

# ADHD Research in Arab Countries: A Systematic Review of Literature

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## Abstract

**Objective:** No systematic reviews could be identified in the literature that address ADHD research in Arab countries. In an attempt to help fill this gap, this systematic review was undertaken. **Method:** An electronic literature search of ADHD studies carried out in Arab countries was done by using Google Scholar, PsycINFO, PubMed, Education Resources Information Center (ERIC), and Arabpsynet. **Results:** The search yielded 58 studies (10 studies on psychoeducational and social aspects of ADHD, 26 prevalence studies and two reviews of epidemiology of ADHD, and 22 studies on risk factors and comorbidities in ADHD). **Conclusion:** Although there has been an increase in ADHD research in Arab countries in recent years, this research remains relatively sparse and used methods and procedures that limit the generalizability of the findings. (*J. of Att. Dis.* XXXX; XX(X) XX-XX)

## Keywords

Arab countries, attention deficit hyperactivity disorder, research, ADHD

ADHD has been extensively studied over the past four decades, especially in the United States, Canada, and Europe and more recently Eastern Asia (Hodgkins et al., 2011; Thomas, Sanders, Doust, Beller, & Glasziou, 2015). This has led researchers to review and synthesize the available studies addressing various aspects of ADHD. These include but are not limited to the following aspects: epidemiology (e.g., Faraone, Sergeant, Gillberg, & Biederman, 2003; Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014; Sciahill, & Schwab-Stone, 2000; Thomas et al., 2015), etiology (e.g., Durston, 2003; Faraone & Mick, 2010; Konofal, Lecendreux, Arnulf, & Mouren, 2004), medical treatment (e.g., Bloch & Qawasmi, 2011; Hosenbocus & Chahal, 2009; Shaw et al., 2012; Vernon, Frick, & Gruzelier, 2004), psychosocial interventions (e.g., Chronis, Jones, & Raggi, 2006; Daley et al., 2014; Fabiano et al., 2009; Hodgson, Hutchinson, & Denson, 2014; Purdie, Hattie, & Carroll, 2002; Watson, Richels, Michalek, & Raymer, 2015), educational interventions (e.g., Kos, Richdale, & Hay, 2006; Loe & Feldman, 2007), assessment (e.g., McGough & McCracken, 2000), and early intervention (e.g., McGoey, Eckert, & Dupaul, 2002; Sonuga-Barke, Thompson, Abikoff, Klein, & Brotman, 2006).

This prompted the authors of this article to survey the literature for ADHD research in Arab countries. Only two surveys could be found (Alhraiwil, Ali, Househ, Al-Shehri, & El-Metwally, 2015; Farah et al., 2009). Both surveys synthesized studies related to epidemiology of ADHD in the Arab world. No similar surveys addressing any other aspect of ADHD were found. Thus, the researchers carried out this

study to investigate Arabic-based ADHD research studies. Because this literature was expected to be relatively sparse, the researchers intended to include all studies of ADHD in Arab countries.

## Method

### Literature Search

An electronic literature search of ADHD studies carried out in Arab countries was done by using Google Scholar, PsycINFO, PubMed, Education Resources Information Center (ERIC), and Arabpsynet. The following keywords were used: “attention deficit hyperactivity disorder,” “ADHD,” “attention deficit disorder,” “ADD,” “hyperactivity,” and “Arab countries,” and names of the 22 Arab countries (“Algeria,” “Bahrain,” “Djibouti,” “Egypt,” “Iraq,” “Jordan,” “Kuwait,” “Lebanon,” “Libya,” “Mauritania,” “Morocco,” “Oman,” “Palestine [Gaza Strip and West Bank],” “Qatar,” “Saudi Arabia,” “Somalia,” “Sudan,” “Syria,” “Tunisia,” “United Arab Emirates [UAE],” and “Yemen”). Reference lists of identified research were also searched to find additional studies.

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## **Study Selection**

All studies addressing ADHD in Arab countries, regardless of publication year, were included in the review. Inclusion criteria for studies in this review were as follows: (a) published in a peer-reviewed journal, (b) reported original empirical research, (c) published in English or in Arabic or French with detailed abstracts in English, (d) conducted in an Arab country, and (e) addressed one or more aspects of ADHD. When in doubt about whether a study met the inclusion criteria, the researchers jointly reread the study's title and abstract and reached a consensus.

## **Data Extraction**

Data on participants, methods of data collection, and findings of each identified study were extracted. The first author extracted the data from all identified studies. Each study was examined for information about country, author(s), publication year, country, purpose, data collection methods, and main findings. The second author independently extracted data presented in 15 randomly selected studies. Disagreements between the two reviewers were resolved by a consensus-based discussion.

## **Results**

The search yielded 58 studies (51 full text, seven detailed abstracts) related to ADHD in Arab countries. These studies were conducted in 14 out of 22 Arab countries (Egypt Saudi Arabia, Qatar, UAE, Jordan, Palestine, Oman, Lebanon, Bahrain, Sudan, Iraq, Yemen, Tunisia, and Kuwait). The researchers grouped the studies into three categories: (a) studies on psychoeducational and social aspects of ADHD, (b) studies on prevalence of ADHD, and (c) studies on risk factors and comorbidities in ADHD. The country, author(s), year of publication, sample, parameters, methods, and main findings are presented in Tables 1 to 3.

