The current study provides evidence that approximately one-third of Omani children referred to a learning support unit for LDs exhibited ADHD symptomatology as rated by their teachers.

**Keywords:** Learning Disorders; Attention Deficit Hyperactivity Disorder; Comorbidity; Children; Oman.

**Abstract: Objectives:** The estimated worldwide prevalence of learning disorders (LDs) is approximately 2–10% among school-aged children. LDs have variable clinical features and are often associated with other disorders. This study aimed to examine the comorbidity of LDs and attention deficit hyperactivity disorder (ADHD) among a sample of schoolchildren in Oman. **Methods:** This study was conducted between January 2014 and January 2015 at the Sultan Qaboos University Hospital, Muscat, Oman. The Learning Disabilities Diagnostic Inventory (LDII) and the 28-item version of the Conners’ Teacher Rating Scale were completed by classroom teachers to determine the existence of LD and ADHD symptoms in 321 children in grades 1–4 who had been referred to a learning support unit for LDs from elementary schools in Muscat. **Results:** The mean age of the students was 8.5 years. Among the cohort, 30% were reported to have symptoms of ADHD, including conduct problems (24%), hyperactivity (24%) and inattentive-passive behaviours (41%). Male students reportedly exhibited greater conduct problems and hyperactivity than females. However, there were no gender differences noted between LLDI scores. **Conclusion:** This study suggests that Omani schoolchildren with LDs are likely to exhibit signs of ADHD. The early identification of this disorder is essential considering the chronic nature of ADHD. For interventional purposes, multidisciplinary teams are recommended, including general and special educators, clinical psychologists, school counsellors, developmental or experienced general paediatricians and child psychiatrists.

**Advances in Knowledge**
- The co-occurrence of learning disorders (LD) and attention deficit hyperactivity disorder (ADHD) is well known. However, data on this topic are still lacking in Oman. To the best of the authors’ knowledge, this is the first study that reports the coexistence of ADHD in a group of Omani schoolchildren with LDs.

- The current study provides evidence that approximately one-third of Omani children referred to a learning support unit for LDs exhibited ADHD symptomatology as rated by their teachers.
Learning disorders (LDs) are neurodevelopmental conditions that affect approximately 2–10% of school-aged children worldwide. Children with LDs frequently exhibit comorbidities with other disorders, including attention deficit hyperactivity disorder (ADHD). The high comorbidity of LDs and ADHD has been well delineated in the literature while the overall estimate of LDs in children with ADHD ranges from 7–92%. Research has shown that the prevalence of ADHD in schoolchildren with LDs ranges from 18–60%, which is seven times higher than that of the general population. Multiple factors contribute to this wide range, including differences in methodologies, definitions of LDs and ADHD and population samples. Most epidemiological information is gathered from clinically referred samples compared to school-based samples; it is well known that clinically referred students usually have multiple comorbidities.

There is a lack of data from Middle Eastern countries with regards to the prevalence of ADHD among children with LDs. In Oman, a cross-sectional study carried out in 2008 screened 1,502 Omani schoolboys for ADHD using the short version of the Conners’ Teacher Rating Scale (CTRS). The findings showed that 7.8% of the sample exhibited hyperactivity, which was strongly associated with conduct disorder, poor academic performance and behavioural problems. Other research noted that the observed rate of ADHD among Omani schoolgirls was 5.1%. This rate is lower than those reported in similar studies of other populations (11.0–19.8%).

The high variability of ADHD prevalence rates between Omani and other populations has been attributed to sociocultural, ecological and/or methodological factors.

In Oman, schoolchildren with LDs receive their education in regular classroom settings alongside their non-affected peers. However, they are sometimes removed from the classroom to receive instruction from specialist teachers within a specialised learning support unit. These units were established in every elementary school in Oman in order to cater for the needs of children with LDs. Students with LDs are also eligible for additional drop-in support if needed. A referral to a learning support unit is based on a teacher’s nomination due to the student’s non-responsiveness to instruction as shown by their monthly reading and mathematics grades. Within the learning support unit, students typically receive approximately eight hours of support per week from a specialised LD teacher, including assistance with reading, writing and mathematical activities and problem-solving. The Omani Ministry of Education initiated the inclusion and support programme for children with LDs in 2007 in Omani elementary schools. In most cases, LD teachers have a specialised diploma. Some hold a Master’s degree and/or have received specialised in-house training.

