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Attention Deficit Hyperactivity Disorder and Parental Factors in School Children Aged Nine to Ten Years in Muscat, Oman

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ABSTRACT

Objectives: The objectives of this study were to determine the prevalence of attention deficit hyperactivity disorder (ADHD) and specific parental risk factors that may contribute to the development of ADHD in children. ***Methods:*** The study was conducted in Oman among fourth-grade students (aged nine to 10 years). A standardized Arabic version of the National Initiative for Children's Health Quality Vanderbilt Assessment Scale (Teachers questionnaire) was used to determine the presence of ADHD. Parental factors such as socioeconomic status, education, and occupation were documented. ***Results:*** The prevalence rate of ADHD was 8.8%. Poor maternal education status, low familial socioeconomic status, and paternal occupation were significantly associated with an increased risk of ADHD. ***Conclusions:*** This was the first study that examined familial and parental characteristics of children with ADHD as potential risk factors for the condition. Such psychosocial factors could be employed to further the development of more proficient preventative measures and remedial services.

Attention deficit hyperactivity disorder (ADHD) is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM)[1] and the International Classification of Diseases[2] as having two distinct behavioral dimensions: inattentive and hyperactive-impulsive. Both have been found to exist across a wide variety of cultures and ethnic groups around the world.[3] The global prevalence of ADHD ranges between 5% and 13%.[4] Children who suffer from ADHD exhibit symptoms such as difficulty following instructions and abiding by rules.[5] They are also more likely to misbehave and interrupt or intrude on others' conversations and activities,[6] and are more prone to risk-taking and rule-violating behavior, and offending social modesty through disruptive behavior. Unfortunately, these behaviors of social misconduct are typically met with a negative response from peers, teachers, and parents.[7,8] Furthermore, these symptoms and corresponding outcomes have been linked to a heightened risk of substance abuse, the presence of comorbid neurobehavioral disorders, and becoming 'social misfits', and all the consequences these may entail affecting quality of life.[9–11]

As the majority of scientific literature on ADHD emanated from Euro-American populations, it led to an initial belief that ADHD might have been a 'culture-bound syndrome'.[12] Nonetheless, a systematic review of literature from different populations and ethnicities identified that the universality of ADHD is undeniable.[13] However, there is a dearth of studies from Gulf populations of the Arabian Peninsula, including Oman. The Sultanate of Oman is a country located at the tip of the Arabian Peninsula, adjacent to and between

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the continents of Africa and Asia. The population structure is pyramidal, with the majority being children and adolescents.[14] Anecdotal studies have indicated that this region is far from immune to the vagaries of neurodevelopmental disorders. In Qatar, using the Conner's scale, teachers indicated that 16.7% of male and 7.3% of female students exhibited symptoms of ADHD.[15] In the principality of Sharjah, UAE, this figure was 18.3% of male and 11.4% of female students.[16] In Saudi Arabia, clinical notes kept at a tertiary care hospital indicated that 10.5% of attendees had symptoms of ADHD.[17] A study from Oman reported that 7.8% of males and 5.1% of females manifested characteristic symptoms of ADHD.[18]

Further research into ADHD risk factors and the familial characteristics of children with ADHD are required. Examination of children's sociodemographic background has the potential to lay the groundwork for the development of more proficient preventative measures and health education programs. Furthermore, quantifying the risk factors of children with ADHD can potentially entertain the theoretical model on whether ADHD is a global challenge or an artifact of sociocultural factors. In Western populations, although genetic and neurological determinants have been found, a range of social and economic factors have been suggested to play a role in the development of ADHD.[19–28]

Our study aimed to explore two interrelated themes. The first was to estimate the prevalence of ADHD in school children aged nine to 10 years old in Muscat, Oman. The second was to assess and ultimately identify familial and parental factors associated with the development of ADHD.

METHODS

One of the objectives of this study was to estimate the prevalence of ADHD in schoolchildren and the associated risk factors. The prevalence of ADHD was previously found to be about 8%.[15–18] To analyze this with a precision of 3% and a confidence interval (CI) of 95%, approximately 315 participants were needed.

