INTRODUCTION

Attention Deficit Hyperactivity Disorder (**ADHD)**, is a neuro -developmental psychiatric disorder ***(Sroubek et al., 2013)*** in which there are significant problems with executive functions (e.g., attentional control and inhibitory control (that cause attention deficits, hyperactivity, or impulsiveness which is not appropriate for a person's age ***(Diamond, 2013).*** These symptoms must begin by age six to twelve and persist for more than six months for a diagnosis to be made. In school-aged individuals inattention symptoms often result in poor school performance ***(National Center on Birth Defects and Developmental Disabilities, 2014).***

The cause of most cases of ADHD is unknown; however, it is believed to involve interactions between genetic and environmental factors **(Thapar et al., 2013).**

The management of ADHD typically involves behavioral therapy or medications either alone or in combination. While treatment may improve long-term outcomes, it does not get rid of negative outcomes entirely **(Shaw et al., 2012).**

Medications used include stimulants, atomoxetine, alpha-2 adrenergic receptor agonists, and sometimes antidepressants **(Bidwell et al., 2011).**

Since the origin of ADHD is unclear which limit the pharmacological effectiveness and makes adverse effects common ***(Hong and Cho et al., 2011***(researchers are developing more effective treatments and interventions,and new tools to treat and/or prevent it(***National Institute of Mental Health NIH, 2011).***

The use of CAM therapies has increased especially for developmental and behavioral disorders such as ADHD ***(Hong and Cho, 2011)***

As part of Complementary Medicine ,acupuncture is found to be the most stable and effective treatment for children with ADHD**(Simon and Becker, 2007).**

Acupuncture is reported to be relatively simple, safe and inexpensive treatment compared to other conventional interventions, it has been widely used to improve the core symptoms of ADHD ***(Li et al., 2011)***

AIM OF THE STUDY

The aim of the study is to evaluate the effectiveness of acupuncture as a complementary medicine tool in the treatment of children with Attention Deficit Hyperactivity disorder (ADHD).

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD is a common neuropsychiatric problem affecting 7-9% of children, the defining features of ADHD are inattention, hyperactivity and impulsivity ***(Hong and Cho, 2011)***, commonly present early in life and cause impairment before age 7 year ***(Pelham, 2006).***

These behavioral manifestations contribute to diminished academic, occupational and social functioning having neurobiological bases ***(De LaFuente, 2013).***

There are three presentations of ADHD: According to the Diagnostic and Statistical Manual of Mental disorder (DSM-IV).

1. Inattentive
2. Hyperactive-impulsive
3. Combined inattentive & hyperactive-impulsive

(American Psychiatric Association APA, 2013)

The inattentive subtype consists of individuals who exhibit inattentive behaviors but not hyperactive or impulsive behaviors where as the hyperactive – impulsive subtype consists of the reverse. Individuals with the combined subtype have both ***(Pelham, 2006; James, 2008).***

History of ADHD:

The first example of a disorder that appears to be similar to ADHD was given by Sir Alexander Crichton in 1798. Crichton was a Scottish physician who gave a short /description of the first alteration of attention ***(Palmer and Finger, 2001).*** He characterized the disorder as "the incapacity of attending with a necessary degree of constancy to any one object". Crichton further describes that "this faculty is incessantly withdrawn from one impression to another", Crichton also reports that the disorder can be "born with a person" and "when born with a person it becomes evident at a very early period of life" ***(Crichton, 1798).*** The proximate conclusion that "it renders him incapable of attending with constancy to any one object of education" Crichton states that the disorder "generally diminished with age ***(Okie, 2006).*** some studies have shown that about 50% of children diagnosed with ADHD retain symptoms of ADHD into adulthood ***(Okie 2006; Arolt, 2008).***

The typical symptoms of ADHD were also described as early as (1846) by Heinrich Hoffmann, a physician who published a children's book entitled "Struwwelpeter". The symptomatology was described in the story of "Zappel-Philipp" a child with ADHD symptoms. Thus; Struwwelpeter can be considered a description of ADHD symptoms by a psychiatrist

and represents an important document of medical history ***(Dobson, 2004).***

Hyperactivity in children was then described clinically in 1902 by a physician called Sir George Frederic Still, he described a group of children who were hyperactive, unable to concentrate, and had learning and conduct difficulties and called the condition "Morbid Defects of Moral Control" ***(Stubbe, 2005).***

Tredgold in 1908 described a childhood syndrome that included developmental impairments in control of attention, impulse and motor function as well as perception, conceptualization, language and memory linked to deviations in the function of the central nervous system and called this syndrome "Minimal Brain Damage" ***(Rutter & Silberg, 2002: Ross & Ross, 1976),*** The syndrome was called minimal brain dysfunction due to the presence of "soft" neurological findings and the expectation that consistent neurological lesions would eventually be found ***(Cormier, 2008).***

