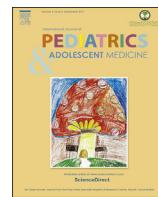




Contents lists available at ScienceDirect

International Journal of Pediatrics and Adolescent Medicine

journal homepage: <http://www.elsevier.com/locate/ijpm>



Original research article

Prevalence of attention deficit hyperactivity disorder among primary school-children in Riyadh, Saudi Arabia; 2015–2016



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ARTICLE INFO

Article history:

Received 24 October 2016

Received in revised form

7 February 2017

Accepted 14 February 2017

Available online 25 October 2017

Keywords:

ADHD

Prevalence

Socio-demographics

Children

Saudi Arabia

ABSTRACT

Objectives: The aim of the study was to 1) determine the prevalence of Attention Deficit Hyperactivity Disorder (ADHD) among both governmental and private primary Saudi school children, 2) measure the gender difference of ADHD prevalence, and 3) determine any association between the socio-demographic characteristic of the parents of children with ADHD.

Methods: This is an observational cross-sectional study of 1000 primary school children belonging to 1st, 2nd and 3rd grade. The selected students were screened by the ADHD rating scale using multistage sampling technique. The first stage was selection of 20 schools from all Riyadh regions by simple randomization. The second stage was choosing children whom serial numbers were multiples of five in each class. The ADHD rating scale was filled by both parents and teachers along with a socio-demographic questionnaire for the parents.

Results: The estimated prevalence of ADHD was 3.4%. ADHD manifestations affect boys more than girls. In addition, ADHD was more frequent among children of illiterate mothers. Finally, ADHD was significantly more prevalent among first grade children.

Conclusion: This epidemiological study filled the data gap of ADHD prevalence in Riyadh. The study's findings go in line with many nearby and global studies.

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1. Introduction

Attention-deficit and hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders among children. It was estimated that every classroom has at least one child suffering from this developmental disorder [1,2]. People with ADHD classically have trouble getting organized, keeping focused, making practical plans and thinking before acting. They may be jittery, noisy and unable to get accustomed to changing situations [3]. This disorder is a behavioral condition that makes concentrating on everyday requests and routines challenging [3]. It is described as a chronic impairing disorder that negatively affects many aspects of a child's life including academic attainment, social skills, difficult child-parent relationship, and the well-being of the

entire family [4]. A population-based cohort study on 4880 persons found that ADHD medical costs were \$ 4306 compared to \$ 1944 for non ADHD individuals [4,5].

Additionally, if the child continues to suffer from this disorder until adulthood, they will most likely be dismissed from employment many times until they settle down and succeed [4,6]. Another effect of ADHD that becomes apparent during adulthood if they were not subjected to medication is drug abuse [4,7]. Not only that, but ADHD symptoms will continue into adulthood in 30–60% of the affected children [4,8]. This certainly will have a negative impact on the child's educational outcome and employment attainment [4,6]. Due to these disastrous effects, and in order to avoid them, we must estimate the size of this problem locally, before deciding how to approach it.

An investigation of 17,461 children was directed in Germany, demonstrating a 4.8% prevalence of ADHD [9]. Furthermore, 71 published studies from January 1997 to June 2007 had shown that there is a wide variation in its prevalence from 0.2% to 26.8% [1,10]. Arab world epidemiological studies conducted on this disorder

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Peer review under responsibility of King Faisal Specialist Hospital & Research Centre (General Organization), Saudi Arabia.

among children showed that its prevalence was between 2.7 and 20.5% on school aged Arab students [1,11–19].

However, only a few studies were conducted to investigate this disorder all over Saudi Arabia, and none of them were conducted in Riyadh although it is the capital city of Saudi Arabia with a huge number of elementary schools. That is why we aim to find out what is the prevalence of this disorder among primary school-children in Riyadh city.

Some socio-demographic factors may play a major role, such as parent's relationship and educational attainment, family's income, and the affected child's gender.