This study was conducted during the 2012–2013 academic year in the Muscat Governorate. There are 39 public schools in this region, which are run by the Ministry of Education. During the 2012-2013 academic year, there were a total of 6855 children in the fourth grade (aged nine to 10 years). The students came from schools classified as serving 'mainstream education' and were likely to exhibit adequate intellectual functioning. In Oman, children with special needs, learning disorders, and mental disabilities typically do not attend these schools.[29] Three schools were randomly selected from the 39. There were about 530 fourth graders in these selected schools. Invitation letters were sent to the parents of these students seeking their permission for their children to participate in the study.

Children who had hereditary or chronic medical conditions or a cognitive impairment that would warrant the diagnosis of other developmental disorders rather than ADHD were excluded from the study. Children taking psychoactive agents or diagnosed with behavioral, cognitive, and/or emotional disorders were also excluded from the study. Lastly, children with hearing and/or visual impairments were excluded. A total of 350 parents gave their consent and their children satisfied all the inclusion criteria.

Sociodemographic characteristics including age, gender, monthly income (as an indicator of socioeconomic status), educational level of both parents, and occupational status of both parents were collected by a trained researcher using face-to-face interviews.

A standardized Arabic version of the National Initiative for Children's Health Quality Vanderbilt Assessment Scales-Teacher Assessment Scale (NICHQ Vanderbilt Assessment Scales) was used.[30,31] The NICHQ Vanderbilt Assessment Scales contain 47 items divided into various subsections, including symptoms of ADHD; symptoms of oppositional defiant/conduct disorder; and symptoms of anxiety/depression. These subsections are scored on a scale of zero to three: 0 = never, 1 = occasionally, 2 = often, 3 = very often. The teachers conducting the assessment were instructed to circle a single number on the scale. The symptoms, which were the predominant focus, of this study are as follows: predominantly inattentive subtype (PIS), predominantly hyperactive/impulsive subtype (PHIS), ADHD combined inattention/hyperactivity (ADHDCIH), oppositional defiant/conduct disorder, and anxiety/depression.

The research team taught the teachers how to correctly fill out the NICHQ Vanderbilt Assessment Scales. The teachers were instructed to base their answers on students' behavior over a six-month

period. The formula used to score the NICHQ Vanderbilt Assessment Scales was equivalent to that detailed by Wamithi et al.[32]

The prevalence rates of PIS, PHIS, and ADHD were presented with a 95% CI. In the unadjusted (bivariate) analysis, a chi-square test was performed to determine the association between the risk variables and outcomes: PIS, PHIS, and ADHD (yes or no). In the adjusted (multivariate) analysis, a logistic regression analysis was performed to control for the effects of confounders and other risk variables. The odds ratio was presented with a 95% CI and *p*-value. A *p*-value < 0.050 was considered statistically significant. The goodness of fit of the logistic regression analyses (model) was done using the Hosmer-Lemeshow test. The test's assumptions were validated using a deviance chi-square test versus predicted probability graphs. All data analysis and statistical testing were performed using SPSS Statistics (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp).

The study was approved by the Research Ethics Committee of the Ministry of Health, Oman (Ref. MH/DGP/R&S/Proposal Approved/8/2012), and the National Research Ethics Committee North West – Haydock, UK (REC reference no. 12/NW/0760) and registered with ISRCTN Register (Reg. No. ISRCTN93233285). Informed and signed consent was obtained from the parents/guardians of the children, and the study was conducted in accordance with the provisions of the two ethics committees and according to the principles of the Helsinki Declaration.

RESULTS

Of the 350 invited students/parents who consented, 22 did not provide complete sociodemographic details and were therefore excluded. The rest satisfied all the other inclusion criteria. Thus, about 4.7% (328/6855) of fourth graders from the Muscat governate were involved in the study. Of the 328 participating children, 142 were boys and 186 were girls.

The prevalence rates of PIS, PHIS, and ADHDCIH were 7.3% (95% CI: 4.5–10.1%), 3.0% (95% CI: 1.2–4.8%), and 8.8% (95% CI: 5.7–11.8%), respectively. The prevalence rates of oppositional defiant/conduct disorder and anxiety/depression were 1.5% (95% CI: 0.2–2.8%) and 1.8% (95% CI: 0.4–3.2%), respectively. Male participants exhibited significantly higher prevalence rates of PIS, PHIS, and ADHDCIH compared to female participants ($p < 0.050$).

