

Estimated Prevalence Study of Attention-Deficit/Hyperactivity Disorder among Eastern Province Children in the Kingdom of Saudi Arabia

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Abstract

Background: Studying mental disorders in children is significantly important due to the huge suffering of educational and psychosocial impairments in adult life. Attention-deficit/hyperactivity disorder (ADHD) is considered the most common mental disorder in children, especially in early school-aged children. It manifests in about 8%–12% of children in the world. In Saudi Arabia, it affects 4%–12% of children. **Objective:** The study aimed to count the number of undiagnosed ADHD cases and the associated risk factors in Eastern Province in Kingdom of Saudi Arabia (KSA). **Methods:** A cross-sectional study was performed among girls' and boys' children aged 6–10 years old in Eastern Province in KSA with a random selection of parents. Sample size is equal to 1658. The assessment was done by an online questionnaire filled it by parents using Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition diagnostic criteria and Connor's scale of ADHD excluding any developmental or mental disorder at the beginning of the questionnaire. **Results:** After excluding the participants who were diagnosed with behavioral and growth developmental disorder, the remaining 1430 have been screened for ADHD based on Connor's scale. 185 of a child out of 1430 were suggested to have ADHD, of which 10 out of them show the signs of ADHD, 76 of them have moderately severe ADHD, and 99 out of them have atypical or severe ADHD based on Connor's scale of ADHD. The study shows that there is a significant relationship between the positive screening of ADHD and gender males (71.35%), females (28.64%), family history (20.5%), nervous system diseases (4.32%), brain damage from trauma (9.72%), smoking habit of the mother (8.64%), smoking during pregnancy (3.78%), mother exposure to second-hand smoking (42.16%), child exposure to a toxic substance like lead during the early life (1.62%), and the preterm labor (15.13%). However, the study shows there is no significant relationship between the positive screening of ADHD with age, drinking alcohol, and central nervous system infection. **Conclusion:** The prevalence of undiagnosed ADHD is slightly high. Also, it has many causes of ADHD including gender, smoking, parental psychiatric disorders, and obstetric and pregnancy problems.

Keywords: Attention, attention-deficit/hyperactivity disorder, Eastern Province, hyperactivity, Kingdom of Saudi Arabia

Résumé

Background: L'étude des troubles mentaux chez les enfants est d'une importance considérable en raison des souffrances liées aux difficultés scolaires et psychosociales qui perdurent à l'âge adulte. Le trouble du déficit de l'attention avec hyperactivité (TDAH) est considéré comme le trouble mental le plus courant chez les enfants, notamment chez les enfants d'âge scolaire précoce. Il se manifeste chez environ 8% à 12% des enfants dans le monde. En Arabie saoudite, il touche entre 4% et 12% des enfants. **Objective:** L'étude visait à dénombrer le nombre de cas de TDAH non diagnostiqués et les facteurs de risque associés dans la province orientale du Royaume d'Arabie saoudite (KSA). **Methods:** Une étude transversale a été réalisée

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auprès d'enfants de filles et de garçons âgés de 6 à 10 ans dans la province orientale de l'Arabie saoudite, en utilisant une sélection aléatoire des parents. La taille de l'échantillon est égale à 1658. L'évaluation a été réalisée à l'aide d'un questionnaire en ligne rempli par les parents, en utilisant les critères diagnostiques du Manuel diagnostique et statistique des troubles mentaux, cinquième édition, ainsi que l'échelle de Connor pour le TDAH, en excluant tout trouble du développement ou trouble mental au début du questionnaire. **Résultats:** Après exclusion des participants ayant été diagnostiqués avec un trouble du comportement et du développement, les 1430 restants ont été dépistés pour le TDAH à l'aide de l'échelle de Connor. Parmi ces enfants, 185 ont été suggérés d'avoir un TDAH, dont 10 présentent des signes de TDAH, 76 présentent un TDAH modérément sévère et 99 présentent un TDAH atypique ou sévère selon l'échelle de Connor. L'étude révèle qu'il existe une relation significative entre le dépistage positif du TDAH et le genre masculin (71,35 %), féminin (28,64 %), les antécédents familiaux (20,5 %), les maladies du système nerveux (4,32 %), les lésions cérébrales suite à un traumatisme (9,72 %), la consommation de tabac par la mère (8,64 %), la consommation de tabac pendant la grossesse (3,78 %), l'exposition de la mère à la fumée secondaire (42,16 %), l'exposition de l'enfant à une substance toxique comme le plomb pendant la petite enfance (1,62 %) et le travail prématuré (15,13 %). Cependant, l'étude montre qu'il n'existe aucune relation significative entre le dépistage positif du TDAH et l'âge, la consommation d'alcool et les infections du système nerveux central. **Conclusion:** La prévalence du TDAH non diagnostiqué est légèrement élevée. De plus, il existe de nombreuses causes du TDAH, dont le genre, le tabagisme, les troubles psychiatriques des parents, ainsi que les problèmes obstétricaux et durant la grossesse.

