionnaire has been reported to be 0.81 by a test-retest method and 0.69 through inter-rater manner.<sup>20</sup> A high sensitivity and specificity for the Persian trans-

lation of K-SADS questionnaire has been reported. We used this tool for to exclude psychiatric co-morbidities in the ADHD group and to check for healthy psychiatric status in the control group.

### Statistical methods

Collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 17. In order to determine out the relationship between the child's birth season and ADHD, the chi-square test was run. Binary logistic regression using the Enter method investigated the effect of factors such as maternal employment, family size, birth season, and parental kinship on ADHD in the ADHD group.  $P < 0.05$  was considered significant.

## Results

Taking into account the inclusion and exclusion criteria, 164 out of 342 ADHD children were selected for the study. In the ADHD case group there were 60 (36.6%) girls and 104 (63.4%) boys. The control group consisted of 82 (49.4%) girls and 84 (50.6%) boys. The mean age of the children was  $9.2 \pm 2.23$  years in the case group and  $9.02 \pm 1.53$  years in the control group.

The results of the chi-square test showed that in the ADHD group the recorded frequency for children born during the Spring was 31 (40.3%), whereas 19 (52.1%) were born in the Summer, 41 (52.6%) in Autumn, and 43 (53.1%) were born during the Winter months. In the control group there were 46 (59.1%) children born in the Spring, 45 (47.9%) in the summer, 37 (47.4%) in Autumn, and 38 (46.9%) born during the Winter months. there was no significant difference between birth season and ADHD (Chi square = 3.59,  $df = 3$ ,  $P = 0.3$ ).

As shown in Table 1 we used the Enter method in binary logistic regression in order to predict the effect of variables such as gender, maternal employment, family size, birth order and parental kinship on ADHD. The results show that male gender and having an employed mother were among the contributing factors for ADHD. There were 54% more boys with ADHD than girls ( $P = 0.01$ ).

Likewise, children whose mothers were employed outside the home were 16% more likely to have ADHD than those whose mothers were housewives ( $P = 0.001$ ). The results of binary logistic regression showed no relationship between family size, birth order, parental kinship, and ADHD.

## Discussion

In line with previous studies, we have shown that males suffer more from ADHD compared to females.<sup>3,7,9-13,21</sup> Unlike other research, the present study has focused on ADHD children with no psychological disorders. However, there is a strong relationship between gender and ADHD which could be interpreted in terms of social factors. It seems that, in Iran, parents feel more relaxed when discussing the psychological problems of their sons and therefore are more willing to visit a psychiatrist. Due to the social and cultural factors prevalent in Iran's society, boys show more distinct symptoms of ADHD, which persuades parents to consult with psychiatrists. However, biological factors should not be ignored. There is a need for further complementary biological and neurological studies to explore the contribution of biological factors to ADHD.

While there are some contradictory reports about the relationship between maternal employment and children's mental health,<sup>22,23</sup> the results of the present study show that maternal employment can be regarded as a predictive factor for ADHD children which supports the findings of another study<sup>19</sup> where the relationship between maternal employment conditions and the seriousness of ADHD symptoms has been observed. Employed mothers have better economic and educational conditions. However, their motherhood function/role might be affected by outdoor factors<sup>24</sup> particularly when it comes to boys who are more subject to psychological problems compared to girls.<sup>25</sup>

The findings of the current study show that being of male gender and having an employed mother leads to some negative biological and training/rearing factors, which increases the likelihood of ADHD. Nevertheless, mothers' awareness and better economic conditions enable them to consult psychiatrists to solve their children's problems in advance. In line with other studies,<sup>17,26</sup> the results of this study do not show any relationship between family size and the probability of ADHD.

Given that large family size accounts for some psychological problems, family size can be among the contributing factors to ADHD due to its impact on interpersonal relationships between family members.<sup>27</sup> Bearing in mind that the family's communicative culture and social factors have a tremendous role/function in the formation of inter- and intra-personal relations, there is need for further cross-culture studies to investigate the relationship between family members and ADHD symptoms. On the other hand, serious family problems and their contributions are significant in psychological disorders and ADHD.

The findings of this study have supported the study by Morady et al.<sup>16</sup> where no relationship was found between birth order and ADHD, however this contrasted the findings of Stormont-Spyrgin M<sup>15</sup>.

Results from other studies<sup>7,28</sup> show a relationship between ADHD and inappropriate ways of child-rearing practices. Given the fact that inexperienced parents are more supportive, it seems that birth order cannot be an effective factor for ADHD.

The findings of the present study support the study by Eapen<sup>29</sup> where no relationship between psychological disorder, parental kinship, and ADHD was noted. In terms of genetic effects the existence of some defective/disturbed genes in ADHD children cannot be considered as the sole contributing factor for ADHD. Provided that genes are among risk factors, the impact process might be a multi-genetic one in addition to the interactions with other training/

rearing practices.