The unadjusted and adjusted analyses results for the PIS scale according to parent's sociodemographic variables and sex are presented in Table 1. Although participant's sex was statistically significant during the unadjusted analyses, it was not following adjustment for parental characteristics. Children with illiterate mothers exhibited higher rates of PIS symptoms compared to children whose mothers were literate ($p = 0.064$). Similarly, children whose fathers worked outside of both the public and military sectors exhibited higher rates of PIS symptoms 2.80 (95% CI: 0.90–8.30; $p = 0.076$). These higher rates were not statistically significant.

The unadjusted and adjusted analysis results for the PHIS scale according to parent's sociodemographic variables and child's sex are presented in Table 2. Male children were 6.24 times (95% CI: 0.91–42.76) more likely to exhibit symptoms of PHIS compared to female children ($p = 0.062$). Interestingly, children with fathers who obtained either preparatory or secondary school diplomas were 83% less likely to exhibit symptoms of PHIS than those whose fathers were university graduates ($p = 0.084$). In addition, children with mothers whose occupation was anything other than that of a homemaker were 7.10 times (95% CI: 1.10–50.00) more likely to exhibit symptoms of PHIS compared to children whose mothers were homemakers ($p = 0.038$). Similarly, children from low-income families were 24.09 times (95% CI: 1.70–341.83) more likely to exhibit symptoms of PHIS than children from medium or high-income families ($p = 0.019$).

The unadjusted and adjusted analysis results for the ADHDCIH scale according to parent's sociodemographic variables and child's sex are presented in Table 3. Children with illiterate mothers or mothers who did not study beyond primary school were 9.49 times (95% CI: 0.72–124.61) more likely to exhibit symptoms of ADHDCIH compared to children whose mothers had an education above primary level ($p = 0.087$). Participants with fathers who were not employed in the public or military sector were 4.20 times (95% CI: 1.40–12.50) more likely to exhibit symptoms of ADHDCIH compared

Table 1: Unadjusted and adjusted analysis for predominantly inattentive subtype (PIS) with sociodemographic variables.

Variables	Unadjusted analysis of PIS				Adjusted analysis of PIS		
	Total n (%)	Yes n (%)	No n (%)	*p*-value	OR	95% CI	*p*-value
Sex							
Male	142 (43.3)	17 (70.8)	125 (41.1)	0.005	1.65	0.60– 4.58	0.334
Female	186 (56.7)	7 (29.2)	179 (58.9)		1.00		
Mother's education							
Illiterate	49 (15.4)	7 (29.2)	42 (14.3)	0.017	11.40	0.87–150.70	0.064
Preparatory/secondary/ diploma	196 (61.6)	16 (66.7)	180 (61.2)		3.49	0.36–34.29	0.283
Baccalaureate/graduate	73 (23.0)	1 (4.2)	72 (24.5)		1.00		
Father's education							
Illiterate	22 (6.9)	2 (8.3)	20 (6.8)	0.791	0.59	0.08–4.18	0.596
Preparatory/secondary/ diploma	177 (55.8)	14 (58.3)	163 (55.6)		0.69	0.19–2.43	0.568
Baccalaureate/graduate	118 (37.2)	8 (33.3)	110 (37.5)		1.00		
Mother's occupation							
Housewife	180 (56.6)	15 (62.5)	165 (56.1)	0.544	0.75	0.20–2.83	0.672
Others	138 (43.4)	9 (37.5)	129 (43.9)		1.00		
Father's occupation							
Public/military sector	169 (53.3)	9 (37.5)	160 (54.6)	0.106	1.00	0.90–8.30	0.076
Others	148 (46.7)	15 (62.5)	133 (45.4)		2.80		
Family income							
Low	137 (54.4)	14 (73.7)	123 (52.8)	0.079	2.04	0.60–6.96	0.252
Medium/high	115 (45.6)	5 (26.3)	110 (47.2)		1.00		

OR: odd ratio; CI: confidence interval.

Table 2: Unadjusted and adjusted analysis for predominantly hyperactive impulsive subtype (PHIS) with sociodemographic variables.

