INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is defined as a developmental condition of inattention and distractibility, with or without accompanying hyperactivity. There are 3 basic forms of ADHD described in the Diagnostic and Statistical Manual, Fifth Edition (DSM-V) of the American Psychiatric Association: inattentive; hyperactive-impulsive; and combined type ***(Moffitt et al., 2015).***

ADHD has a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development. Six or more of the symptoms have persisted for at least six months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities ***(DSM, 2013).***

ADHD is associated with hypoarousal (a state of increased sleepiness) rather than hyper arousal. This indicates that hyperactivity could be a coping mechanism to overcome the daytime sleepiness the children experience ***(Bartholomew and Owens, 2006).***

Sleep disorder symptoms can resemble the ADHD symptoms, such as inattention and difficult concentration; they can actually be misdiagnosed as ADHD. Clinicians should be aware of the co-existence of Sleep Disordered Breathing (SDB) and Obstructive Sleep Apnea (OSA) for example with the

ADHD when diagnosing and treating symptoms ***(Philipsen et al., 2006).***

Rationale of the work

Sleep problems associated with ADHD are very common sources of childhood illnesses and are sometimes common causes of decreased quality of life; they also affect the growth and development of children and other aspects of their lives which needs through investigation for satisfactory treatment.

Hypothesis

The study hypothesizes the presence of sleep problems among children with ADHD with directly proportionate relation between the severity of symptoms of ADHD and sleep changes. There may also be significant differences between children with ADHD and controls in the sleep patterns.

RELATION OF THE STUDY TO GOALS OF DEPARTMENT:

Sleep profile associated with ADHD are very common sources of childhood illness and sometimes common causes of decrease quality of life, they affects growth and development of children and all aspect of their life.

AIM OF THE WORK

1. To study the sleep problems in children with ADHD.
2. To estimate the severity of ADHD symptoms and their relation with the sleep profile in children.
3. To compare the sleep polysomnography in both cases and control group.

Chapter 1

AN OVERVIEW ON ADHD IN CHILDREN

Epidemiology of ADHD in children

A worldwide meta-analysis of 86 studies in children and adolescents and 11 studies in adults indicated that the inattentive type of ADHD was the most predominantly common subtype in all samples, except in pre-school children, where predominantly hyperactive-impulsive type was the most common ***(Willcutt, 2012)***.

The prevalence of ADHD in children varies from 2 to 18 %; depending on the diagnostic criteria and the population studied like in primary care versus psychiatrist referral ***(Boyle et al., 2011; American Psychiatric Association, 2013)***.

The prevalence of ADHD in school-age children is estimated to be between 8 and 11 %, making it one of the most common disorders of childhood ***(Visser et al., 2014).***

I. 1Prevalence factors

ADHD prevalence rates may vary depending on several factors:

- **Age**

ADHD was considered to be a childhood disease with a decreasing presentation of symptoms during maturation to

adulthood. Recently, it is acknowledged to persist into adulthood in about 50-66% of individuals ***(Ebejer et al., 2012).***

- **Gender**

A systematic literature review investigating 86 results of studies of children and adolescents revealed higher prevalence of ADHD is often present in males than in females ***(Willcutt, 2012)***.

Symptoms of ADHD presented in female children and adolescents are different from male, which may explain the lower prevalence rates of ADHD in females; some studies have found that girls with ADHD may be up to twice as likely as boys to have the inattentive type of ADHD and may suffer more from internalizing symptoms and inattention, on other hand the hyperactive and aggressive symptoms shown more in boys ***(Biederman et al., 2012; Biederman and Faraone 2004).***

- **Geographical location**

ADHD affects individuals worldwide. The Diagnostic and Statistical Manual of Mental Disorders-5th edition (DSM-5) suggests that cultural attitudes towards the interpretation of behavior may contribute to differences in prevalence estimates across studies ***(American Psychiatric Association, 2013).***

I. Clinical picture of ADHD in children

II. 1. Types of ADHD presentations

ADHD may present with both inattention and hyperactivity/impulsivity, or one symptom pattern may predominate (as shown in Table 1). According to the DSM-5™ classification system, the presentation of ADHD is based on the predominant symptom pattern for the last six months ***(American Psychiatric Association, 2013)***.