2. Methods

After obtaining the ethical approval from the Institutional Review Board (IRB), an observational cross sectional study was conducted. The study covered 20 randomly selected primary governmental and private schools from all Riyadh regions in Saudi Arabia, during 2015–2016. It has been conducted among first, second, and third grade children. We have included Saudi boys and girls attending primary schools. Children who are foreigners were excluded. Two questionnaires are needed to be filled for each child since the diagnosis of ADHD requires the subject to show the symptoms in at least two different settings as the Diagnostic and Statistical Manual requires. Due to that, those whom teachers or parents refused to fill the ADHD rating scale were also excluded. The study sample size was calculated to be 1000 and instead of making it 50% girls and 50% boys, we decided to gender adjust it to 60% girls and 40% boys. The education system in KSA dictates that there are separated schools for girls and boys, and as female researchers, it was considerably easier for us to access girls' schools. The multistage sampling technique was applied; the first stage was choosing 20 schools by simple randomization using a list of all Riyadh primary schools that had been provided by the Ministry of Education. The second stage was systematic-randomization, from each class we chose children whom serial numbers were multiples of five in the pattern of (5, 10, 15, 20 ...) and so on. Recruitment of the subjects was conducted by the researchers along with a group of male volunteers according to the inclusion and exclusion criteria. Data distribution and collection took time between December and February. We choose this specific time because it was the end of the first semester and the teachers have spent enough time to pay attention to their students' behavior. We gained a letter of permission from the Ministry of Education to allow us entry to the schools. As we are a group of female researchers, we had no trouble entering girls' schools; therefore we recruited male volunteers to collect data from boys' schools. Each school provided us with their list of students who belong to the first, second, and third grades. After that, subjects were selected according to our sampling technique. An informed consent signed by the participants was obtained prior to the questionnaires distribution. It had the study purpose clearly explained. The participants' right to withdraw at anytime without any obligation was mentioned as well. Furthermore, for each subject a single code was prepared to ensure their confidentiality. We distributed two copies of the ADHD rating scale for each subject; both were labeled with the subject's code. One of the two copies was filled by the class pioneer (main teacher), and the other copy was sent home with the child along with the socio-demographics questionnaire to be filled by the parents. The selected study participants were given 5 days to fill the questionnaires. After that, the questionnaires were collected by the researchers and the volunteers, and later handed to the Principal Investigator to be held in his constant care. The collected data were revised to exclude any unfilled questionnaires. Subjects who had only one ADHD rating scale filled by either their teachers or parents

were labeled incomplete and were also excluded. Later on, data were sorted out into 6 groups depending on the gender and grade (3 females' groups, 3 males' groups, according to their grades).

The ADHD rating scale is a screening tool of ADHD symptoms. It is not sufficient to diagnose a child with ADHD, and an expert opinion should be sought out. We used the Arabic version that has been validated in 2009 [20]. The used scale is based on the criteria of the Diagnostic and Statistical Manual revised 3rd version (DSM-III-R). It contains 14 questions, and each question has 4-point scale (from 0 to 3), in the following pattern (not at all, just a little, pretty much, very much). Any child who scores 23 or more in this scale is considered to have ADHD symptoms and should be seen by a psychiatrist for further evaluation. There are many updates made in the DSM 5 but in regard to the ADHD section, the new DSM-5 broadens the ADHD diagnosis, allowing for adult-onset and relaxing the strictness of the criteria to more accurately reflect new research on this disorder. Given that adults have more developed brains and generally greater impulse control, adults can now be diagnosed with ADHD if they have fewer signs and symptoms than children, although this does not affect our study as the targeted sample was children. Another questionnaire, which is self-developed by the research group, was sent alongside the ADHD scale to the parents, it contains 10 questions, regarding the socio-demographics, in order to assess correlation between ADHD and the socio-demographics of the affected children families'.

Data were extracted from the hard copies of the filled questionnaires into an SPSS 21.04 form built specifically for the used scale. Each item in the scale has four options on the SPSS form. Data are presented in the frequency table as percentages. Statistical analysis was performed according to the scoring technique of the written scale. Prevalence has been calculated as a percentage using the study sample as the denominator and the number of the affected children as the nominator (Chi-square) was preformed to test the association between ADHD and the socio-demographics.

