Original Article

The prevalence and risk factors of attention deficit hyperactivity disorder among the elementary school students in Ardabil, Iran, in 2011-2012

Moslem Abolhassanzadeh[1], Ali Reza Shafiee-Kandjani*[2], Zahra Vaziri[3], Parviz Molavi[4], Fariba Sadeghi-Movahhed[5], Gholamreza Noorazar[2], Sajjad Basharpoor[6]

[1] Psychiatrist, Department of Psychiatry, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

[2] Assistant Professor, Research Center of Psychiatry and Behavioral Sciences AND Department of Psychiatry, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

[3] Ministry of Education, Education Office of Ardabil Province, Ardabil, Iran

[4] Associate Professor, Department of Psychiatry, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

[5] Assistant Professor, Department of Psychiatry, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

[6] Associate Professor, Department of Psychology, University of Mohaghegh Ardabili, Ardabil, Iran

Abstract

Introduction: Attention deficit hyperactivity disorder (ADHD) is the most prevalent neurodevelopmental disorder among children and adolescents. Given the importance of this disorder, the aim of this study was to investigate the prevalence of ADHD and the relevant factors among the elementary school students in Ardabil, Iran.

Methods: Using the stratified random cluster sampling method, this cross-sectional descriptive study was conducted on 2826 schoolchildren aged 6-11 in Ardabil, in the year 2011-2012. The necessary information was collected in the first step employing the ADHD questionnaire based on 18 Diagnostic and Statistical Manual of Mental Disorders-4th edition (DSM-IV) criteria filled out by parents and teachers. Then the students were interviewed by psychiatrists in the second step. SPSS was used to analyze the research findings.

Results: The research results indicated that the life-time prevalence of ADHD was 9.8%. The most prevalent type of ADHD was the hyperactive-impulsive (6.8%). The results also indicated that the prevalence of ADHD was higher in boys than girls. One-third of affected children were premature at birth and 49.2% had attended kindergartens. The ADHD group was significantly different from the normal students in terms of the average discipline score and the overall grade at school.

Conclusion: There is a relatively high prevalence of ADHD in elementary school students; therefore, it is strongly recommended to identify and treat it appropriately in the years prior to school.

* Corresponding Author: Ali Reza Shafiee-Kandjani, Email: shafieear@tbzmed.ac.ir

Introduction

Attention deficit hyperactivity disorder (ADHD) is the most prevalent psychiatric disorder in childhood and adolescence. Characterized by the symptoms of inattention, hyperactivity, and impulsivity which are disproportionate to age, ADHD is also one of the main reasons for referring children to mental health clinics.[1] This disorder emerges in the form of a sustainable pattern of hyperactivity-impulsivity, or deficit in attention and concentration, or combination of both. These patterns are usually more severe in affected children compared to their counterparts with the same age and developmental status. According to the Diagnostic and Statistical Manual of Mental Disorders-4th Edition-Text Revision (DSM-IV-TR),[2] a patient should have at least 6 out of 9 criteria for hyperactivity-impulsivity, 6 of 9 criteria for inattention, or combination of both at the same time. Moreover, some of the symptoms should at least start before the age of 7 and result in the failure of a patient's performance at school, home, work and a decline in the social, individual or educational performance. The symptoms should not merely occur in pervasive developmental disorders, schizophrenia, or other psychotic disorders, and affective, anxiety and dissociative disorders. In other words, personality disorders should not be better justifications for them. If there were some criteria for impulsive hyperactivity during the last 6 months, the hyperactive-impulsive type is diagnosed. On the other hand, if the criteria for inattention were prominent in the same period, then the inattention type is diagnosed.[2]

The disorder is highly prevalent, insofar as its prevalence has been reported to be between 2 and 17% in schoolchildren.[3] Among children from normal population, it has been reported from 8-10%.[4] The prevalence among boys is 3 times higher than girls.[4,5] In a study conducted by Adewuya and Famuyiwa, the prevalence of ADHD was 8.7% among 1112 children aged 7-12 years, and the prevalence in boys compared with girls was 2:1.[6] Skounti et al. conducted a review on the papers published on the prevalence of ADHD from 1992 to 2007 and found that it varied from 2.2 to 17.8% based on different studies.[7] The prevalence was reported to be higher in boys and younger children, based on DSM-IV criteria compared to DSM-III.[7] Polanczyk et al. conducted a systematic review to investigate the prevalence of ADHD throughout the world. After reviewing 9105 papers of which 303 were complete, the average prevalence of ADHD was 5.2%.[8] Accordingly, there was not a major difference in the prevalence of ADHD in Europe, America, North Asia, and Africa. The authors believed that geographical location had a limited role in the prevalence difference, and the differences observed in these continents resulted from the research methodologies.