Variables	Unadjusted analysis of PHIS				Adjusted analysis of PHIS		
	Total n (%)	Yes n (%)	No n (%)	*p*- value	OR	95% CI	*p*-value
Sex							
Male	142 (43.3)	8 (80.0)	134 (42.1)	0.023	6.24	0.91–42.76	0.062
Female	186 (56.7)	2 (20.0)	184 (57.9)		1.00		
Mother's education							
Illiterate	49 (15.4)	2 (20.0)	47 (15.3)	0.722	6.89	0.25–193.48	0.257
Preparatory/secondary/ diploma	196 (61.6)	7 (70.0)	189 (61.4)		1.74	0.14–22.47	0.669
Baccalaureate/graduate	73 (23.0)	1 (10.0)	72 (23.4)		1.00		
Father's education							
Illiterate	22 (6.9)	1 (10.0)	21 (6.8)	0.675	0.29	0.01–5.94	0.421
Preparatory/secondary/ diploma	177 (55.8)	5 (50.0)	172 (56.0)		0.17	0.02–1.27	0.084
Baccalaureate/graduate	118 (37.2)	4 (40.0)	114 (37.1)		1.00		
Mother's occupation							
Housewife	180 (56.6)	5 (50.0)	175 (56.8)	0.751	1.00	1.10–50.00	0.038
Others	138 (43.4)	5 (50.0)	133 (43.2)		7.10		
Father's occupation							
Public/military sector	169 (53.3)	1 (10.0)	168 (54.7)	0.007	-	-	-
Others	148 (46.7)	9 (90.0)	139 (45.3)				
Family income							
Low	137 (54.4)	7 (87.5)	130 (53.3)	0.074	24.09	1.70–340.83	0.019
Medium/high	115 (45.6)	1 (12.5)	114 (46.7)		1.00		

OR: odd ratio; CI: confidence interval

Table 3: Unadjusted and adjusted analysis for attention deficit hyperactivity disorder (ADHD) combined inattention hyperactivity with sociodemographic variables.

Variables	Unadjusted analysis of ADHD				Adjusted analysis of ADHD		
	Total n (%)	Yes n (%)	No n (%)	*p*-value	OR	95% CI	*p*-value
Sex							
Male	142 (43.3)	21 (72.4)	121 (40.5)	0.001	2.27	0.85–6.06	0.101
Female	186 (56.7)	8 (27.6)	178 (59.5)		1.00		
Mother's education							
Illiterate	49 (15.4)	7 (24.1)	42 (14.5)	0.009	9.49	0.72–124.61	0.087
Preparatory/secondary/ diploma	196 (61.6)	21 (72.4)	175 (60.6)		3.61	0.36–35.94	0.273
Baccalaureate/graduate	73 (23.0)	1 (3.4)	72 (24.9)		1.00		
Father's education							
Illiterate	22 (6.9)	2 (6.9)	20 (6.9)	0.864	0.28	0.04–1.92	0.197
Preparatory/secondary/ diploma	177 (55.8)	15 (51.7)	162 (56.2)		0.39	0.13–1.19	0.098
Baccalaureate/graduate	118 (37.2)	12 (41.4)	106 (36.8)		1.00		
Mother's occupation							
Housewife	180 (56.6)	19 (65.5)	161 (55.7)	0.310	0.98	0.27–3.55	0.971
Others	138 (43.4)	10 (34.5)	128 (44.3)		1.00		
Father's occupation							
Public/military sector	169 (53.3)	10 (34.5)	159 (55.2)	0.033	1.00	1.40–12.50	0.012
Others	148 (46.7)	19 (65.5)	129 (44.8)		4.20		
Family income							
Low	137 (54.4)	18 (78.2)	119 (52.0)	0.016	2.96	0.86–10.15	0.084
Medium/high	115 (45.6)	5 (21.7)	110 (48.0)		1.00		

OR: odd ratio; CI: confidence interval.

to children with fathers who worked in the public or military sectors ($p = 0.012$). Similarly, children from low-income families were nearly 2.96 times (95% CI: 0.86–10.15) more likely to exhibit symptoms of ADHDCIH than children from medium or higher income families ($p = 0.084$).