Mots-clés: Attention, trouble du déficit de l'attention/hyperactivité, Province orientale, hyperactivité, Royaume d'Arabie saoudite

INTRODUCTION

The study of mental disorders in children is important due to educational and psychosocial impairments in adult life.^[1] Attention-deficit/hyperactivity disorder (ADHD) is the most common mental disorder in children, especially in early school-aged children.^[2] It manifests in approximately 8%–12% of children worldwide.^[2] In Saudi Arabia, it affects 4%–12% of children.^[3]

ADHD is a brain disorder characterized by a group of behavioral problems categorized into inattention, hyperactivity, and impulsivity.^[2] According to the CDC analysis of the 2003 National Survey of Children's Health (NSCH), males are diagnosed with ADHD 2.5 times higher than females.^[4] Many studies have shown that ADHD is inherited. Other findings have suggested that obstetric or pregnancy complications and psychosocial problems increase the risk of ADHD.^[2] ADHD is diagnosed using Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) diagnostic criteria.^[5] Accordingly, children should be diagnosed before 12 years old with six or more core symptoms of inattentive type or hyperactive/impulsive type persisting for at least 6 months in two or more settings.^[5] According to a study conducted in Assir, Saudi Arabia, the overall rate of ADHD was 2.7%; the rate of attention types was 2.0%, hyperactive/impulsivity types was 1.4%, and the combined type was 0.7%.^[6] Teachers reported ADHD at a higher frequency than parents.^[6] Another study conducted in Lebanon found the inattentive frequency was 11.4%, the hyperactive/impulsive was 8.7%, and the combined type was 3.5%.^[7]

Studies have found that undiagnosed or untreated ADHD can lead to comorbidities, and lack of awareness regarding ADHD and associated problems can cause serious adverse effects later in the child's life.^[8] Another study showed that 90% of patients with ADHD show a good recovery with adequate management.^[9]

LITERATURE REVIEW

Alqahtani conducted an ADHD study on school-aged children in Saudi Arabia, including 708 primary school students in Grades 1–3 (aged 7–9 years).^[6] According to their findings, the overall rate of ADHD was 2.7%, with inattentive type accounting for 2.0%; hyperactivity/impulsivity type, 1.4%; and combination type, 0.7%.

Albatti *et al.* conducted a study on the prevalence of ADHD among primary school children in Riyadh.^[10] A total of 646 students participated; 22 children were reported to have ADHD symptoms by both their parents and teachers. The prevalence was 3.4% in this study. The study results demonstrated that gender was associated with ADHD, with a male-to-female ratio of 3:1.

Osman *et al.* conducted a cross-sectional study in a random sample of 190 schools,^[11] from which a sample of 1000 boys and girls aged 7–14 years were selected by systematic random sampling to assess the prevalence and factors affecting ADHD among school children in Khartoum State. The study found that ADHD was prevalent in 9.4% of the students. The inattentive, hyperactive-impulsive, and combination subtypes had prevalence rates of 3.5%, 6.9%, and 1.0%, respectively. The disorder was also more prevalent in boys than in girls, and there was a strong correlation between ADHD and residing in rural areas.

Mohammadi *et al.* investigated the prevalence and comorbidities of ADHD in a population-based sample of 30,532 children and adolescents aged 6–18 years from all Iranian provinces.^[12] The prevalence of ADHD was reported as 4% and was more common in boys than in girls (5.2% vs. 2.7%, respectively) and more frequent in younger age groups. Moreover, ADHD was more prevalent in children whose mothers had a history of psychiatric hospitalization.

Al Zaben *et al.* conducted a case-control study of 929 students aged 6–12 years, 46 of whom met the criteria of the Vanderbilt

ADHD Diagnostic Teacher Rating Scale.^[13] The results of this study suggest that high family stress is the strongest risk factor for ADHD, and that motor/language delay, early parental loss, family psychiatric history, and early childhood head trauma may also increase the risk of ADHD. In addition, the study found no significant correlation between ADHD and pregnancy, labor, or neonatal complications in mothers.