A recent study, conducted on a national sample of children from the United States of America, indicated that children from low-income families meet ADHD diagnostic criteria more than the others while receiving a low level of healthcare services.[9] The results of different studies indicated that the prevalence of ADHD varied with respect to age, gender, and socio-economic status. In other words, the highest prevalence was reported to be among males, school-aged children, and low-income groups.[3,5,10,11]

ADHD is also highly prevalent in Iran. Tavakkolizadeh et al. reported a 9% prevalence rate.[12] In a study conducted on the students of elementary schools in Shiraz, Iran, the prevalence was 5-8.5%, and inattention increased with age; however, this difference was not significant between girls and boys.[13] Akhavan Karbasi et al. carried out a study on 6 year-old children from Yazd, Iran, and found that the overall prevalence of ADHD was 16.3% based on DSM-IV-TR criteria and the prevalence among boys and girls was 19.5 and 13% respectively. However, the frequency of this disorder was not associated with gender, birth rank, and birth weight.[14]

In a study conducted by Shabani and Yadegari on 428 elementary students from Zanjan, Iran, the prevalence was 9.1% and it was insignificantly higher in boys rather than girls.[15] Alishahi et al. used the random sampling method, DSM-IV criteria and clinical follow-up interviews to conduct a study on 2182 elementary school students located in four districts of Shiraz and concluded that the prevalence of these disorders was 5.8% including 1.1% inattention type, 0.4% hyperactive type, and 4.2% combined type and there was a significant difference between the prevalence in boys (8.4%) and girls (3.1%). Moreover, the discipline scores of affected students were significantly lower than healthy students.[16] In a descriptive cross-sectional study by Moradi et al.[17] employing the Connors parents and teachers scale, the prevalence of this disorder was reported 12.5% and it was higher in girls than boys. The highest prevalence was reported in the fourth grade, with first grade coming afterwards (13.5%).

Although various studies have been conducted on the epidemiology of ADHD all over the world, its precise prevalence has not been specified yet. The estimations on the treatment and prevalence of this disorder is usually inferred from the sales of stimulants.[18] However, the main symptoms usually last lifelong. Although the presentation of this disorder may change during growth before school until adulthood, the symptoms generally result in many individual, familial, and social problems. If not treated, ADHD usually results in a low academic performance, ineffective relationship between the individual and family, teachers, or friends, increase in criminality and accidents, and growth of simultaneous psychiatric symptoms such as disobedience, anxiety, depression, and drug abuse.[19,20] These factors indicate the necessity of diagnosing and treating ADHD at an early stage. Given what has been mentioned and lack of an epidemiological study, the aim of the current study was to determine the prevalence of ADHD and the relevant factors among elementary school students in Ardabil, Iran, in the academic year of 2011-2012.

Methods

This cross sectional-descriptive study, was done from October 2011 until June 2012. The statistical population included all the students studying at elementary schools in Ardabil, in the academic year 2011-2012. Based on the Z formula and given the values P = 0.80, Q = 0.92 and Z = 96.1, the sample was estimated to include almost 2826 individuals. The information collection tools were researcher-made demographic questionnaire, ADHD rating scale and psychiatric interview. The questionnaire, filled out by the child or parents, included demographic information such as age, gender, birth rank, education grade, educational district, the type of elementary school (state-run or non-profit; male or female), the total number of students in classroom, overall grade at school, discipline score, birth weight, prematurity. The Conners' Teacher Rating Scale (CTRS) is a tool comprised of a list of ADHD symptoms designed for this purpose based on DSM-IV-TR criteria. This scale includes 28 items which measure the core symptoms of ADHD in a Likert scale in four degrees from never (0) to very much (3). The psychiatric interview was conducted to confirm or reject the diagnosis of disorder by a psychiatrist.

First, the population of elementary students studying in Ardabil, was divided into two districts (1 and 2). Using the random cluster sampling method, some schools were then selected from the entire schools of both districts. After that, one class was selected from the students studying in each grade at these schools. The ADHD questionnaires were distributed among their parents and teachers. After completion, the questionnaires were then collected by the researchers. To confirm the final diagnosis, in the first step of screening, we selected those students who meet the diagnostic criteria for this disorder based on the questionnaires filled out by their parents and teachers. In the

second step, a psychiatrist evaluated them through a clinical interview based on DSM-IV-TR criteria. The students having the necessary diagnostic criteria in the clinical interview were included in the final analysis, and those who were suspected to have intellectual disability or other major psychiatric disorders including learning disability were excluded from the study. Data was analyzed using SPSS software (version 17, SPSS Inc., Chicago, IL, USA).