Children with ADHD can exhibit academic, educational and neurobehavioural problems such as anxiety, depression, disruptive behaviours and tics. These associations often result in higher rates of school suspension, grade retention and the use of special education or ancillary services. It is therefore important to recognise ADHD symptoms in order to effectively plan for and manage affected children.

As such, the present study was designed to examine the relationship between LDs and ADHD among an Omani school-based sample referred to a learning support unit for LDs.

Methods

This study was conducted between January 2014 and January 2015 at the Sultan Qaboos University, Muscat, Oman. Students between grades 1–4 from elementary public schools across Muscat, Oman, who had been referred for LDs to a learning support unit from elementary schools in Oman were recruited for inclusion in the study. The sample was drawn from a large pool of students referred for learning support in elementary schools across Oman. General classroom teachers were requested to complete two questionnaires rating the existence of LD and ADHD symptoms in a particular child based on their personal views and experiences teaching the child.

The Learning Disabilities Diagnostic Inventory (LDDI) is a rating scale designed to examine the presence of LDs in students between the ages of 0–8 and 11–17 years and consists of six independent 15-item subscales (listening, speaking, reading, writing, mathematics and reasoning). Each item is rated on a 9-point Likert scale. The normalisation sample of the inventory includes 2,152 students with LDs from the USA. Teachers were requested to complete an adapted Arabic version of the LDDI following two rounds of consecutive translation and one round of back-translation. The back-translation
was conducted by a translator with a background in
a related discipline and without access to the original
questionnaire. A number of items from the original
inventory were modified in order to fit the structure,
morphology and phonology of the Arabic language. The
questionnaire items originally included English
examples which were replaced by Arabic examples.
Examples were provided to the teachers in order to
help them understand statements before rating the
pupil. These examples increased the face validity
of the Arabic version of the LDDI. Additionally,
Cronbach’s alpha for the validated Arabic versions of
the subscales used were as follows: α = 0.95 (listening);
α = 0.96 (speaking, writing and mathematics); α = 0.97 (reading and reasoning). Scores were reported
in percentiles or scaled on a 9-point standard scale
with a mean of five and a standard deviation of two.

The CTRS is a widely used measure to assess the
presence of ADHD in children and adolescents. The
28-item version of the CTRS (CTRS-28) assesses
behaviour on four subscales (hyperactivity, conduct
problems, inattentive-passive behaviours and hyper-
activity index) as defined in the psychiatric nomen-
clature. The items on the hyperactivity index
subscale are drawn from the other three subscales
and provide a sensitive indicator of ADHD symptoms
in children. Each item is rated on 3-point Likert
scale. General classroom teachers were requested to
complete an adapted Arabic version of the CTRS-28
following forward- and back-translation. The back-
translation was conducted by an external translator
with a background in educational psychology and
without the original questionnaire. An empirical
study validated the CTRS-28 on a large Egyptian
sample and found moderate internal consistency
(α = 0.76). Test-retest reliability of the validated Arabic
version of the four subscales was as follows: hyper-
activity = 0.48; conduct problems = 0.46; inattentive-
passive behaviours = 0.59; and hyperactivity index
= 0.52. Internal consistency estimates for the
hyperactivity, conduct problems, inattentive-passive
behaviours and hyperactivity index subscales were
α = 0.80, 0.85, 0.82 and 0.85, respectively.

Data were collected, coded and analysed using the
Statistical Package for the Social Sciences (SPSS),
Version 21.0 (IBM Corp., Chicago, Illinois, USA). The
association between LD and ADHD was measured
using the correlation coefficient of the LDDI and
CTRS-28 scores. Gender differences among LD
and ADHD symptoms were estimated using an
independent two-sample t-test after calculating the
mean scores and standard deviation.