In 1957 Laufer, Denhoff and Solomons stated that "hyperactivity was the most striking item", and called the disorder "hyperkinetic impulse disorder" ***(Laufer et al., 1957).*** Hyperactivity was recognized to be "a behavioral syndrome that could arise from organic pathology, but could also occur in its

absence. Even so, it would continue to be viewed as the result of some biological difficulty, rather than due solely to environmental causes" ***(Barkley, 2006).***

In 1968, a definition of the concept of hyperactivity was incorporated in the official diagnostic nomenclature, i.e. the second edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-II) ***(Berkley, 2006).*** This concept was labeled "Hyperkinetic Reaction of Childhood" and defined with two sentences: "The disorder is characterized by over activity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes by adolescence" ***(American Psychiatric Association, 1968).***

In the 1970s, the predominant focus on hyperactivity was shifted toward an emphasis on the attention deficit in affected children ***(Rothenberger and Neumarker, 2005).*** With the publication of DSM-III in 1980, the American Psychiatric Association renamed the disorder "Attention Deficit Disorder (ADD) (with or without hyperactivity)" ***(Barkley, 2006).*** DSM-III took the position that the syndrome occurred in two types "with or without hyperactivity" ***(Conners, 2000).***

In the International Classification of Diseases (ICD-10) ***(WHO, 1992)***, the "disorder was defined under the category of "Hyperkinetic Disorder "and is charactered by the presence of

abnormal levels of inattention and restlessness that are. Pervasive a cross situations and persistent over time. These can be demonstrated by direct **observation** and are not caused by others disorders such as autism or affective disorders ***(WHO, 1992).***

Epidemiology

Prevalence

The mean worldwide prevalence of ADHD is between 5.29% and 7.1% in children and adolescents (<18 years) ***(Willcutt, 2012).***

The prevalence of ADHD in Europe was estimated at just under 5%, however, there are still few global or European data on rates of incidence, prevalence or epidemiology of ADHD. Estimation of the prevalence of ADHD may be complicated by a range of factors such as methodological and cultural differences, and variability in identification and medical classification systems used for diagnosis ***(Polanczyk et al., 2007).***

Various studies discussed the prevalence rate of ADHD in Egypt, El Tallawy and Co-workers have found that the prevalence rate of ADHD among students of elementary school at Assiut city to be 6% ***(EL-Tallawy et al., 2005).*** Another study

in Cairo found the prevalence rate to be7-9% among the school children ***(Farid et al., 2008).***

Prevalence factors

ADHD prevalence rates may vary depending on several factors:

- Age – ADHD can affect children from pre-school age and increasing recognition is now given to the fact that ADHD can extend beyond childhood and adolescence into adulthood ***(Wichstrøm et al., 2012).***
- Gender – a higher prevalence is often reported in males ***(Novik et al., 2006).***
- Subtype of ADHD – combined-type ADHD is generally considered most prevalent in all age-groups ***(Wilens et al., 2009).with*** predominance of impulsive type in boys than girls, but no difference with inattention was found ***(Hasson,2012).***

ADHD is often present along side co-morbidities such as oppositional defiant disorder (ODD) and anxiety disorder, which may further complicate understanding of true prevalence rates ***(Yoshimasu et al., 2012).***

Geographical factors

ADHD affects individuals across regions worldwide and prevalence rates vary depending on geographical location,

although these variations may reflect the fewer number of contributory studies in certain geographical regions. Cultural differences and differences in the study methodology are also likely to play a role in prevalence variations. For example, prevalence rates may vary depending on the source of information, on a patient's condition (e.g. parent, patients, teacher or specialist) and the origin of the population sample (e.g. community versus school samples). Global variations in diagnostic criteria or rating scales used to assess symptoms may also contribute to variations in prevalence rates ***(Skounti et al., 2007).***

Etiology of ADHD:

Researches into the etiology of ADHD had revealed genetic biochemical, environmental and social factors ***(Bassett-Harknett, 2007).***

Genetic factors

Genetic researches on ADHD started with the finding that hyperactivity tends to aggregate in families also, increased rates of ADHD among the parents and siblings of ADHD children have been observed ***(Franke et al., 2012).***

ADHD appears to have some type of genetic basis in the majority of cases, as a child with ADHD is four times as likely

to have had a relative who was also diagnosed with attention deficit disorder. At the moment, researchers are investigating many different genes, particularly ones involved with the brain chemical dopamine. People with ADHD seem to have lower levels of dopamine in the brain ***(Grohol, 2013).***

In 2010, a British study found one likely something called copy number variants (CNVs) in human genome. CNVs occur when there are deletions or duplications among chromosomes (the building blocks of human DNA). The genome wide burden of CNVs was significantly greater in ADHD patients than in the controls ***(Grohol, 2013).***