Table (1): Types of presentations of ADHD

Presentations of ADHD		
Combined	*Inattentive*	*Hyperactive/impulsive*
All three core features are present and ADHD is diagnosed when ≥6 symptoms of hyperactivity/ impulsivity and ≥6 symptoms of inattention have been observed for ≥6 months	Diagnosed if ≥6 symptoms of inattention (but <6 symptoms of hyperactivity/impulsivity) have persisted for ≥6 months	Diagnosed if ≥6 symptoms of hyperactivity/ impulsivity (but <6 symptoms of inattention) have been present for ≥6 months

A study showed a preliminary evidence for the change in prevalence of ADHD presentations over time as indicated by a cross-sectional analysis (as shown in Figure 1) ***(Willcutt, 2012).***

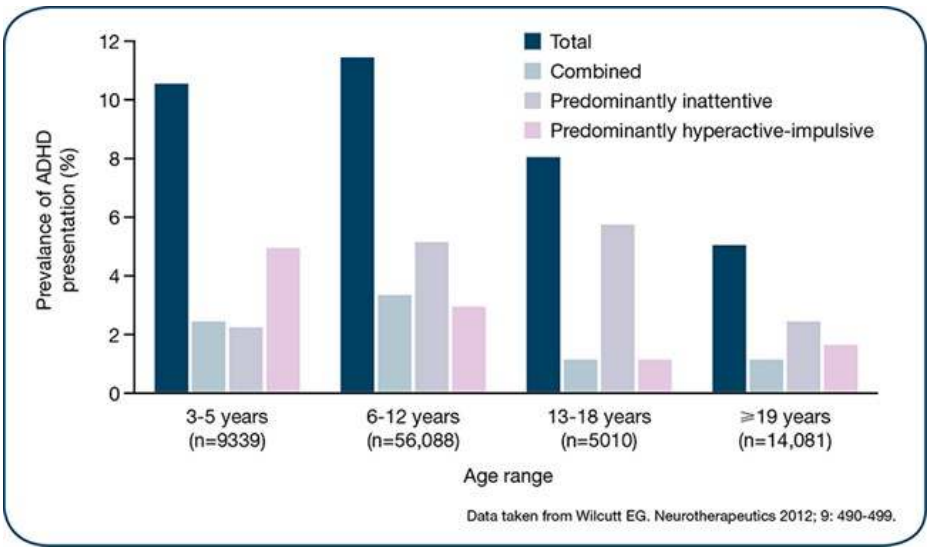

Figure (1): Prevalence of ADHD presentations ***(Willcutt, 2012).***

Furthermore, the DSM-5^{TM} also states that it must be specified whether the individual with ADHD is in "partial remission" (when partial ADHD criteria have been met for the past six months with full criteria met previously) or not, and if the symptoms still result in impairment in social, academic or occupational functioning); and the current severity of the disease (as shown in Table 2).

Table (2): Current severity of ADHD (American Psychiatric Association, (2013)

Current severity of ADHD		
Mild	**Moderate**	**Severe**
Few, if any, symptoms in excess of those required to make the diagnosis are present, and symptoms result in no more than minor impairments in social or occupational functioning	Symptoms or functional impairment between "mild" and "severe" are present	Many symptoms in excess of those required to make the diagnosis, or several symptoms that are particularly severe, are present; or the symptoms result in marked impairment in social or occupational functioning

II.2. Clinical picture of ADHD in children according to the DSM-V

The ADHD symptoms must not solely be a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. Several inattentive or hyperactive-impulsive symptoms were present prior to age 12 years. Several inattentive or hyperactive-impulsive symptoms are present in two or more settings (e.g. at home, school, or work; with friends or relatives; in other activities). There is clear evidence that the symptoms interfere with, or reduce the quality of, social, academic or occupational functioning ***(DSM, 2013).***

- **Inattention**

Inattention seen in ADHD is when an individual is moving between tasks without completing any one activity,

seemingly losing interest in one task because they become diverted to another. Individuals with inattention are often forgetful and easily distracted experience difficulties when organizing activities. For example, at school, children with ADHD may struggle to listen and be frequently distracted (as shown in Figure 2). Also adults with ADHD in the workplace may appear as if their mind is elsewhere and their work may be performed carelessly and messy ***(American Psychiatric Association, 2013).***

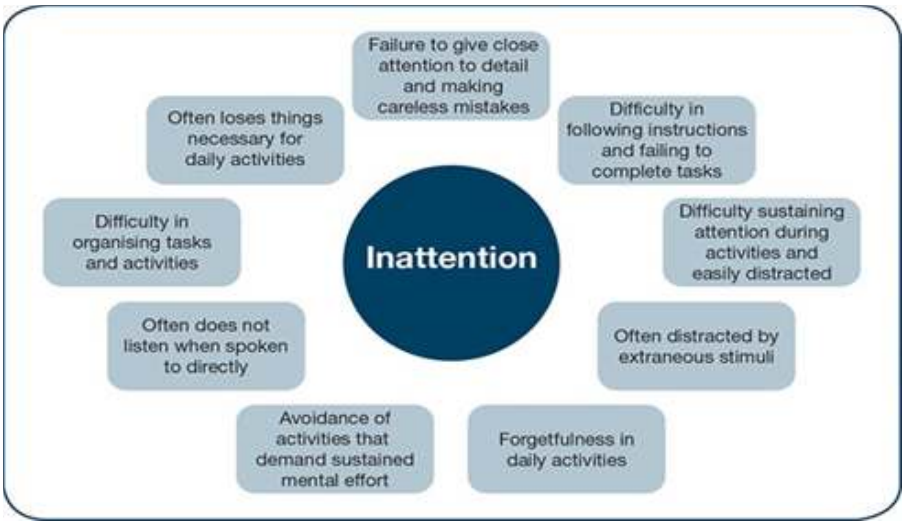

Figure (2): Typical symptoms of inattention *(Figure is created from information in the DSM-5™ and ICD-10 classification* ***(APA, 2013)***