Results

This study was conducted on 2826 individuals, out of whom 2628 were included until the end of study, and 200 subjects were excluded from the clinical follow-up interview because of not filling out the questionnaires completely, not having the inclusion criteria, having other psychiatric disorders influencing the results, or not being diagnosed by the psychiatrists.

Table 1 indicates the frequency and percentage of students participating in this study with respect to gender, education grade, school type, birth rank, mean, standard deviation, age, overall grade, birth weight, and discipline score.

Table 1. Demographic characteristics of participating students

Variables	Level of variable	Statistical indices
Gender [n (%)]	Boy	1236 (47.0)
	Girl	1392 (53.0)
Education grade [n (%)]	Preschool	29 (1.0)
	First	429 (15.2)
	Second	450 (15.9)
	Third	661 (23.4)
	Fourth	616 (21.8)
	Fifth	639 (22.6)
School type [n (%)]	State-Run	2597 (91.9)
	Non profit	229 (8.1)
Birth rank [n (%)]	First	1246 (48.0)
	Second	762 (29.4)
	Third	320 (12.3)
	Fourth	130 (5.3)
	Fifth	71 (2.7)
	Higher	59 (2.3)
Age (year) (mean ± SD)		9.5 ± 1.56
Overall grade at school (mean ± SD)		19.47 ± 1.15
Birth weight (g) (mean ± SD)		3300 ± 609
Discipline score (mean ± SD)		19.41 1.21

Accordingly, 257 individuals out of 2628 were diagnosed with ADHD. Among them, 52 individuals (2.0%) were inattentive type while 179 (6.8%) were hyperactive-impulsive type, and 26 (1.0%) were combined type.

The results of inferential analyses indicated that 142 (55%) ADHD students were boys and 115 (45%) were girls. The result of the chi-squared test indicated that these two groups were significantly different (χ^2 = 7.28, P < 0.010). Considering the variable of birth weight, the results indicated that 101 students with ADHD were lighter than 2500 g at birth; however, they were not significantly different from healthy students (P = 0.170, t = 1.34). Seven students with ADHD and 75 healthy students had a history of head trauma around birth. This difference was not statistically significant, either (χ^2 = 3.85, P < 0.070). According to the results obtained from the ADHD group, 72 individuals had the history of hyperactive and aggressive parents. In the healthy group, 814 subjects had the same record and the result of the chi-squared test, conducted to investigate the significance of difference between the two groups, was statistically significant (χ^2 = 4.07, P < 0.040). Sixty five out of ADHD patients as well as 1227 healthy children attended kindergarten (χ^2 = 50.12, P < 0.001). The average score of the two groups in terms of discipline was statistically different based on Student's t-test (P < 0.001, t = 10.94). The results of t-test also indicated a significant difference between the two groups in terms of overall grade (P < 0.001, t = 9.31).

Discussion

ADHD is one of the most prevalent psychiatric disorders among children and adolescents which may lead to negative consequences such as dysfunction in education, personal and social relationships if not treated. As the psychiatric co-morbidities are also highly prevalent in ADHD patients, the importance becomes much more noticeable.[20] The findings of this study

indicated that the life-time prevalence of ADHD was 9.8% among male and female school-aged children in Ardabil. It is consistent with those of Shabani and Yadegari[15] and also in agreement with the results of the studies conducted by Baumgaertel et al. in Germany[21] and Amiri et al. in Tabriz,[22] Iran, in which the life-time prevalence rates were 9.6 and 9.7%, respectively. However, these findings were inconsistent with those of Alishahi et al.,[16] Polanczyk et al.[8] and Gallucci et al.[23] who obtained the life-time prevalence of 3.9%. The differences between the prevalence in the above-mentioned studies can result from their different sample sizes (the sample in the current study is larger in comparison with the other studies), use of different tools for diagnosis, different diagnostic precisions of the disorder in each study, and also cultural, social and geographical differences of the populations. In other words, given the multistep nature of the current study, the results seem to be more realistic because after the first diagnosis of the disorder based on the DSM-IV-TR questionnaires filled out by parents and teachers, the results were confirmed by the executive psychiatrist through an interview in the next step.