Whereas the results of the current study supported the findings by Atladóttir<sup>18</sup> where there was no relationship between birth season and ADHD, this contrasted results obtained by Moradi et al.<sup>16</sup> who observed that the highest frequency of ADHD was found in children born during the Spring, with the lowest frequency seen in those who were born during the Summer months. The production of some  $\zeta$  microorganisms and viruses due to variations in climate in different seasons was less likely to be a risk factor for ADHD.

It is necessary to have extended studies in different geographical areas to determine the role of geographical conditions and birth season in the development of ADHD. In this regard, the study on the effects of microorganisms on the nervous system and their roles in ADHD would be helpful.

Study findings are significant when the inclusion and exclusion criteria and their limitations are considered. The present study has enrolled 6 – 12 year old ADHD children with no psychiatric disorders. The exclusion criterion (i. e., children without comorbidities) was employed to examine the findings of the previous studies in a new context which would contribute to the identification of the potential ADHD-related factors. However, the findings were limited to ADHD children without psychiatric disorders.

### Limitations of the study

During the data collection period (12 months) the number of normal children who referred to the Child and Adolescent Clinic was not sufficient (less than  $\frac{1}{4}$ ), thus the control group was selected from among students of primary and secondary schools in Tabriz using random-cluster sampling. This was considered to be a limitation of the present study.

The results of the present case-control study conducted on 6 – 12 year-old ADHD children without comorbid psychiatric disorders and physical/mental deficiencies showed that being of male gender and having an employed mother were among the risk factors for ADHD. However, there was no relationship between ADHD and such factors as birth season, family size, birth order and parental kinship. It was observed that the symptoms of ADHD in children without comorbid psychiatric disorders were less severe than other ADHD children.<sup>30,31</sup> In summary, the likelihood of ADHD with no comorbid psychiatric disorders could be attributed to biological and behavioral factors compatible with the findings of the previous studies. Further studies on ADHD children would be helpful, considering the contradictory findings of the previous studies.

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### Reference

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Text revision. 4th ed. Washington D.C: American psychiatric association press; 2000.
2. Sadock BJ, Sadock VA. Kaplan & Sadock's comprehensive textbook of psychiatry, 9th ed. New York: Lippincott Williams & Wilkins. 2009; pp: 3560 – 3579.
3. Amiri Sh, Fakhari A, Maheri M, Mohammadpoorasl A. Attention deficit/hyperactivity disorder in primary school children of Tabriz, North-West Iran. *Paediatr Perinat Epidemiol.* 2010; **24**: 597 – 601.
4. Mark AS, Nichols M, Blasey C. Girls with ADHD and associated behavioral problems: Patterns of comorbidity. *North American Journal of*