- **Hyperactivity**

Hyperactivity means excessive motor activity. In children, it is sometimes presented as the child running and jumping around at inappropriate times, getting up from a seat

when he or she is supposed to remain seated, wriggling fidgeting or noisiness excessive and talkativeness (as shown in Figure 3).In adolescents and adults, hyperactivity can be manifested as extreme restlessness and wearing others out with their activity ***(American Psychiatric Association, 2013).***

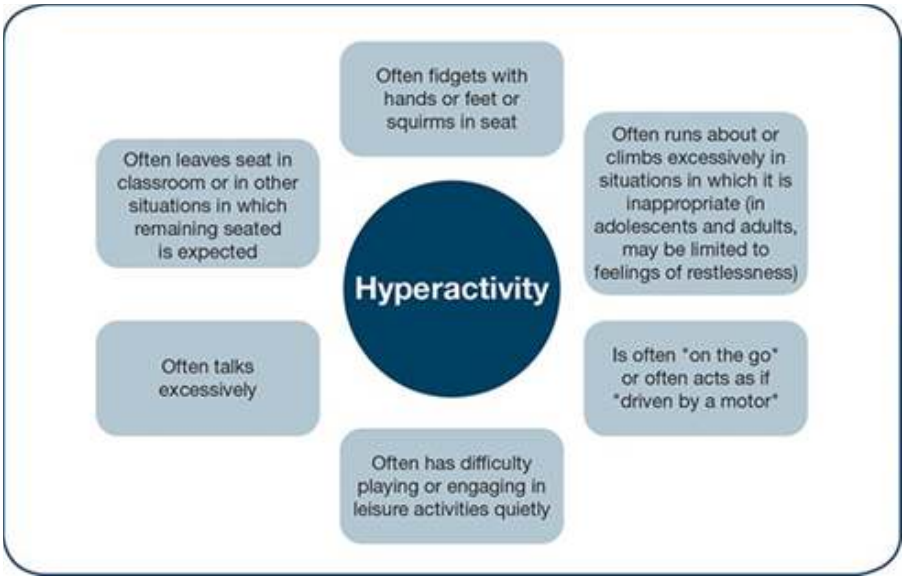

Figure (3): Typical symptoms of hyperactivity *(Figure created from information in the DSM-5™ and ICD-10 classification)* ***(APA, 2013).***

- **Impulsivity**

In ADHD, children have impulsive tendencies to be reckless and appear impatient, and are usually disinhibited in social situations. They may find it difficult to wait their turn, intruding on or interrupting others' activities or jump out to answers question before it has been completed (a shown in Figure 4) ***(American Psychiatric Association, 2013)***.

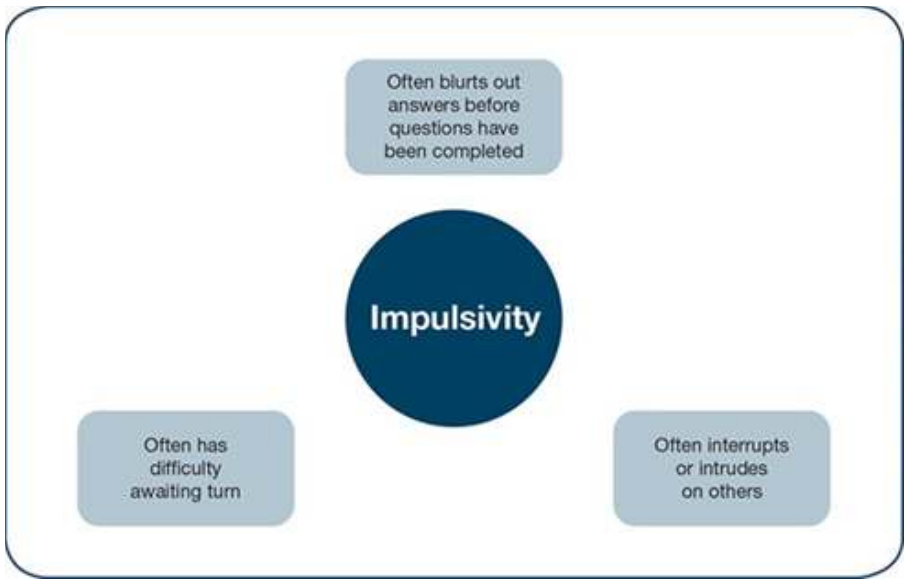

Figure (4): Typical symptoms of impulsivity ***(APA, 2013).***

(Figure created from information in the DSM-5™ and ICD-10 classifications

II. Risk factors of ADHD

The etiology of ADHD is complex which present differently between individuals, are associated with the development and pathology of this heterogeneous disorder, there is evidence that multiple genetic ***(Larsson et al., 2013)***.