3. Results

Out of the 1000 subjects that we distributed the questionnaire to, 646 returned complete questionnaires. The rest (354) were either incomplete or were not returned at all. The overall ADHD prevalence was found to be 3.4% since 22 children were reported to have ADHD symptoms by both their parents and teachers. From them, 13(5.9%) were males, while 9(2.1%) were females, with a ratio of 3:1. Gender was shown to be associated with ADHD ($p = 0.013$) as shown in (Table 1). More than half of the 22 children who has ADHD symptoms, 12 belonged to the first grade; so 5.7% of first grade children had ADHD symptoms compared to 2.2% for the other two grades. This concludes that being in a lower grade is affiliated with ADHD ($p = 0.048$), also shown in (Table 1). Demographics that showed to be associated with the presence of ADHD were the level of maternal education ($p = 0.033$), as ADHD was more common among children whom mothers' were illiterate (Table 2). There was no association between ADHD and marital status, paternal education level, number of siblings, child's school-type, the family's level of income, nor the parents' occupation.

4. Discussion/limitations

The aim of our study was to fill the data gap of ADHD studies in Riyadh, Saudi Arabia. The study showed a prevalence of 3.4% which goes in line with the most recent local study that has been conducted in Assir [1]. The previously mentioned study used Vanderbilt ADHD rating scale. It covered 708 primary school-children and showed an ADHD prevalence of 2.7%. This difference can be explained by the use of different diagnostic criteria, since some are

Table 1

Association between socio-demographic and ADHD characteristics of the families of study subjects.

Factors		ADHD Present	ADHD Absent	Chi-square	P-Value
		Frequency (%)			
Marital status	Married	17(2.8)	582(97.2)	1.833	0.176
	Divorced	2(7.4)	25(92.6)		
Father's level of education	Illiterate	0(0)	10(100)	0.330	0.565
	Literate	20(3.2)	605(96.8)		
Mother's level of education	Illiterate	2(11.1)	16(88.9)	4.536	0.033 ^a
	Literate	16(2.6)	595(97.4)		
Father's Occupation	Employee	20(3.3)	592(96.7)	2.885	0.089
	Unemployed	2(10.5)	17(89.5)		
Mother's Occupation	Employee	9(4.0)	217(96.0)	0.263	0.608
	Unemployed	13(3.2)	393(96.8)		
Family level of income ^b	Less than 12000SR	9(3.9)	220(96.1)	0.719	0.698
	12000–20000SR	8(3.5)	218(96.5)		
	More than 20000SR	3(0.3)	129(97.7)		
Number of siblings	5 or less	16(3.1)	493(96.9)	0.147	0.701
	More than 5	3(2.5)	118(97.5)		

^a Statistically significant at $\alpha = 0.05$.^b \$1US = 3.75SR.**Table 2**

Association between study variables of the study subjects and ADHD.

Factors		ADHD Present	ADHD Absent	Chi-square	P-Value
		Frequency (%)			
Gender	Female	9(2.1)	415(97.9)	6.173	0.013 ^a
	Male	13(5.9)	209(94.1)		
Type of School	Private	7(2.4)	289(97.6)	1.799	0.180
	Governmental	15(4.3)	335(95.7)		
Grade	First	12(5.7)	198(94.3)	6.057	0.048
	Second	3(1.4)	211(98.6)		
	Third	7(3.2)	215(26.8)		

^a Statistically significant at $\alpha = 0.05$.

stricter than others.

A recent literature review in the Arab world showed a high variable rate ranging from 2.7% to 20.5%. Nearby studies were carried out in Qatar and UAE. Their results showed an ADHD prevalence of 9.4% and 14.9% respectively [16,19]. Their higher prevalence can be attributed to the fact that they used the Arabic version of Conners' Classroom rating scale that has been distributed among the teachers only, meaning that they only covered the school setting which has many rules to instruct the students' behavior, due to these circumstances it would be easier to pick children with ADHD traits. However, we considered the home setting, where children can act more freely, in addition to school. On the global level, a study conducted in Germany in 2008 demonstrated a 4.8% prevalence of ADHD [9]. Another similar study was conducted in France and stated that the prevalence of ADHD ranged between 3.5 and 5.6% [21]. This suggests that European countries are not so far from us. Unlike North America they have higher prevalence rates than Middle East and both Africa's. This is explained by using deferent methodological assessment. However, the geographic location may play a limited role in the explanation of this variability [22]. Regarding the gender difference, and according to our results, boys were reported to show ADHD manifestations more frequently than girls, with a male to female ratio of 3:1. This matches what has been stated in many previous studies [1,9,11–16,21,23,24].