The results pertaining to the prevalence of different types of ADHD obtained in this study were inconsistent with those of Alishahi et al.[16] and Shahim et al.[13] who reported that the most prevalent one was the combined type. This result can be related to the circumstances of social and geographical environments. Furthermore, it appears that parents were more sensitive to the symptoms of inattention in comparison with those of hyperactivity and if they observed inattention symptoms, they would look for treatment more; therefore, the inattention or combined type were diagnosed more in clinical samples. Regarding the gender, boys had the highest level of prevalence contributing to 55% of all cases. This result was consistent with DSM-IV report stating that ADHD was more prevalent in boys than girls with the ratio of 3 to 1. This result also

confirmed the findings of Shahim et al.,[13], Akhavan Karbasi et al.,[14] Shabani and Yadegari,[15] and Alishahi et al.[16] According to these results, male gender can be considered a risk factor for ADHD. Most probably, hormonal effects, social factors, and different parenting styles in boys and girls influence the high prevalence of ADHD in boys.

The results showed that ADHD was not significantly related to low birth weight. This is consistent with the results obtained by Akhavan Karbasi et al.[14] The history of head trauma around birth in children with ADHD was not significantly different from the normal group, a result which was consistent with the study conducted by Moradi et al.[17] This might indicate that head trauma at birth could not have an important role in the emergence of ADHD.

The results of this study revealed that the history of hyperactivity and aggression in the parents of children with ADHD was significantly higher than the normal children's parents. This result also may support the positive biologic or environmental role of family in this disorder. Children with ADHD attended kindergartens more significantly than the healthy children group; this might show that the parents of children with ADHD were more likely to take them to such places due to inability in controlling their behaviors. The average discipline score of children with ADHD was significantly lower than the normal group. This result was consistent with the findings of Alishahi et al.[16] Hyperactivity, restlessness and impulsivity of children with ADHD would result in their inability to follow disciplinary rules, adapt to school regulations, and finally reduction of their discipline score at school. Moreover, the school grades of children with ADHD was significantly lower than those of the healthy children, a result which was consistent with the findings of Alishahi et al.[16] In other words, children with ADHD did not concentrate well due to inattention; therefore, their learning process would be

disrupted, and they would experience low academic performance.

In general, the results of this study indicated that ADHD was highly prevalent in elementary school students in Ardabil. The privilege of this study were the selection of a very large sample (2826 subjects) and more accurate diagnostic tools employed (DSM-IV-TR criteria and confirmation of positive cases through psychiatric interviews). The limitations can include its multistep nature, impossibility to perform complete interviews with parents, and lack of paraclinical diagnostic tools such as quantitative electroencephalography (QEEG). Therefore, it is suggested to use electrophysiological devices like QEEG in future works to make a better diagnosis.

Conclusion

The rate of ADHD is high in Ardabil province, Iran. Therefore, it seems mandatory to evaluate pre-school students and suggest intervention as needed in order to prevent probable consequences in future.

Authors' Contribution

Dr. Abolhassanzadeh and Dr. Shafiee-Kandjani designed the research. Dr. Abolhassanzadeh, Mrs. Zahra Vaziri, Dr. Molavi, Dr. Sadeghi-Movahhed and Dr. Noorazar collected the clinical data. Dr. Basharpour performed statistical analysis and interpreted the data. Dr. Shafiee-Kandjani and Dr. Abolhassanzadeh drafted the manuscript. Dr. Shafiee-Kandjani revised it critically for important intellectual content. All authors have read and approved the final manuscript.

Conflict of Interest

Authors have no conflict of interest.

Ethic approval

This study was approved by Ardabil University of Medical Sciences.

References

1. Goldman LS, Genel M, Bezman RJ, Slanetz PJ. Diagnosis and treatment of attention-deficit/hyperactivity disorder in children and adolescents. Council on Scientific Affairs, American Medical Association. JAMA 1998; 279(14): 1100-7. DOI: 10.1001/jama.279.14.1100
2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV-TR. 4th ed. Arlington, VA: American Psychiatric Association; 2000.
3. Scahill L, Schwab-Stone M. Epidemiology of ADHD in school-age children. Child Adolesc Psychiatr Clin N Am 2000; 9(3): 541-55, vii.
4. Committee on Quality Improvement, Subcommittee on Attention-Deficit/Hyperactivity Disorder. Clinical Practice Guideline: Diagnosis and Evaluation of the Child with Attention-Deficit/Hyperactivity Disorder. Pediatrics 2000; 105(5): 1158-70.
5. Biederman J, Mick E, Faraone SV, Braaten E, Doyle A, Spencer T, et al. Influence of gender on attention deficit hyperactivity disorder in children referred to a psychiatric clinic. Am J Psychiatry 2002; 159(1): 36-42. DOI: 10.1176/appi.ajp.159.1.36
6. Adewuya AO, Famuyiwa OO. Attention deficit hyperactivity disorder among Nigerian primary school children: prevalence and co-morbid conditions. Eur Child Adolesc Psychiatry 2007; 16(1): 10-5. DOI: 10.1007/s00787-006-0569-9
7. Skounti M, Philalithis A, Galanakis E. Variations in prevalence of attention deficit hyperactivity disorder worldwide. Eur J Pediatr 2007; 166(2): 117-23. DOI: 10.1007/s00431-006-0299-5
8. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: a systematic review and metaregression analysis. Am J Psychiatry 2007; 164(6): 942-8. DOI: 10.1176/ajp.2007.164.6.942