### **Studies on Psychoeducational and Social Aspects of ADHD**

Ten studies addressing ADHD-related psychoeducational and social issues in the Arab world were published in the period 1995-2015 (Table 1). These studies were conducted in six Arab countries (Bahrain, Egypt, Jordan, Lebanon, Saudi Arabia, and Sudan). Collectively, these studies included 1,866 participants (1,224 teachers, 469 parents, and 173 children). These studies investigated the following issues related to ADHD: central auditory processing (Abdel-Hamid, Safwat, Raafat, Hamed, & Farouk, 2013), teacher knowledge and beliefs (Abed, Pearson, Clarke, & Chambers, 2014; Alkahtani, 2013; Al-Omari, Al-Motlaq, & Al-Modallal, 2015), functional impairments in children (Al-Ansari, 2013),

psychometric properties of measurement tools (Al-Awad & Sonuga-Barke, 2002; Hassan, Al-Haidar, Al-Alim, & Al-Hag, 2009), concentration skills, and efficacy of intervention programs (ElDaou & El-Shamieh, 2015; Shata, Abu-Nazel, Fahmy, & El-Dawaway, 2014; Zaghlawan, Ostrosky, & Al-Khateeb, 2007).

### **Studies on Prevalence of ADHD**

Twenty-six studies investigating the prevalence of ADHD in Arab countries and two reviews of literature from these countries on the epidemiology of ADHD were published in the last 25 years (Table 2). Empirical studies were carried out in 11 countries: Egypt (Abdelkarim, Salama, Abdel Latif, & Abou El Magd, 2015; Attia, Tayel, Mounier, Ahmed, & Abo-Rass, 2000; Bishry et al., 2014; El-Nemr, Badr, & Salem, 2015; Farahat, Alkot, Rajab, & Anbar, 2014; Soliman, Afify, Yehia, Abdel-Naem, & Abd Alkarim, 2010), Iraq (AlObaidi & Ali, 2009), Jordan (Nafi & Shaheen, 2010), Kuwait (Salem et al., 2014), Lebanon (ElDaou & El-Shamieh, 2015), Oman (M. Al-Sharbati, Al-Adawi, Ganguly, Al-Lawatiya, & Al-Mshefri, 2008), Palestine (Elumour & Thabet, 2014; Khamis, 2006, 2011; Miller, el-Masri, Allodi, & Qouta, 1999; Thabet, Al Ghamdi, Abdulla, Elhelou, & Vostanis, 2010), Qatar (Bener, Al Qahtani, & Abdelaal, 2006; Bener, Al Qahtani, Teebi, & Bessiso, 2008; Bradshaw & Kamal, 2014), Saudi Arabia (Al Hamed, Taha, Sabra, & Bella, 2008; Homidi, Obaidat, & Hamaidi, 2013; Jenahi, Khalil, & Bellac, 2012), UAE (Bu-Haroon, Eapen, & Bener, 1999; Eapen, Al-Sabosy, Saeed, & Sabri, 2004; Eapen et al., 2009; Khamis, 2011), and Yemen (Alyahri & Goodman, 2008). Collectively, these studies included 35,798 children and adolescents. The vast majority of participants were drawn from schools. Data collection tools used were Arabic forms of Conners' rating scales, the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) Checklist for ADHD, and other American instruments. Prevalence estimates of ADHD reported varied greatly across studies, ranging from 1.3% (Alyahri & Goodman, 2008) to 34.5% (Khamis, 2006) for children and youth. The study by Salem et al. (2014) was excluded from analysis because it focused on a small group of school-age children recruited from a child psychiatric outpatient clinic that did not represent a true population-based estimate. Similarly, the study by Abdelkarim et al. (2015) was excluded because it focused on adult male inpatients at an addiction treatment center.

### **Studies on Risk Factors and Comorbidities in ADHD**

The present review identified 22 studies that addressed risk factors and comorbidities in ADHD in Arab countries: Egypt, Jordan, Lebanon, Oman, Palestine, Qatar, Saudi Arabia,

**Table 1.** An Overview of Studies on Psychoeducational and Social Aspects of ADHD in Arab Countries Published in English From Years 1995 to 2015.