Other risk factors for ADHD can be due to environmental **variables** ***(Galera et al., 2011)*** and neurobiological risk factors ***(Economidou et al., 2012).***

III.1. Genetics Factors

Genetics play a role in individual susceptibility to ADHD, with the estimated heritability of ADHD estimated to be 76% of the population with the involvement of specific candidate genes reported ***(Faraone et al., 2005)***.

There is also evidence for a genetic component associated with the persistence of ADHD into adulthood ***(Lesch et al., 2008).***

Preliminary evidence suggests that individual genetic differences may contribute to the variability in response to ADHD medication, although this is an area which requires further research ***(Froehlich et al., 2011).***

III.2. Neurobiological Factors

Neurobiological component of ADHD has received much attention in recent years. Evidence exists for the association between ADHD and possible structural, functional, chemical and electrical activity correlates in various regions of the brain in children, adolescents and adults with ADHD ***(Makris et al., 2013).***

III.3. Environmental Risk Factors

Various risk factors have been reported in the development of ADHD ***(Galera et al., 2011).***

- Premature birth, low birth weight and prenatal tobacco/alcohol exposure
- Specific gene-environment interactions
- Socioeconomic adversity
- Environmental contaminant

III. Psychiatric comorbidities with ADHD

In general, ADHD disorder often has other behavior disorders that impact the patients' ability to function well. The comorbidity of ADHD with other disorders is between 60% and 80% ***(Michael et al., 2015).***

The prevalence of ADHD in children is 3-11% worldwide and has a wide range of comorbidity; more than 2/3 of patients with ADHD have a psychiatric disorder associated with their picture. However, it is important to screen for the presence of other comorbid disorders when a child is diagnosed with ADHD. It depends on the psychopathologies associated with ADHD, the clinical presentation may be more complex and it can represent a diagnostic challenge. Consequently, a careful initial evaluation should be made to eliminate any possible differential **diagnosis**. Additionally, the prognostic and the outcome of children with ADHD with psychiatric comorbidity are much worse than children with ADHD only ***(Acquavia and Stordeur, 2014).***

Comorbid disorders found with ADHD in children change all through times and developmental stages. During early childhood, oppositional defiaent disorder (ODD), language disorder and enuresis are commonly found with ADHD picture. Also, many children with ADHD have a specific learning disorder. Children with borderline IQ, intellectual disabilities or developmental disabilities, have ADHD with is three times more prevalent compared to the general population. Anxiety symptoms and tics are mostly often observed in the mid-school age years. And when adolescence phase starts, it is usually associated with the emergence of **mood disorder**s, personality issues and substance use disorder ***(Mayes et al., 2000).***

IV.1.Oppositional Defiant Disorder

Behavioral problems are the most frequent comorbidities with ADHD; among those disorders, oppositional defiant disorder (ODD) should be distinguished from conduct disorder (CD). The prevalence of ODD is 5-10%. ODD is concomitant with ADHD in 25-75% of patients. Children with co morbid ODD are more impaired, on other hand effective treatments may reduce the risk of complications such as depression, conduct disorder or substance abuse where there should be an introduction of rules and aims to re-establish generational boundaries by a psycho-educator or a special educator. So if it co morbid with ADHD, it is better to combine medication

approach with psychosocial, especially behavioral treatments ***(Spencer et al., 2006).***

IV.2. Conduct Disorder (CD)

CD and ADHD: have the same risk factors, one disorder is a risk of developing the other. The prevalence of CD is about 2-9% and higher in low socioeconomic status groups ***(Baker, 2013).***

About 1/3 of the cases of CD are comorbid with ADHD, which affect the severity of the condition ***(Sirois et al., 2013).***

Children with both conditions have a poor prognosis and in adulthood, usually suffer from antisocial personality disorder and substance abuse ***(Barkley et al., 2004).***

IV.3. Major Depression

When ADHD is comorbid with mood disorders, it is recommended to stabilize the mood condition first ***(CADDRA, 2014)***.

Also it is important to determine which disorder comes first. Patients with ADHD might become depressed because they have to face numerous, or they might have dysphoria symptoms due to effects of medications because stimulant medication produces dysphoria in up to 30% of patients as one disorder is the precursor of the other ***(Shachar and Tannock, 1995).***