9. Froehlich TE, Lanphear BP, Epstein JN, Barbaresi WJ, Katusic SK, Kahn RS. Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of S children. Arch Pediatr Adolesc Med 2007; 161(9): 857-64. DOI: 10.1001/archpedi.161.9.857

10. Faraone SV, Sergeant J, Gillberg C, Biederman J. The worldwide prevalence of ADHD: is it an American condition? World Psychiatry 2003; 2(2): 104-13.

11. Biederman J, Milberger S, Faraone SV, Kiely K, Guite J, Mick E, et al. Impact of adversity on functioning and comorbidity in children with attention-deficit hyperactivity disorder. J Am Acad Child Adolesc Psychiatry 1995; 34(11): 1495-503. DOI: 10.1097/00004583-199511000-00017

12. Tavakkolizadeh J, Bolhari J, Mehryar AH, Dezhkam M. Epidemiology of attention deficit and disruptive behaviour disorders in elementary school children of Gonabad town, north east Iran (1996-1997). Iran J Psychiatry Clin Psychol 1997; 3(1-2): 40-52. [In Persian].

13. Shahim S, Mehrangiz L, Yousefi F. Prevalence of attention deficit hyperactivity disorder in a group of elementary school children. Iran J Pediatr 2007; 17(Suppl 2): 211-6.

14. Akhavan Karbasi S, Golestan M, Fallah R, Sadr Bafghi M. Prevalence of attention deficit hyperactivity disorder in 6 year olds of Yazd city. J Shahid Sadoughi Univ Med Sci 2008; 15(4): 29-34. [In Persian].

15. Shabani M, Yadegari A. Prevalence of attention deficit hyperactivity disorder (ADHD) in elementary school children in Zanjan, 2003-2005. J Zanjan Univ Med Sci 2005; 13(51): 42-8. [In Persian].

16. Alishahi MJ, Deh Bozorgi GHR, Dehghan B. Prevalence rate of attention deficit hyperactivity disorder among the students of primary schools. Zahedan J Res Med Sci 2003; 5(1): 61-7. [In Persian].

17. Moradi A, Khabazkhoob M, Agah T, Javaherforoushzadeh A, Rezvan B, Haeri Kermani Z, et al. The prevalence of attention deficit hyperactivity disorder (ADHD) among school children of Nishaboor- Iran during 2006. J Gorgan Univ Med Sci 2008; 10(2): 37-42. [In Persian].

18. Scheffler RM, Hinshaw SP, Modrek S, Levine P. The global market for ADHD medications. Health Aff (Millwood) 2007; 26(2): 450-7. DOI: 10.1377/hlthaff.26.2.450

19. Kessler RC, Adler L, Barkley R, Biederman J, Conners CK, Demler O, et al. The prevalence and correlates of adult ADHD in the United States: results from the National Comorbidity Survey Replication. Am J Psychiatry 2006; 163(4): 716-23. DOI: 10.1176/ajp.2006.163.4.716

20. Amiri S, Shafiee-Kandjani AR, Fakhari A, Abdi S, Golmirzaei J, Akbari RZ, et al. Psychiatric comorbidities in ADHD children: an Iranian study among primary school students. Arch Iran Med 2013; 16(9): 513-7. DOI: 013169/AIM.006

21. Baumgaertel A, Wolraich ML, Dietrich M. Comparison of diagnostic criteria for attention deficit disorders in a German elementary school sample. J Am Acad Child Adolesc Psychiatry 1995; 34(5): 629-38. DOI: 10.1097/00004583-199505000-00015

22. Amiri S, Fakhari A, Maheri M, Mohammadpoor AA. Attention deficit/hyperactivity disorder in primary school children of Tabriz, North-West Iran. Paediatr Perinat Epidemiol 2010; 24(6): 597-601. DOI: 10.1111/j.1365-3016.2010.01145.x

23. Gallucci F, Bird HR, Berardi C, Gallai V, Pfanner P, Weinberg A. Symptoms of attention-deficit hyperactivity disorder in an Italian school sample: findings of a pilot study. J Am Acad Child Adolesc Psychiatry 1993; 32(5): 1051-8. DOI: 10.1097/00004583-199309000-00026