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Lebanon	EIDaou and El-Shamieh (2015)	Fourteen children with ADHD aged 11 to 13 years.	Effect of playing chess on the concentration of students with ADHD.	The translated Arabic version of CTRS.	Concentration and listening skills of the experimental group improved significantly.
Jordan	Al-Omari, Al-Motlaq, and Al-Modallal (2015)	One hundred thirty teachers recruited from 13 primary schools in a Jordanian city.	Levels of teachers' knowledge of and attitudes toward ADHD.	A self-report questionnaire.	Findings revealed a gap in teachers' knowledge of ADHD causes and management. Teachers' attitudes toward children with ADHD were also lower than expected. The findings stressed the need for implementing special programs targeting schoolteachers and reforming preservice teachers' training to meet the needs of children with ADHD.
Saudi Arabia	Abed, Pearson, Clarke, and Chambers (2014)	Two hundred eighty-one teachers of children with ADHD and 384 teachers in mainstream schools.	Knowledge and beliefs of teachers in Saudi Arabia about children with ADHD.	KADD-Q administered to teachers, followed by interviews with a focus group from the total respondents.	Teachers had some knowledge about general characteristics of ADHD, but they had little understanding of causes and possible interventions.
Egypt	Shata, Abu-Nazel, Fahmy, and El-Dawaway (2014)	Fifty parents of children with ADHD.	Efficacy of a psychological intervention parent training program in the treatment of ADHD.	CPRS, HSQ, PS, DASS, and parental ADHD-related knowledge questionnaire.	There was a statistically significant decrease in the mean total scores recorded by parents on CPRS, Parenting Scale, and DASS. There also was a significant increase in participants' ADHD-related knowledge.
Egypt	Abdel-Hamid, Safwat, Raafat, Hamed, and Farouk (2013)	Forty children with ADHD and 39 healthy children.	Central auditory processing in ADHD and selected psycholinguistic abilities.	Semistructured psychiatric interviews, CPRS, and Arabic edition of ITPA.	Children with ADHD had central auditory processing disorders.
Bahrain	Al-Ansari (2013)	Twenty children aged 4 to 16 years who attended an outpatient clinic at a psychiatric hospital.	Functional impairment among children with ADHD.	C-GAS, diagnosis of ADHD was made using DSM-IV Checklist for ADHD.	All children showed improvement in the degree of impairment after a 1-year treatment program (which was unspecified in the study).
Saudi Arabia	Alkahtani (2013)	A total of 429 teachers.	Teachers' knowledge and misconceptions of ADHD.	KADD-Q and a demographic questionnaire.	Teachers showed a significant lack of knowledge about ADHD. Teachers' level of knowledge of ADHD was positively related to their prior training and experience with ADHD and with their level of confidence in teaching a student with ADHD.

(continued)

**Table 1. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Saudi Arabia	Hassan, Al-Haidar, Al-Alim, and Al-Hag (2009)	Guardians of 119 children who were either healthy, had a diagnosis of ADHD, or had a non-ADHD psychiatric diagnosis.	Validity and reliability of the behavioral rating scale.	Arabic version of the ADHD Rating Scale.	The scale differentiated between children with ADHD and children who were either healthy or had a psychiatric diagnosis other than ADHD.
Jordan	Zaghlanian, Ostrosky, and Al-Khateeb (2007)	Sixty 3rd- and 4th-grade students with ADHD inattentive subtype randomly assigned into an experimental group and a control group).	Efficacy of response cost and differential reinforcement of incompatible behavior (DRI) in reducing inattentive behavior of children.	DSM-IV criteria for ADHD inattentive subtype.	Response cost and DRI reduced inattentive behavior significantly compared with students in the control group. Behavioral gain was maintained at follow-up.
Sudan	Al-Awad and Sonuga-Barke (2002)	A total of 300 families with children between 6 and 10 years of age.	Psychometric properties of a Sudanese version of the CPRS and CTRS.	CPRS and CTRS.	Both versions of the scale displayed high levels of reliability and satisfactory internal consistency.

Note. CTRS = Conners' Teacher Rating Scale; KADD-Q = Knowledge About Attention Deficit Disorder Questionnaire; CPRS = Conners' Parent Rating Scale; HSQ = Home Situations Questionnaire; PS = Parenting Scale; DASS = Depression Anxiety Stress Scales; ITPA = Illinois Test of Psycholinguistic Abilities; C-GAS = Children Global Assessment Scale; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*; DRI = differential reinforcement of incompatible behavior.

**Table 2. An Overview of Studies on the Prevalence of ADHD in Arab Countries Published in English from Years 1995 to 2015.**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Egypt	Abdelkarim, Salama, Abdel Latif, and Abou El Magd (2015)	One hundred two adult male inpatients at an addiction treatment center.	Prevalence of ADHD among patients with SUD.	Arabic-translated and validated versions of WURS, and DSM-IV-TR criteria.	Thirty-six percent of substance-abuse patients were diagnosed as having adult ADHD. Also, presence of ADHD was associated with a more complicated course of SUD.
Egypt	El-Nemr, Badr, and Salem (2015)	A total of 600 children (5-12 years) attending a general pediatric outpatient clinic.	Prevalence of ADHD and associated risk factors.	A questionnaire inquiring about risk factors for ADHD, DSM-IV Checklist for ADHD, and physical examination.	Prevalence rate of ADHD among study participants was 19.7%. The most common type was the combined type, and prevalence of ADHD was higher in males than in females.
All Arab countries	Alhraiwil, Ali, Househ, Al-Shehri, and El-Metwally (2015)	Twenty-two studies investigating the prevalence of ADHD in Arab countries. These studies were published in PubMed.	Analysis of epidemiological studies of ADHD in Arab countries.	Searching PubMed from July 1978 to July 2014 and reviewing local journals with cross-referencing.	Prevalence rate ranged from 1.3% to 16%. A significant association was found between ADHD and male gender, previous psychiatric illness in the family, vitamin D deficiency, poor school performance, sleep problems, and nocturnal enuresis.
Palestine	Elumour and Thabet (2014)	Three hundred eighty-eight participants, aged 12 to 15 years.	Prevalence of ADHD and conduct disorders among Palestinian children in the south Gaza Strip.	A self-report questionnaire, including sociodemographic scale, and DSM-IV Checklist for ADHD.	ADHD combined type was reported in 4.4% of children according to parents and in 9.8% according to teachers. ADHD combined type symptoms were higher in boys than in girls.