Soheilipour *et al.* evaluated the risk factors associated with ADHD in a case-control study of children aged 5–12 years admitted to the Tehran Institute of Psychiatry in Iran.^[14] The study found that preterm birth, a higher birth weight, and having at least one neonatal disease, such as hypoglycemia, severe hyperbilirubinemia, serious chronic kidney disease, serious chronic liver disease, and immunodeficiency diseases, were associated with a higher risk of ADHD, implying that the harmful individual and social effects of this disorder can be avoided by controlling the associated factors before or immediately after birth.

Banerjee *et al.* reviewed the environmental risk factors for ADHD across multiple studies.^[15] Exposure to toxins, including lead, cigarette smoke, alcohol, and polychlorinated biphenyls (PCBs) has been found to increase the risk of ADHD, and exposure in the fetal phase has been identified as vital. Many studies have linked pregnancy and delivery problems with hypoxia and low birth weight. Low social class and psychosocial adversity in the home environment appear to play a role in the etiology of ADHD. Conversely, viewing television has not been proven to be a substantial risk factor.

STUDY METHODOLOGY

A cross-sectional study was performed among girls and boys in the Eastern Province of Saudi Arabia using randomly selected parents. The target age of the children was 6–10 years, with a sample size of 1658. SPSS version 19 (IBM, Armonk, NY, USA) was used for statistical analysis and the Chi-square test was used to compare categorical variables, associated risk factors, and the prevalence percentages of girls and boys. Parents filled out an online questionnaire in a Google form using the DSM-V diagnostic criteria and Connors rating scale for ADHD. Children diagnosed with any developmental and

mental disorders were excluded via a question at the beginning of the questionnaire.

Study procedure

We used the Delphi technique in the preparation of the questionnaire using DSM-V diagnostic criteria and Connors rating scale to define ADHD criteria. Patients with developmental or mental disorders were identified at the beginning of the questionnaire and those participants were excluded. Four experts evaluated the quality of the parameters for each question. The validity of the questionnaire was verified using a pilot study with 10 participants. The reliability coefficient was > 0.6.

Data management

Each participant was assigned a specific code for data storage that was secured with a password.

Ethical consideration

Permission from Imam Abdulrahman Bin Faisal University was obtained for this research, with informed consent received from everyone who completed the questionnaire. Confidentiality of the participants' data was password-protected, and no data identifying any of the participants was published.

RESULTS

Baseline information

The participants were children aged 6–10 years studying in schools in the eastern region of Saudi Arabia. The total number of samples was 1658 of which 698 were girls and 960 were boys. A total of 228 of participants who had been diagnosed with behavioral and developmental disorders were excluded from the study.

Attention-deficit/hyperactivity disorder screening

The remaining 1430 individuals were screened for ADHD based on the Connors scale. Of these, 185 children possibly had ADHD; 10 showed signs of ADHD, 76 had moderately severe ADHD, and 99 had atypical or severe ADHD. Figure 1 illustrates the screening results using Connors rating scale.

Factors associated with a positive screening test result for attention-deficit/hyperactivity disorder

There was a significant relationship between a positive screening for ADHD and gender ($P = 0.039$), family history ($P = 0.004$), nervous system diseases ($P = 0.012$), brain damage from trauma ($P = 0.012$), maternal smoking habit ($P = 0.015$), smoking during pregnancy ($P = 0.008$), maternal exposure to second hand smoking ($P = 0.000$), child exposure to toxic substances during the early life ($P = 0.016$), and the preterm labor ($P = 0.001$). Conversely, the study showed no significant relationship between a positive screening for ADHD and age, drinking alcohol, and central nervous system infection ($P > 0.05$). Table 1 illustrates the factors which have a significant relationship with a positive screening of ADHD.

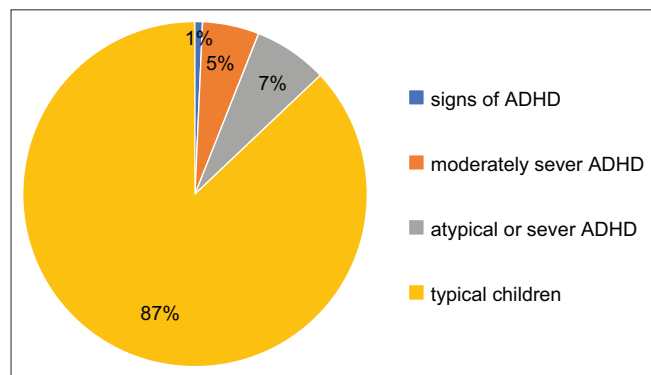


Figure 1: Attention-deficit/hyperactivity disorder screening result based on Connor's scale. ADHD: Attention-deficit/hyperactivity disorder