DISCUSSION

To the best of our knowledge, this is the first study to comprehensively investigate the prevalence rate of ADHD in a young student population in Oman. Using the NICHQ Vanderbilt Assessment Scale, we determined that 8.8% of our cohort exhibited symptoms of ADHD. The majority of literature investigating this topic used Conner's scale,[16,18] but the NICHQ Vanderbilt Assessment Scales have been shown to be more valid.[32,33] NICHQ Vanderbilt Assessment Scales are well-equipped to detect manifestation of a broad spectrum of ADHD symptoms (e.g., inattentiveness and hyperactivity) and any given combination of these characteristic symptoms. In addition, these scales are proficient at identifying any sort of impairment these symptoms may entail, as well as a comorbidity of other neurobehavioral problems, such as oppositional defiant/conduct disorder and anxiety/depression.[32]

The results indicate that 7.3% of students were marked by their teachers as exhibiting inattentive symptoms, while 3% were marked as exhibiting symptoms of hyperactivity and/or impulsivity. The 8.8% prevalence rate falls within the average international range,[4] and falls within the lower range when compared to assessment using questionnaires and/or symptom checklists.[4] In fact, similar studies that used the 'golden standard' semi-structured interview method of assessment obtained ADHD prevalence rates between 6% and 7%.[4] Past literature supports this trend, with indications that Arab populations exhibit a lower prevalence rate of ADHD compared to Euro-American populations.[13]

Our study indicated that ADHD is common among young students in Muscat, where the majority of Omanis live.[14] Given that this study's sample was taken from the coterminous and mainly urban area, Muscat, the capital city of Oman, the result's generalizability may be limited. Further

investigations including rural populations are necessary to render greater generalizability.

While most studies in this area of research adhered strictly to the assessment of prevalence rates, this study's second interrelated aim was to highlight ADHD risk factors; specifically, parental and familial factors associated with the development of ADHD.[16,18] Establishing risk factors would lay the groundwork for the development of more proficient preventative measures and remedial services. This study indicates that maternal education status is a strong predictor of ADHD development. The more educated the mother, the less likely their child is to develop and/or manifest symptoms of ADHD. Paternal education status was not a significant indicator. The lack of relationship between paternal education and ADHD might stem from the stereotypical sociocultural teaching that mothers play the dominant role in molding the behavior patterns of children.[9–11] These results parallel those of St Sauver et al,[23] who similarly reported that low parental education status was predictive of ADHD development.

The results also suggest that socioeconomic status has a direct influence on the development and manifestation of ADHD symptoms. Specifically, children from medium or high-income families are far less likely to exhibit ADHD-related tendencies than children from low-income families.[19,34]

Lastly, the results indicate that parental occupation is significantly correlated with ADHD. Children of parents who work within the public or military sectors are less likely to exhibit symptoms of ADHD compared to those whose parents who work within the private sector. It is believed that this is the case in Oman because jobs within the public/government/military sector are provided more holidays and higher salaries. In fact, studies have found that the most preferred jobs among the Omani labor force are within the government sector.[29] Furthermore, a study has found that individuals working within the private sector are more likely to have a lower educational status, and more likely to be marked with emotional disorders.[35]

The objectives of determining ADHD prevalence and the identification of risk factors were addressed through a cross-sectional study. As a result, this is a single snapshot measurement, and likely to change with time as the children grow older. Given this limitation, the ideal research design would be a longitudinal cohort, with six-month intervals during which ADHD is assessed. A second limitation is that this study strictly assessed children aged nine or 10 from the Muscat region. Both these specific attributes reduced the study's representation of the entire national population, thereby limiting the results' generalizability. To deal with this problem, we suggest a multicentre study analyzing children across Oman's many regions to increase representation and generalizability. A third and final limitation is that many previous studies identified IQ as an important factor contributing to the development of ADHD. Nonetheless, we did not explore IQ as an ADHD risk factor in this study.

CONCLUSION

The prevalence rates of PIS, PHIS, and ADHD are 7.3% (95% CI: 4.5%–10.1%), 3.0% (95% CI: 1.2%–4.8%), and 8.8% (95% CI: 5.7%–11.8%), respectively. Results on risk factors suggest that low family income, poor maternal education, and private sector jobs are all associated with an increased risk in the development and manifestation of ADHD symptoms. Some of these specific factors are significant, even after controlling for other factors.

Disclosure

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