(continued)

**Table 2. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Egypt	Bishry et al. (2014)	A total of 925 adolescents.	Distribution of different subtypes of ADHD, associated comorbidities, and sociodemographic correlates.	CASS:S and K-SADS-PL.	Prevalence rate of ADHD symptoms was 9.4% (13.8% in boys and 5.8% in girls). The hyperactive-impulsive subtype was the most common. ADHD was associated with high psychiatric comorbidity and a significant impact on academic performance.
Qatar	Bradshaw and Kamal (2014)	A total of 4,489 students aged 6 to 19 years.	Estimates of the number of students with ADHD.	SNAP-IV Rating Scale.	Prevalence rate of ADHD was 8.3%. This study also found that ADHD prevalence was significantly higher for male than female students.
Lebanon	Richa et al. (2014)	A total of 1,000 children aged between 6 and 10 years.	Prevalence estimate ADHD prevalence in school-age population.	ADHD Rating Scale-IV School version.	Prevalence of ADHD combined subtype was 1.7%. ADHD was significantly more prevalent in boys than in girls.
Kuwait	Salem et al. (2014)	Seventy school-aged children recruited from the child psychiatric outpatient clinic.	Clinical profile, sociodemographics, and impairments in patients with ADHD subtypes.	VADRS, a semistructured interview, and the MINI-KID.	Seventy percent had ADHD. The ADHD inattentive subtype was significantly more prevalent among females, and ADHD-hyperactive/impulsive subtype was significantly more common among males. Functional impairments were observed in children at both home and school.
Egypt	Farahat, Alkot, Rajab, and Anbar (2014)	A total of 1,362 primary school children.	Prevalence and risk factors of ADHD among children.	WISC-R, Arabic forms of CPRS and CTRS, and the DSM-IV Checklist for ADHD.	Total prevalence of ADHD among basic school children was 6.9%. Prevalence of ADHD was significantly higher in male than female children.
Saudi Arabia	Homidi, Obaidat, and Hamaidi (2013)	A sample of 2,770 boys and girls from primary public schools in the city of Jeddah.	Prevalence of ADHD in primary school children.	An adapted Arab version of the ADHD Evaluation Scale, which was administered by classroom teachers.	Prevalence rate of ADHD was 11.6%. ADHD prevalence was significantly higher among male students and younger children.
Saudi Arabia	Jenahi, Khalil, and Bellac (2012)	A total of 1,009 students selected from primary schools for girls.	Prevalence of ADHD symptoms in female schoolchildren.	ADDES.	Overall prevalence rate was 3.5%. This rate decreased significantly with increase in age.
UAE	Khamis (2011)	Two hundred UAE school-age children.	Prevalence of ADHD among school-age children, and variables that distinguish ADHD and non-ADHD children.	DSM-IV Checklist for ADHD, a child and family data sheet, and other scale.	Prevalence rate of ADHD symptomatology was 12.5%. Children with ADHD inattentive type were predominately males and were more likely to experience harsh disciplining compared with children without ADHD.

(continued)

**Table 2. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Jordan	Nafi and Shaheen (2010)	A total of 4,374 schoolchildren.	Prevalence rate of ADHD.	DSM-IV Checklist for ADHD.	Prevalence of ADHD was 6.24%. ADHD symptoms were significantly higher among males. ADHD was significantly associated with learning difficulties, and consanguinity was observed in one third of the cases.
Egypt	Soliman, Afify, Yehia, Abdel-Naem, and Abd Alkarim (2010)	A total of 4,223 preschool and school children aged 4 to 12 years.	Prevalence of ADHD among children.	Conners' ADHD Index, and DSM-IV Checklist for ADHD.	Overall prevalence of ADHD was 6.5%. Prevalence in males was higher than in females.
Palestine	Thabet, Al Ghamsi, Abdulla, Elhelou, and Vostanis (2010)	A total of 349 children aged 6 to 15 years selected from 23 schools in Gaza and the West Bank.	Prevalence and distribution of ADHD symptoms and associated comorbid mental health problems.	Parents' and teachers' ratings using both the ADHD DSM-IV Checklist for ADHD, and the SDQ.	Overall prevalence was with 4.3%. Gender, family size, and living in an area of socioeconomic deprivation were independently associated with ADHD symptoms.
Iraq	AlObaidi and Ali (2009)	A total of 1,043 children with an age range of 6 to 10 years attending eight elementary schools.	Rate of ADHD among schoolchildren in Baghdad.	DSM-IV Checklist for ADHD.	Prevalence rate of ADHD was 10.5% according to teacher reports and 5.9% according to parent reports.
UAE	Eapen et al. (2009)	A total of 1,165 schoolchildren aged 5 to 14 years.	Epidemiology of ADHD.	Semistructured interview schedule, CTRS, and CBCL—Parent Version.	Prevalence rate of ADHD was 4.1% according to parent reports and 3.4% according to teacher reports. ADHD in children was associated with a range of psychiatric comorbidity.
All Arab countries	Farah et al. (2009)	Twelve articles reporting results of prevalence rates of ADHD among Arab students.	Analysis of findings reported by epidemiological studies of ADHD.	Several search engines were used to identify published research on ADHD in the Arab world.	Rate of ADHD symptoms using rating scales in school setting ranged from 5.1% to 14.9%, whereas the rate of ADHD diagnosis using structured interviews in children and adolescents ranged from 0.5% in the school setting to 0.9% in the community.
Oman	M. Al-Sharabati, Al-Adawi, Ganguly, Al-Lawatiya, and Al-Mshefri (2008)	A total of 1,502 schoolboys from eight randomly selected schools representing the urban population of Oman.	Prevalence of hyperactivity in schoolboys.	The short version of CTRS, and other assessment measures.	Prevalence of hyperactivity was 7.8 % and was strongly associated with conduct disorder, poor school performance, and behavioral disorders. Child's rank, number of siblings, and parental education were not significant.
Yemen	Alyahri and Goodman (2008)	A total of 1,210 schoolchildren aged 7 to 10 years old.	Prevalence of DSM-IV psychiatric disorders among 7- to 10-year-old schoolchildren.	SDQ, and DAWBA.	Prevalence of ADHD was 1.3%. There were no significant urban–rural differences.