- Psychology*. 2002; **4**: 143 – 149.
5. Loo SK, Hale TS, Macion J, Hanada G, Mc Gough JJ, McCracken JT, et al. Cortical activity patterns in ADHD during arousal, activation and sustained attention. *Neuropsychologia*. 2009; **47(10)**: 2114 – 2119.
  6. Barkley RA. Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psycho Bulletin*. 1997; **121**: 65 – 94.
  7. Alizadeh H, Andries C. Interaction of parenting styles and attention deficit hyperactivity disorder in Iranian parents. *Child Fam Behav Ther*. 2002; **24**: 37 – 52.
  8. Fontana Rda S, Vasconcelos MM, Werner Jr, Goes FV, Liberal EF. ADHD prevalence in four Brazilian. *Public schools. Arq Neuropsiquiatr*. 2007; **65(1)**: 134 – 170.
  9. Adewuya Ao, Famuyiwo Oo. Attention deficit hyperactivity among Nigerian primary school children: prevalence and co-morbid conditions. *Eur Child Adolesc Psychiatry*. 2007; **16(1)**: 5 – 10.
  10. Froehlich TE, Lanphear BP, Epstein JN, Barbiarasi WJ, Katusic SK, Kahn RS. Prevalence, recognition and treatment of attention deficit/hyperactivity disorder in a national sample of US children. *Arch Pediatr Adolesc Med*. 2007; **161(9)**: 857 – 864.
  11. Bener A, Qahtani RA, Abdelaal I. The prevalence of ADHD among primary school children in an Arabian society. *J Atten Disord*. 2006; **10(1)**: 77 – 82.
  12. Pineda D, Ardila A, Rosseli M. Prevalence of attention deficit hyperactivity disorder symptoms in 4 to 17 years old children in the general population. *J of Abnorm Child Psychol*. 1999; **27(6)**: 455 – 462.
  13. Abdekhodaie Z, Tabatabaei SM, Gholizadeh M. The investigation of ADHD prevalence in kindergarten children in northeast Iran and a determination of the criterion validity of Conners' questionnaire via clinical interview. *Res Dev Disabil*. 2011; **24**: 357– 361.
  14. Graetz BW, Sawyer MG, Baghurst P. Gender differences among children with DSM-IV ADHD in Australia. *J Am Acad Child Adolesc Psychiatry*. 2005; **44(2)**: 159 – 168.
  15. Stormont - Spyrgin M, Zental S. Child rearing practices associated with aggression in youth and without ADHD: An expletory study. *International Journal of Disability, Development and Education*. 1996; **43**: 135 – 146.
  16. Moradi A, khabaz KM, Agah T, Javaherforoushzadeh A, Rezvan B, Haeri Kerrmani Z, et al. The prevalence of attention deficit hyperactivity disorder among school children of Nishaboor-Iran during 2006. *Journal of Gorgan University of Medical Sciences*. 2008; **10**: 37 – 43. [Article in Persian]
  17. Eddy LS, Toro TJ, Salamero BM, Castro FJ, Cruz HM. Attention Deficit hyperactivity disorder. A survey to evaluate risk factors, associated factors and prenatal child- rearing behavior. *An Esp Pediatr*. 1999; **50(2)**: 145 – 150.
  18. Atladóttir HO, Parner ET, Schendel D, Dalsgaard S, Thomsen PH, Thorsen P. Variation in incidence of neurodevelopmental disorders with season of birth. *Epidemiology*. 2007; **18(2)**: 240 – 245.
  19. Bener A, Al Qahtani R, Teebi AS, Bessiso M. The prevalence of attention deficit hyperactivity symptoms in schoolchildren in a highly consanguineous community. *Med Princ Pract*. 2008; **17(6)**: 440 – 446.
  20. Ghanizadeh A, Mohammadi MR, Yazdanshenas A. Psychometric properties of the Farsi translation of the kiddie schedule for affective disorders and schizophrenia present and lifetime version. *BMC Psychiatry*. 2006; **15**: 6 – 10.
  21. Mugnaini D, Masi G, Bravedani P, Chelazzi C, Matas M, Romagnoli C, et al. Teacher reports of ADHD symptoms in Italian children at the end of first grade. *Eur Psychiatry*. 2006; **21**: 419 – 426.
  22. Morrill MS. The effects of maternal employment on the health of school-age children. *J Health Econ*. 2011; **30(2)**: 240 – 257.
  23. Wills JB, Brauer JR. Have children adapted to their mothers working, or was adaptation unnecessary? Cohort effects and the relationship between maternal employment and child well-being, Social Science Research, in press, doi:10.1016/j.ssresearch.
  24. Berger L, Brooks-Gunn J, Paxson C, Waldfogel J. First-year maternal employment and child outcomes: Differences across racial and ethnic groups. *Child Youth Serv Rev*. 2008; **30(4)**: 365 – 387.
  25. Baydar N, Brooks-Gunn J. Effects of Maternal Employment and Child-Care Arrangements on Preschoolers' Cognitive and Behavioral Outcomes: Evidence From the Children of the National Longitudinal Survey of Youth. *Developmental Psychology*. 1991; **27(6)**: 932 – 945.
  26. Kashala E, Tylleskar T, Elgen I, Kayembe KT. Sommerfelt K3 Attention deficit and hyperactivity disorder among school children in Kinshasa, Democratic Republic of Congo. *Afr Health Sci*. 2005; **5(3)**: 172 – 181.
  27. Pheula GF, Rohde LA, Schmitz M. Are family variables associated with ADHD, inattentive type? A case-control study in schools. *Eur Child Adolesc Psychiatry*. 2011; **20(3)**: 137 – 145.
  28. Alizadeh H, Applequist KF, Coolidge FL. Parental self-confidence, parenting styles, and corporal punishment in families of ADHD children in Iran. *Child Abuse Negl*. 2007; **31(5)**: 567 – 572.
  29. Eapen V, Al-Sabosy M, Saeed M, Sabri S. Child psychiatric disorders in a primary care Arab population. *Int J Psychiatry Med*. 2004; **34(1)**: 51 – 60.
  30. Elia J, Ambrosini P, Berrettini W. ADHD characteristics: I. Concurrent co-morbidity patterns in children & adolescents. *Child Adolesc Psychiatry Ment Health*. 2008; **2(1)**: 15.
  31. Rommelse NN, Altink ME, Fliers EA, Martin NC, Buschgens CJ, Hartman CA, et al. Comorbid problems in ADHD: degree of association, shared endophenotypes, and formation of distinct subtypes. Implications for a future DSM. *J Abnorm Child Psychol*. 2009; **37(6)**: 793 – 804.