This study was approved by the Research Ethical
Committee Board of the Sultan Qaboos University
(#SR/EDU/PSYC/12/01). Consent was obtained from
the administration of the involved elementary schools

| Table 1: Correlation matrix between learning disorders* and attention deficit hyperactivity disorder† among Omani schoolchildren referred for learning disorders (N = 321) |
|---|---|---|---|---|
| **Correlation matrix** | **LDDI subscale** | **CTRS-28 subscale** |  |
| | | Conduct problems | Hyperactivity | Inattentive-passive behaviours | Hyperactivity index |
| Total | Listening | 0.243 | 0.193 | 0.367 | 0.260 |
| | Speaking | 0.259 | 0.206 | 0.421 | 0.291 |
| | Reading | 0.278 | 0.218 | 0.461 | 0.325 |
| | Writing | 0.297 | 0.229 | 0.457 | 0.339 |
| | Mathematics | 0.205 | 0.172 | 0.347 | 0.242 |
| | Reasoning | 0.294 | 0.266 | 0.503 | 0.366 |
| **Male** (n = 203) | Listening | 0.215 | 0.138 | 0.290 | 0.201 |
| | Speaking | 0.250 | 0.183 | 0.376 | 0.260 |
| | Reading | 0.260 | 0.156 | 0.385 | 0.263 |
| | Writing | 0.255 | 0.146 | 0.370 | 0.253 |
| | Mathematics | 0.236 | 0.163 | 0.303 | 0.248 |
| | Reasoning | 0.286 | 0.227 | 0.448 | 0.330 |
| **Female** (n = 118) | Listening | 0.328 | 0.305 | 0.487 | 0.382 |
| | Speaking | 0.288 | 0.248 | 0.494 | 0.351 |
| | Reading | 0.344 | 0.336 | 0.578 | 0.451 |
| | Writing | 0.394 | 0.365 | 0.566 | 0.487 |
| | Mathematics | 0.227 | 0.248 | 0.421 | 0.295 |
| | Reasoning | 0.324 | 0.281 | 0.594 | 0.441 |

LDDI = Learning Disabilities Diagnostic Inventory; CTRS-28 = 28-item version of the Conners’ Teacher Rating Scale.

*Learning disorders were scored by teachers using an Arabic version of the LDDI. †Attention deficit hyperactivity disorder was scored by teachers using an Arabic version of the CTRS-28. ‡All values except those otherwise marked were significant at the 0.01 level using an independent two-sample t-test. §Significant at the 0.05 level using an independent two-sample t-test.
Table 2: Gender differences between learning disorders* and attention deficit hyperactivity disorder† among Omani schoolchildren referred for learning disorders (N = 321)

<table>
<thead>
<tr>
<th>LDDI subscale</th>
<th>Mean ± SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n = 203)</td>
<td>Female (n = 118)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening</td>
<td>5.11 ± 1.58</td>
<td>5.10 ± 1.74</td>
<td>0.04</td>
</tr>
<tr>
<td>Speaking</td>
<td>5.42 ± 1.58</td>
<td>5.32 ± 1.68</td>
<td>0.50</td>
</tr>
<tr>
<td>Reading</td>
<td>5.83 ± 1.65</td>
<td>5.79 ± 1.86</td>
<td>0.21</td>
</tr>
<tr>
<td>Writing</td>
<td>6.04 ± 1.50</td>
<td>5.89 ± 1.78</td>
<td>0.81</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5.90 ± 1.56</td>
<td>6.20 ± 1.63</td>
<td>1.64</td>
</tr>
<tr>
<td>Reasoning</td>
<td>6.12 ± 1.55</td>
<td>6.02 ± 1.63</td>
<td>0.54</td>
</tr>
<tr>
<td>CTRS-28 subscale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct problems</td>
<td>0.81 ± 0.55</td>
<td>0.59 ± 0.41</td>
<td>3.80</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>0.82 ± 0.61</td>
<td>0.60 ± 0.53</td>
<td>3.32</td>
</tr>
<tr>
<td>Inattentive-passive</td>
<td>1.21 ± 0.58</td>
<td>1.23 ± 0.59</td>
<td>0.27</td>
</tr>
<tr>
<td>Hyperactivity index</td>
<td>0.97 ± 0.54</td>
<td>0.77 ± 0.47</td>
<td>3.23</td>
</tr>
</tbody>
</table>

SD = standard deviation; LDDI = Learning Disabilities Diagnostic Inventory; CTRS-28 = 28-item version of the Conners’ Teacher Rating Scale.
*Learning disorders were scored on a 9-point Likert scale by teachers using an Arabic version of the LDDI. †Attention deficit hyperactivity disorder was scored on a 3-point Likert scale by teachers using an Arabic version of the CTRS-28.

and from all parents of the participating children before data collection began.