(continued)

**Table 2. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Saudi Arabia	Al Hamed, Taha, Sabra, and Bella (2008)	A total of 1,287 students aged 6 to 13 years in 67 government and 10 private primary schools.	Prevalence of ADHD and associated family and psychosocial factors among male primary school children in a Saudi Arabian city.	A modified Arabic version of ADDES, and a parents' questionnaire to measure child's behavioral problems at home.	The prevalence of ADHD was 16.4%. A variety of family factors were significantly associated with ADHD.
Qatar	Bener, Al Qahtani, Teebi, and Bessiso (2008)	A total of 1,869 primary school students, aged 6 to 12 years.	Prevalence of ADHD symptoms in a sample of primary school children.	A standardized Arabic version of CTRS, and a questionnaire to collect the sociodemographic data.	The overall prevalence of ADHD was 11.1%. Children who had higher scores for ADHD symptoms had a poorer school performance and more behavioral problems than those with lower scores.
Qatar	Bener, Al Qahtani, and Abdelaal (2006)	A total of 1,541 primary school students, aged 6 to 12 years.	Prevalence of ADHD among primary school children.	A standardized Arabic version of CTRS, and a questionnaire to collect the sociodemographic data.	Overall prevalence of ADHD was 9.4%. Higher score for ADHD symptoms was associated with poorer school performance.
Palestine	Khamis (2006)	A total of 1,000 Palestinian school-age children.	Prevalence of ADHD among school-age children.	Child characteristics, parents' sociodemographics, socioeconomic status, family environment, and parental style of influence.	Prevalence rate of ADHD symptomatology was 34.5%. Children with ADHD had more academic underachievement, displayed antisocial behavior, and experienced parental psychological maltreatment compared with children without ADHD.
UAE	Eapen, Al-Sabosy, Saeed, and Sabri (2004)	A total of 141 boys and 137 girls aged 6 to 18 years attending a primary facility.	Prevalence of child psychiatric disorders.	Systematic psychiatric evaluations.	ADHD present in 3% of the children.
Egypt	Attia, Tayel, Mounier, Ahmed, and Abo-Rass (2000)	A sample of 1,350 primary school children.	Prevalence of ADHD among primary school children.	CPRS and CTRS.	Prevalence of ADHD was 7.5%. Prevalence was higher among boys than girls.
UAE	Bu-Haroon, Eapen, and Bener (1999)	A total of 1,110 primary school children in government schools in Sharjah, UAE.	Prevalence of ADHD symptoms based on teachers' rating.	CTRS.	An overall prevalence of 14.9% was reported. Boys were more often reported to have the symptoms than girls.
Palestine	Miller, el-Masri, Allodi, and Qouta (1999)	A total of 669 school-age children from age 6 to 16 and their families living in the Gaza Strip.	Epidemiological survey of Palestinian children and their families.	OCHS and CPTSR.	Prevalence rates of ADHD were higher than those reported internationally on children in nonconflict areas.

Note. SUD = substance use disorders; WURS = Wender Utah Rating Scale; DSM-IV-TR = *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, text rev.*; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*; CASS:S = Conners-Wells' Adolescent Self-Report Scale; K-SADS-PL = Kiddie Schedule for Affective Disorders and Schizophrenia—Present and Lifetime Versions; VADRS = Vanderbilt ADHD Diagnostic Rating Scales; MINI-KID = Mini International Neuropsychiatric Interview for Children and Adolescents; WISC-R = Wechsler Intelligence Scale for Children-Revised; CPRS = Conners' Parent Rating Scale; CTRS = Conners' Teacher Rating Scale; ADDES = Attention Deficit Disorders Evaluation Scale; UAE = United Arab Emirates; SDQ = Strengths and the Difficulties Questionnaire; CBCL = Child Behavior Checklist; DAWBA = development and well-being assessment; SNAP-IV = Swanson, Nolan and Pelham Questionnaire-revised; OCHS = Ontario Child Health Scale; CPTSR = Child Posttraumatic Stress Reaction Index.

**Table 3.** An Overview of Studies on Risk Factors and Comorbidities in ADHD in Arab Countries Published in English From Years 1995 to 2015.