Quantitative genetic studies help us to understand the etiological links between ADHD and co-occurring disorders and traits.The cognitive processes that mediate genetic effects of behavior. Further work, is needed to understand the process that underline the associated cognitive performance deficits such as reaction time and errors performance deficits. Dopamine system genes have been implicated in the etiology of ADHD, particularly the DRD4 and DRD5 genes, and there is evidence from Genome Wide Association Studies (GWAS)that,other genes regulating neurotransmission and neurodevelopment– such as SNAP-25 and CDH13, are involved. Some studies have identified the copy number variation as major risk for ADHD, but these only appear to affect a few cases ***(Elia et al., 2010).***

Researches from family,Twin and Adoption studies support the theory that there is a substance of genetic component in the etiology of ADHD. Heritability estimates range from 0.50 to 0.98% in the monozygotic twins the ADHD Concordance rate are in the higher range of 0.80 to 0.98 ***(Li et al., 2011).***

Enviromental Factors

Many different environmental factors have been reported associated with ADHD, but it has been difficult to identify which are definitely causal, for more detailed explanations, as correlation does not necessarily mean causation, extreme caution is needed when interpreting association findings from epidemiological and clinical studies. Many observed associations could arise as a consequence of child and/or parent psychopathology or disposition (e.g. negative mother–child relationship). They could also represent the effects of an unmeasured 'third variable' ***(Lahey et al., 2009, Rutter, 2007; Rutter and Thapar, 2009).***

Environmental risks have been found to be causes. For example, for antisocial behavior, there is consistent evidence from longitudinal randomized control treatment trials done by ***(Scott et al., 2010),*** and genetically informative studies done by ***(Jaffee et al., 2004),both*** showed that negative parenting,

maltreatment and poverty are causal risk factors, especially in those that are also genetically susceptible ***(Thapar et al., 2013).***

Table (1): Illustrates a summary of the environmental factors that have been most widely studied in relation to attention deficit hyperactivity disorder.

Table (1). Environmental risks that have been most commonly been studied in relation to Attention Deficit Hyperactivity Disorder.

Pre- and perinatal factors	**Environmental toxins**	**Dietary factors**	**Psychosocial adversity**
Maternal smoking, alcohol and substance misuse Risk but not proven causal risk factor	Organophosphate pesticides Risk but not proven causal risk factor	Nutritional deficiencies eg zinc, magnesium, polyunsaturated fatty acids Correlate not yet proven risk factor	Family adversity & low income Correlate not yet proven risk factor
Maternal stress Risk but not proven causal risk factor	Polychlorinated biphenyls Risk but not proven causal risk factor	Nutritional surpluses eg sugar, artificial food colourings Correlate not yet proven risk factor	Conflict/parent–child hostility Correlate not yet proven risk factor
Low birth weight and prematurity Risk but not proven causal risk factor	Lead Risk but not proven causal risk factor	Low/high IgG foods Correlate not yet proven risk factor	Severe early deprivation Risk, likely causal risk factor

(Thapar et al., 2013)

A –Pre and Peri-natal Risks:

Maternal smoking during pregnancy is one of the most commonly cited prenatal risks associated with increased rates of ADHD.

There is a link between ADHD and maternal smoking. However, women who suffer from ADHD themselves are more likely to smoke, so a genetic explanation cannot be ruled out.. Nevertheless, nicotine can cause hypoxia (lack of oxygen) in utero ***(Grohol, 2013).***

Also, maternal stress during pregnancy has been noted to be associated with offspring suffering from ADHD ***(Glover, 2011).***

Exposure to other substances during pregnancy has also been found to be associated with ADHD, although with the exception of fetal alcohol syndrome, less robustly. Moderate maternal alcohol use during pregnancy and exposure to illicit substances has been associated with increased risk of ADHD in some, but not all, studies ***(Linnet et al., 2003).***

ADHD, especially the inattentive subtype, has also been found to be associated with low birth weight and prematurity, with a meta-analysis suggesting significant association between ADHD low birth weight**.** However, some genetically

informative studies suggest low birth weight is not likely to represent an inherited ***(Groen-Blokhuis, 2011)***

The dopamine system is extremely sensitive to hypoxia, particularly in the fetus or infant. Thus, any events pre- or postnatally that disrupt the flow of blood or oxygen to the brain might set the stage for later ADHD behaviors. This observation is supported both by laboratory studies(**Decker&Rye,2002**)and a study of examination of ex- premature infants who had documented cerebral ischemia at birth and were re examined in early adolescence ***(Lou et al., 2004).***

B-Environmental toxins:

Exposures to other toxins in prenatal and/or postnatal life have also been considered as increasing the risk of ADHD. In particular, organic pollutants and lead toxins may damage the neural systems and implicated in ADHD ***(Nigg, 2008).***

Pesticides

Organophosphate pesticides have been studied in relation to ADHD, although not widely. A cross-sectional investigation of the relationship between urinary dialkyl- phosphate (DAP), which is an end metabolites of organophosphates and ADHD diagnosed in middle childhood and early adolescence found that those with detectable urinary (DMAP) metabolite concentrations