Results

Among the cohort, there were 118 female students (36.8%) and 203 male students (63.2%). The mean age of the children was 8.53 ± 0.76 years. The subjects were predominantly Arabic-speaking and of Omani nationality. According to their teachers, 30.0% of pupils referred to the learning support unit for suspected LDs exhibited significant ADHD symptomatology. These included conduct problems (24.0%), hyperactivity (24.0%) and inattentive-passive behaviours (41.0%).

The correlation matrix for the LDDI and CTRS-28 subscales is shown in Table 1. There were positive correlation coefficients between all of the subscales for the total sample as well as by gender. Gender differences between LD and ADHD symptoms are shown in Table 2. There were no gender differences observed in LDDI scores. However, there were gender differences observed in three of the CTRS-28 subscales, with males displaying greater conduct problems, hyperactivity and hyperactivity indexes according to their teachers. There were no reported gender differences with regards to the inattentive-passive behaviours subscale.

Discussion

In the current study, the majority of the referred children with LDs were boys. This is consistent with a previous study on LDs carried out in Oman. However, no significant gender differences were observed among the current cohort regarding teachers’ ratings of LD symptoms as expressed within the LDDI. Previous research has suggested that boys are more likely to be referred for LDs associated with difficulties in reading, comprehension and mathematics. However, gender differences in LDs are still controversial and have yet not been confirmed by recent epidemiological studies. It is likely that behavioural problems which result in a referral among girls are seen as more extreme. Interestingly, gender differences in the manifestation of ADHD were also observed in the current study. Boys were reported to exhibit greater conduct problems, hyperactivity and hyperactivity indexes than girls. Additionally, more boys met the diagnostic criteria for both LDs and ADHD. However, the reported male-to-female ratio for ADHD varies widely.

The findings of the present study suggest that ADHD has a significant correlation with LDs among schoolchildren. Although a number of studies have examined the coexistence of LDs and ADHD, only a few have studied the prevalence of ADHD in a cohort of school-aged children diagnosed with LDs. Positive correlation coefficients were noted in the current study between all of the subscales for the total sample as well as according to gender. This finding suggests that there are common symptoms identified by both the LDDI and CTRS-28 questionnaires.

Nevertheless, it is not surprising that ADHD and LDs were interconnected in the current study. The overall effect of psychological and educational difficulties has been previously confirmed in children from the general population. Research has provided substantial evidence that children with internalised and externalised psychological problems are poor learners. Additionally, educational difficulties are likely to affect academic performance as well as self-esteem. However, researchers have yet to agree on implications for children at risk of developing LDs.

A detailed examination of such associations in previous studies has indicated that literacy difficulties are predicted by both hyperactivity and conduct problems. Another study also postulated that the link between conduct problems and literacy difficulties is mediated by ADHD, of which hyperactivity is
Comorbidity of Learning Disorders and Attention Deficit Hyperactivity Disorder in a Sample of Omani Schoolchildren

Among the studied sample of schoolchildren in Oman referred for LDs, 30.0% were reported to have symptoms of ADHD by their teachers, including conduct problems, hyperactivity and inattentive-passive behaviours. Male students were reported to show greater conduct problems and hyperactivity than the females. However, there were no gender differences noted between LDDI scores. These findings suggest that Omani children referred for LDs are likely to exhibit ADHD symptomatology. As ADHD can have serious implications for paediatric development, it is vital that these children are assessed and treated by a multidisciplinary team including experts in the fields of education and child psychology.

ACKNOWLEDGEMENTS

The data reported in this study were part of a larger dataset of a strategic project aiming to identify key stage one pupils with LDs in Omani schools. This project was funded by a grant from the His Majesty’s Research Trust Fund (HMRTF) at Sultan Qaboos University (#SR/EDU/PSYC/12/01). The authors therefore wish to thank the HMRTF organisers for their technical and financial support.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

References