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Egypt	Salama et al. (2015)	Sixty four patients with past history of childhood ADHD.	Impact of both childhood and adult ADHD on substance use disorders.	Arabic version of WURS, and Arabic version of ASRS.	Adult ADHD was associated with earlier onset of substance use disorders and a poorer clinical outcome.
Tunisia	Khemakhem et al. (2015)	Five hundred thirteen students aged 6 to 12 years.	Psychological problems among school-aged children diagnosed with ADHD.	CPRS and CTRS, and interviews.	About 72.54 % of children with ADHD had one or more of the following psychological disorders: Learning disabilities, anxiety disorder, oppositional defiant disorder, and mood disorder.
Egypt	Abd El Rahman, Abd El Mawella, Hussein, and El Mosalmey (2014)	Thirteen children with ADHD and 14 healthy control children.	Association between thyroid dysfunction and ADHD in children.	CPRS and CTRS, and laboratory assessment of thyroid gland.	Children with ADHD had no thyroid dysfunction.
Qatar	Bener et al. (2014a)	A total of 520 asthmatic children with ADHD and 520 controls aged 5 to 16 years old controls.	Potential risk factors in asthmatic children with ADHD.	ISAAC questionnaire, CTRS, and serum measurements of vitamin D.	Severe vitamin D deficiency was significantly higher among asthmatic children with ADHD compared with the healthy controls. Furthermore, overweight and obesity were significantly higher among asthmatic children with ADHD than healthy controls. Finally, serum iron, hemoglobin, magnesium, potassium, and phosphorous were significantly lower among asthmatic children with ADHD than in controls.
Qatar	Bener et al. (2014b)	A total of 630 children with ADHD and 630 controls aged 5 to 18.	Association between iron deficiency may be related to the path physiology of ADHD.	CTRS, clinical and sociodemographic data, and physician diagnosis.	Compared with control children, children with ADHD had significantly lower levels of serum iron.
Qatar	Kamal, Bener, and Ehlail (2014)	A total of 1,331 children and adolescents with ADHD and 1,331 controls.	Association between vitamin D and ADHD, and difference in the level of vitamin D in ADHD children and healthy children.	BMI, clinical biochemistry variables including tests.	Vitamin D deficiency was significantly higher in ADHD children compared with healthy children.
Egypt	Khodeir, El-Hamady, El-Bakry, and Mikhael (2014)	Thirty seven children with ADHD and 377 healthy children aged 5 to 15 years.	Association between ADHD and neurological and psychiatric disorders.	CPRS, Arabic version of RBPC, and semistructured interviews.	Children with ADHD had delayed language development and several neuropsychiatric comorbidities.
Egypt	Seleem, El-Gohary, Eid, and Sroor (2014)	Thirty children with ADHD (6-12 years old) and 15 healthy children.	Iron status in a sample of Egyptian children with ADHD.	Interviews, CPRS, and laboratory measures.	Children with ADHD had significantly lower levels of hemoglobin and serum ferritin as compared with control group.
Qatar	Bener and Kamal (2013)	A total of 1,331 of ADHD and 1,331 of healthy children.	Association between vitamin D deficiency and ADHD.	An instrument for collecting sociodemographic and clinical data.	Vitamin D deficiency was considerably higher in ADHD children compared with healthy children. Calcium and phosphorous were significantly higher in control compared with ADHD children.

(continued)

**Table 3. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Jordan	Nafi (2013)	Eighty-two patients fulfilling the criteria for ADHD diagnosis.	Prevalence of epilepsy, intellectual impairment, and autism spectrum disorder among children with ADHD.	SWAN rating scale for ADHD, parent interviews, family history, medical and developmental history, and neurological evaluation.	Seventy percent of children with ADHD children, presented a comorbidity: Epilepsy (29.3%), intellectual impairment (28%), or autistic spectrum disorder (12.2%).
Egypt	Abou-Khadra, Amin, Shaker, and Rabah (2013)	Parents of 41 children with ADHD, aged 6 to 12 years.	Parent-reported sleep problems in a sample of Egyptian children with ADHD and 62 children without ADHD.	The abbreviated version of the CSHQ, CPRS, and serum ferritin levels.	The ADHD group showed significantly more sleep problems. No significant correlations were found between serum ferritin levels and ADHD Index subscale scores.
Palestine	Thabet et al. (2013)	A total of 410 children aged 6 to 17 years.	Comorbidity of PTSD, ADHD, conduct, and oppositional defiant disorder in children.	Gaza Traumatic Checklist–War on Gaza, and DSM-IV criteria for PTSD, conduct disorder, and oppositional defiant disorder.	According to both parents' and children's reports, ADHD and PTSD were comorbid.
Saudi Arabia	El-Tarras et al. (2012)	One hundred twenty children with ADHD and 160 controls.	Association between dopamine-related candidate gene polymorphisms and ADHD.	PCR technique.	No significant association between ADHD and MAOA. However, a significant association was found between two MAOA genotypes and ADHD.
Egypt	Roufael, El-Bakry, Amer, Refaat, and Emad-Eldin (2012)	Thirty boys and 30 girls aged 8 to 12 years diagnosed with ADHD.	EF and reading abilities in a group of primary school children with ADHD.	CPRS, WCST, and MRCS.	Children with ADHD had lower EF and reading abilities than controls.
Oman	M. M. Al-Sharbati, Zaidan, Dovlo, and Al-Adawi (2011)	A total of 221 schoolchildren with ADHD.	Characteristics of ADHD among schoolchildren.	DSM-IV Checklist for ADHD.	Contribution of consanguinity and a history of acquired brain injury were common features associated with ADHD.
Egypt	Effat, Tawfik, Hussein, Azzam, and El Eraky (2011)	A group of 20 children with ADHD.	Relationship between ADHD and CAPD.	CPRS and SAB.	High comorbidity existed between CAPD and ADHD, with the temporal auditory processing the most affected ability.
UAE	Yousef et al. (2011)	Eighteen children with ADHD and 74 children without ADHD.	Relationship between blood levels of heavy metals and ADHD.	Blood concentrations of lead, manganese, and zinc.	ADHD was significantly associated with increased blood concentrations of lead, manganese, and zinc.
Egypt	Mahmoud, El-Mazary, Maher, and Saber (2011)	Fifty-eight children aged 5 to 15 years with ADHD attending an Egyptian hospital and 25 healthy children.	Role of some minerals in the pathogenesis of ADHD.	DSM-IV Checklist for ADHD, and zinc, ferritin, magnesium, and copper blood levels.	Zinc, ferritin, and magnesium levels were significantly lower in children with ADHD, whereas copper levels were not significantly different.