Table 1: Factors associated with a positive screening test of attention deficit/hyperactivity disorder

Factors	Positive screening test (185 participants), n (%)	P
Gender		
Male	132 (71.35)	0.039
Female	53 (28.64)	
Family history		
Yes	38 (20.5)	0.004
No	147 (79.5)	
Nervous system diseases		
Yes	8 (4.32)	0.012
No	177 (95.68)	
Brain damage from trauma		
Yes	18 (9.72)	0.012
No	167 (90.28)	
Maternal smoking habit		
Yes	16 (8.64)	0.015
No	169 (91.36)	
Smoking during pregnancy		
Yes	7 (3.78)	0.008
No	178 (96.22)	
Maternal exposure to second hand smoking		
Yes	78 (42.16)	0.000
No	107 (57.84)	
Child exposure to toxic substance during early life		
Yes	3 (1.62)	0.016
No	182 (98.38)	
Preterm labour		
Yes	28 (15.13)	0.001
No	157 (84.87)	

DISCUSSION

A lot of studies are done to assess the prevalence of ADHD among children. This study aimed to count the number of undiagnosed ADHD cases and associated risk factors in the Eastern Province of Saudi Arabia. We found that 185 of the 1430 children were likely to have ADHD; of these, 10 showed signs of ADHD, 76 had moderately severe ADHD, and 99 of them had atypical or severe ADHD based on the Conners scale. This was considered high prevalence, and this result is similar to that of Osman *et al.*,^[11] who assessed the prevalence and factors affecting ADHD among schoolchildren in Khartoum State, using a sample of 1000 boys and girls aged 7–14 years and found ADHD prevalence in 9.4% of the students.

In addition, there was a significant relationship between the positive screening of ADHD and gender (132 [71.35%] males, 53 [28.64%] females) which is in agreement with a study done by Albatti *et al.*,^[10] who conducted a study of the prevalence of ADHD among primary school children in Riyadh with a sample of 646 students, and the results showed that male sex was associated with ADHD, with a male-to-female ratio of 3:1. This was confirmed by Mohammadi *et al.*,^[12] who investigated the prevalence and comorbidities of ADHD in a population-based sample of 30,532 children and adolescents aged 6–18 years from all Iranian provinces. The results of the study reported that the prevalence of ADHD was 4%, and it

was more common in boys than in girls (5.2% vs. 2.7%) and more frequent in younger age groups.

Our study suggests that there is a significant relationship between positive screening for ADHD and a family history of ADHD, which is in accordance with a study conducted by Al Zaben *et al.* to define the risk factors for ADHD and comorbid psychiatric, academic, and behavioral problems among primary-school students in Jeddah.^[13] The results of their study suggested that high family stress was the strongest risk factor for ADHD and that motor/language delay, early parental loss, family psychiatric history, and early childhood head trauma may also indicate an increase in ADHD risk. However, our study suggested that there was a significant relationship between positive screening for ADHD and preterm labor during the child's birth, which contradicts Al Zaben *et al.*, who found no significant correlations with pregnancy problems, early labor, or neonatal complications.^[13]

Moreover, our study demonstrated a significant relationship between positive screening for ADHD and nervous system diseases, brain damage from trauma, maternal smoking habits, maternal smoking during pregnancy, maternal exposure to second-hand smoke during pregnancy, and the child's exposure to toxic substances such as lead during early life. This is in accordance with Banerjee *et al.*,^[15] who reviewed the environmental risk factors of ADHD across multiple studies.

They found that exposure to toxins, including lead, cigarette smoke, alcohol, and PCBs increases risk. However, our study found no significant relationship between positive screening for ADHD and alcohol consumption, which contradicts Banerjee *et al.*,^[15] who found that alcohol consumption increased the risk.

CONCLUSION

This study suggested that many children undiagnosed with ADHD meet the DSM-V diagnostic criteria. More boys that were screened had clinical features suggestive of ADHD than girls. A significant relationship was found between ADHD and many risk factors, including having a family history of ADHD, early head injury, exposure to toxic substances during early life, smoking habits of the mother or exposure to second-hand smoke during the mother's pregnancy, and preterm labor during the child's birth. However, there was no significant relationship found between central nervous system infections or alcohol consumption and ADHD in children in the eastern region of Saudi Arabia.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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