Concerning socio-demographics, ADHD was found to affect first graders more than the other two higher grades that we covered in our study. This is similar to what has been mentioned in a German study that showed that ADHD was more common in younger age groups [9]. The level of mother education was shown to be related to ADHD in our study, since ADHD was more common in children with illiterate mothers, while a study released from UAE in 2009

showed no relation between the level of mother education and ADHD [15]. On the other hand, regarding the father's level of education, almost all studies found in the literature found no association [16,19]. A Korean study directed in Seoul, on 1645 children demonstrated an ADHD prevalence of 5.9%. This study suggested that there is an association between the marital status of the parents and the presence of ADHD in children [23], while our study did not find a significant association between what they suggested and ADHD. In regard to family income and its association with ADHD, our study revealed no association, while in a Qatari study, children from middle and low income families were affected more than those from higher income families [16]. Regarding ADHD and subtypes, a study that took place in Dammam, Saudi Arabia in 2008 examined each subtype prevalence alone, then combined them as one overall prevalence, which amounted to 16.4%; the study had different criteria from ours.

For the limitations we faced, firstly, the birthdate and child age were incomplete by the parents so we grouped the sample population according to the grade. Next, the response rate from the parents was less compared to teachers. Our tool was used for screening purposes only. Furthermore this research was done as a college course requirement; therefore, the researchers did not have much time to spend on translating any other ADHD scales. The options were extremely limited since not many ADHD screening tool are found in Arabic. The research team had to choose between the one that was used in this study and the Vanderbilt's ADHD scale. They settled for the ADHD rating scale even though it's not as new as the other ADHD scales, because it is shorter and easier to understand by both parents and teachers, which will result in more compliance from both sides. Still, we believe it would be better to use a screening tool that is based on the DSM-V diagnostic criteria.

Lastly, another significant limitation in this study is the fact that the questionnaires were given to the students. Children by nature are careless and do not tend to pay much attention to questionnaires and similar things, so perhaps not all of the subjects delivered their questionnaires properly. We believe this factor played a role in increasing the percentage of missed/not returned data. It would be much better if there was a way to contact the parents and gather the data directly from them.

5. Conclusion/recommendations

In conclusion, we found a 3.4% prevalence of ADHD among school children in Riyadh, Saudi Arabia. The results go in line with

what we found in the literature. ADHD affects boys more than girls. It is also more common among the lower grade students (1st grade). Low maternal level education seemed to be associated with ADHD as well.

ADHD is a common, chronic and treatable disorder that affects at least one child in each class. Early detection results in an excellent prognosis and it has a role in preventing the negative effects on the child's life, parent-child relationship and the community as well. Lastly, it is the responsibility of the Ministry of Health and the Ministry of Education officials to provide awareness programs, early detection tools, and appropriate medical advice. We also recommend to expand the study all over the Kingdom, as well as suggest a comparison between teachers and parents results to see who picked ADHD symptoms more than the other.

Ethical considerations

Informed consent signed by parents and teachers will be obtained prior to the rating scale distribution. It will have the study purpose clearly explained. The participant's right to withdraw at any time without any obligation will be mentioned as well. In addition, those who are interested in knowing either their child's result or the result of the study as a whole will be asked to give a way to contact them. Besides that, in order to avoid worrying the parents, it will be mentioned that the scale is not 100% diagnostic, and that ADHD cannot be diagnosed without seeking clinical help.

Conflict of interest

The authors have no conflict of interest.

Acknowledgments

We would like to thank a group of volunteers for their assistance in collecting the questionnaires among schools. Also, we show our gratitude to our colleagues Felwa AlHarthi and Malak AlMutairi for their help in data analysis.

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