(continued)

**Table 3. (continued)**

Country	Author(s), (year)	Sample	Parameters	Method	Main findings
Saudi Arabia	Alqahtani (2010)	Parents and teachers of 652 primary school children aged between 7 and 9 years.	Comorbidity of oppositional defiant disorder, conduct disorder, anxiety, and depression among children with ADHD.	VADRS.	Oppositional defiant disorder and conduct disorder were reported in 73% of children with ADHD. Anxiety and depression disorders were estimated to be present in 36% of children with ADHD. Children with ADHD also showed high levels of impairment in academic achievement and social performance compared with non-ADHD children.
Oman	M. Al-Sharbati, Al-Zaidi, Al-Naamani, Al-Futaisi, and Jain (2010)	A 7-year-old Omani girl.	Association between tuberous sclerosis, ADHD, and bipolar disorder.	Physical history, CT, MRI, EEG, chest X-ray, and abdominal ultrasonography for a child with ADHD.	ADHD was reported to be associated with tuberous sclerosis and bipolar disorder.
Lebanon	Hamdan et al. (2009)	Nineteen children diagnosed with ADHD and 19 controls.	Vocal changes in patients with ADHD.	DSM-IV Checklist for ADHD, and vocal perceptual evaluation and acoustic analysis.	Children with ADHD had significantly more hoarseness, breathiness, and straining in their voice. There was also a significant change in fundamental frequency, which was lower in the ADHD group.
Oman	Simsek, Al-Sharbati, Al-Adawi, Ganguly, and Lawatia (2005)	Ninety-two children with ADHD and 110 healthy children.	Association of dopamine transporter gene (DAT1*10) with ADHD.	PCR tests.	No significant differences in the distribution of allele of dopamine transporter gene (DAT1*10) among the two groups.

Note. WURS = Wender Utah Rating Scale; ASRS = Adult ADHD Self-Report Scale; CPRS = Conners' Parent Rating Scale; CTRS = Conners' Teacher Rating Scale; ISAAC Questionnaire = International Study of Asthma and Allergies in Childhood Questionnaire; BMI = body mass index; RBPC = Revised Behavior Problem Checklist; SWAN = Strengths and Weaknesses of ADHD Symptoms and Normal Behavior Scale; CSHQ = Children's Sleep Habits Questionnaire; PTSD = posttraumatic stress disorder; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*; PCR = polymerase chain reaction; MAOA = monoamine oxidase A; EF = executive functions; WCST = Wisconsin Card Sorting Test; MRCS = Metacognitive Reading Comprehension Scale; CAPD = central auditory processing disorder; SAB = Scale of Auditory Behavior; UAE = United Arab Emirates; VADRS = Vanderbilt ADHD Diagnostic Rating Scales; CT = computed tomography; MRI = magnetic resonance imaging; EEG = electroencephalogram.

Tunisia, and UAE. The total number of participants in these studies was 11,298 (10,605 children and adolescents, 693 parents).

Significant associations were reported between ADHD and vitamin D deficiency (Bener et al., 2014a; Bener & Kamal, 2013; Kamal, Bener, & Ehlail, 2014); consanguinity and a history of acquired brain injury (M. M. Al-Sharbati, Zaidan, Dovlo, & Al-Adawi, 2011); obesity (Bener et al., 2014a); abnormal blood levels of major minerals such as iron, magnesium, potassium, and phosphorous (Bener et al., 2014b; Bener & Kamal, 2013; Mahmoud, El-Mazary, Maher, & Saber, 2011; Seleem, El-Gohary, Eid, & Sroor, 2014; Yousef et al., 2011); and some Monoamine Oxidase A genotypes (El-Tarras et al., 2012). Inconsistent results were reported regarding associations between ADHD and serum

ferritin levels, with two studies reporting significant associations (Mahmoud et al., 2011; Seleem et al., 2014) and one study (Abou-Khadra, Amin, Shaker, & Rabah, 2013) reporting no association. Significant associations were also reported between ADHD and central auditory processing disorder (Effat, Tawfik, Hussein, Azzam, & El Eraky, 2011); sleep problems (Abou-Khadra et al., 2013); vocal and acoustic characteristics (Hamdan et al., 2009); learning disabilities, anxiety disorder, oppositional defiant disorder, and mood disorder (Khemakhem et al., 2015); delayed language development and several neuropsychiatric comorbidities (Khodeir, El-Hamady, El-Bakry, & Mikhael, 2014); epilepsy, intellectual disability, and autistic spectrum disorder (Nafi, 2013); impaired executive functions and reading abilities (Roufael, El-Bakry, Amer, Refaat, & Emad-Eldin,

2012); substance use disorders (Salama et al., 2015); and posttraumatic stress disorder (Thabet et al., 2013). On the contrary, no associations were found between ADHD and thyroid dysfunction (Abd El Rahman, Abd El Mawella, Hussein, & El Mosalmy, 2014) or copper levels (Mahmoud et al., 2011).

## Discussion

This review shows that scientific research on ADHD in Arab countries is quite limited compared with research conducted in other world regions (Barkley, Murphy, & Fischer, 2010; Hinshaw & Scheffler, 2014). It is also limited given that the total number of children and adolescents with ADHD in these countries, based on prevalence rates reported in studies included in this review, is anticipated to exceed five million. Yet, around one third of the Arab countries have not published any studies, and all published studies, with the exception of two previous epidemiology review studies, investigated ADHD in a part of one country only. Furthermore, more than 90% of the ADHD-related Arabic studies were published in the last 10 years. Obviously, more research is needed to better understand the magnitude and burden, as well as the biological and environmental aspects of ADHD in Arab countries.

A major point to be made here is that only nine (15%) of the studies included in this review used *DSM* criteria for ADHD. All others used screening tests or rating scales with no further investigation or differential diagnosis of ADHD. Screening tools and self-report rating scales are not diagnostic tests and can only provide preliminary screening information and do not generate an ADHD diagnosis (Adler & Cohen, 2004; Farah et al., 2009). Diagnosing ADHD can be difficult because its symptoms may be similar to those of several other behavioral problems such as disruptive behavioral disorders, anxiety disorders, affective disorders, and adjustment disorders (Robb, 2006). It is worthwhile to mention here that researchers like Faraone et al. (2003) and Polanczyk et al. (2014) only included studies using *DSM* criteria to assess the prevalence of ADHD.

The prevalence rates of ADHD in the Arab world reported by the studies included in this review are roughly similar to estimates reported in several previous studies (Adewuya & Famuyiwa, 2007; Thomas et al., 2015). However, caution should be used when making comparisons between ADHD estimates in developed and developing countries like Arab countries because of differing diagnostic criteria, and because ADHD is related to biological, cultural, and familial factors (Bener et al., 2014; Hinshaw et al., 2011). From another side, all studies reported that ADHD prevalence was higher in males and decreased with age, and that the combined subtype was the most prevalent. These findings are also consistent, to a large extent, with findings of studies carried out somewhere else (Biederman, Mick, & Faraone,

2000; Gephart, 2003; Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007).

The vast majority of studies reviewed were conducted by medical researchers. Studies addressing psychoeducational and social issues in ADHD were very few. Experimental studies were also sparse; indicating a serious lack in intervention programs aimed at improving the quality of life of children and adolescents with ADHD as well as the skills of their parents and teachers in Arab countries. Another observation is that all studies reviewed included school-age children and adolescents. An exception was a study by Abdelkarim et al. (2015), which was carried out with adult participants and not children.

This review also showed that the results of studies pertaining to risk factors for ADHD in Arab countries were generally similar to those found in studies carried out in other countries. For example, significant associations in Arab studies were found between ADHD and vitamin D deficiency; a history of acquired brain injury; obesity; abnormal blood levels of major minerals such as iron, magnesium, potassium, phosphorous, and Monoamine Oxidase A genotypes. International studies investigating these factors reached similar conclusions (e.g., Banerjee, Middleton, & Faraone, 2007; Kalil, Gregory, & Makled, 2014). However, results of Arab studies related to comorbidities in ADHD reported several comorbid disorders such as central auditory processing disorder, sleep problems, learning disabilities, anxiety disorder, oppositional defiant disorder, mood disorder, delayed language development, epilepsy, intellectual disability, and autistic spectrum disorder and posttraumatic stress disorder. Similar results were reported by previous studies carried elsewhere (e.g., Gillberg et al., 2004). However, risk factors and comorbidities investigated by Arab researchers were relatively few, and more research is needed to verify the findings and to investigate other possible biological and psychosocial risk factors and comorbid disorders in ADHD such as familial factors, socioeconomic status, prematurity, smoking and alcohol use during pregnancy, and parent mental health (Banerjee et al., 2007; Freitag et al., 2012; Kalil et al., 2014; Silva, Houghton, Hagemann, & Bower, 2015).

Finally, this review has limitations that need to be taken into account. One limitation is that the review only included research published in English on ADHD in Arab countries. The researchers' decision to include only studies published in English was based on their knowledge that accessibility to Arabic literature is extremely difficult because Arabic electronic databases are still seriously lacking, and that using a comprehensive manual search is a formidable task in the Arab world. However, the results may have been different had non-English studies been included in this review. Thus, caution should be used in generalizing the results of this review. Another limitation pertains to the fact that most studies analyzed in this review included convenience samples

from single towns or regions in a single country, which further limits the generalization of findings. A third limitation is the researchers' use of different data collection tools and convenience samples, which makes comparison of findings across the Arab region more difficult. A third potential limitation may be that this review could not locate all studies relevant to ADHD in the Arab region.

## Conclusion

Although there has been an increase in ADHD research in Arab countries in recent years, this research remains relatively sparse and covers only parts of some countries, which limits the generalizability of the findings. By synthesizing available research studies, this review presented the results of this research and offered interpretations that can positively influence the direction and methodological rigor of future research on ADHD in these countries. Specifically, this review highlighted the need for more careful selection of instruments used in determining the prevalence of ADHD. It also emphasized the need for studying a wider range of risk factors and comorbidities. Furthermore, it stressed the importance of filling the serious gap in research on the psychoeducational and social aspects of ADHD in Arab countries.

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