ADHD: Etiology, Diagnosis, Symptoms, And Associated Consequences

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common early childhood behavioural disorders as 5% of the children or more have this disorder. It is also known as Attention Deficit Disorder (ADD), which is an outdated term. It is an early onset disorder as it is usually obvious at a very young age between 6 and 12 years old, which may continue in adulthood, and it is more prevalent to males than females (American Psychiatric Association; DSM-5 Task Force, 2013; Visser et al., 2014).

According to the International Classification of Diseases-11th version (ICD-11), it is a neurodevelopmental disorder that is persistent, as it lasts for more than 6 months, and it includes the symptoms of inattention and/or hyperactivity-impulsivity which are not according to the developmental stage of the child (World Health Organization, 2018). This definition is also given by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), which also points out that it “interferes with functioning or development” and that the “symptoms are present in two or more settings” (American Psychiatric Association; DSM-5 Task Force, 2013: 59-60).

Etiology

ADHD is an extremely heterogeneous disorder and its causes have not been specifically identified yet. Due to the barrier of heterogeneity it has been difficult to investigate its neurobiology (Costa Dias et al., 2015) and thus, there are many inconsistencies in the studies. Nevertheless, it is known that both genetic and environmental factors are responsible for its emergence (Pingault et al., 2015; Curaloto, D’ Agati and Moavero, 2010). Heritability appears to be the dominant cause for increased risk with the percentages being tremendously high, fluctuating between 70-90% (Brickel, Kuja-Halkola and Larsson, 2015; Faraone and Mick, 2010). Furthermore, it has also been identified that the strong heritability is present across the life span, as apart from children, studies have also had the same results with ADHD in adults, in contrast to previous studies (Larsson et al., 2013).

The disorder has strong genetic sources as many studies have suggested so far. For example, according to Middeldorp et al. (2016) and Stergiakouli et al. (2012) two genes, CNV and SNP are possible risk variants for ADHD. Another risk gene reported is CDH13 according to Arias-Vásquez et al. (2011) and Salatino-Oliveira (2015), developing associations of the hyperactive symptoms of the disorder with the working memory performance. As many other pathways analyses exist and a range of genes have been suspected to have an effect, it is argued that a lot of common and rare variants together can play a role to the development of ADHD (Akutagava-Martins, Rohde and Hutz, 2015).

Prenatal environment is also a significant risk factor and one of the main focal points of the research on this area. Pregnancy related issues like maternal smoking are shown as important variants that increase the risk for ADHD symptoms (Obel et al., 2015; Silva et al., 2013; Froehlich et al., 2011; Banerjee, Middleton, and Faraone, 2007). However, it is very difficult to draw a firm conclusion due to the limitations of the studies. The majority of the studies use maternal self report which is not always reliable and may be seen as biased and also the

correlation between the disorder and smoking may have genetic roots (Obel et al., 2015; Froehlich et al., 2011). In addition, exposure to environmental smoking and nicotine replacements, which can be possibly used as self-treatment of ADHD, can make the results even more complex (Han et al., 2015; Obel et al., 2015).

Alcohol is another common risk factor evident in the literature. Even though there are both positive and negative studies for this argument, due to different measures and small samples (Froehlich et al., 2011), according to a Korean study by Han et al. “alcohol consumption in pregnancy increased the prevalence of ADHD by 1.55 times” (2015:166). Antidepressants during pregnancy is a controversial subject among researchers as well, with some of them supporting 38% increased risk (Morales et al., 2018) while others proposing that it is not the medication itself but the need for it, meaning that maternal psychiatric disorders is the real risk factor (Man et al.,2017; Castro et al., 2016; Clements et al., 2015). Moreover, illegal drugs, toxins and even caffeine are reported in several pieces of research (Froehlich et al., 2011; Banerjee, Middleton, and Faraone, 2007) whereas insufficient levels of mother’s vitamin D can increase the risk as well (Morales et al., 2015).

Birth and delivery complications are also a potential link to Attention Deficit Hyperactivity Disorder. Primarily, preterm labor, low birth weight and cord collapse are highly explored by a large body of research, concluding that they could possibly add to the risk and that every week is important for the fetal growth (Sucksdorff et al., 2015; Van Dyk et al., 2014; Silva et al., 2013), whilst birth by caesarean section needs to be further examined (Curran et al., 2014). Moreover, maternal stress, intensive care stay and long separation from the mother, insufficient breastfeeding period and early traumatic events are considered to be equally important (Van Dyk et al., 2014; Froehlich et al., 2011). Other postnatal environmental factors such as diet and nutrition have recently been related to the high prevalence of the diagnosis (San Mauro Martín, 2017) even though food additives are not likely to cause ADHD (Banerjee, Middleton, and Faraone, 2007).

To sum up, understanding all the inconsistencies due to methodological issues and the inconclusive evidence due to small sample sizes and any other limitations, all the above genetic and environmental elements have been more or less connected to ADHD over the years and many more, like rejecting parental styles and high criticism, have been discussed through the literature (Musser et al, 2016; Storebø, Rasmussen and Simonsen, 2013). However, the next matter of greater significance is to examine which are the core features and symptoms of this disorder in order to achieve better identification.

Diagnosis and Symptoms

According to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association; DSM-5 Task Force, 2013), Attention Deficit Hyperactivity Disorder’s primary features are inattention and hyperactivity-impulsivity. According to the criteria, there are three subtypes: the predominantly inattentive type, the predominantly hyperactive/impulsive type and the combined one which shares characteristics from both categories.

The DSM-5’s predominantly inattentive type cannot focus on activities and pay attention to details while they seem often abstracted and inclined to forget as well. All the above have as a result their losing of things, making frequent mistakes, not being able to carry particular tasks, being unorganized and having ineffective time control and prioritization. Thus, in line with the

manual, there are harmful consequences on their social and academic life. Not being able to follow guidelines, to prepare and submit school work on time or making too many mistakes and having difficulty in spending long time reading are only a few direct effects.

The predominantly hyperactive/impulsive type struggles with motor control like sitting on a chair or standing still while waiting. They often face problems with remaining quiet and silent and have a sense of restlessness and impatience. They seem unable to follow rules of appropriateness in certain settings or in a conversation and they tend to run and climb when this is not expected. As the DSM-5 proposes, again these features collide with their public image as they cannot attend lessons and business meetings properly or moderate their talking and in general engage to activities in a way that is socially accepted. In addition, they present faulty decision making as they lack prior reflection on the possible outcomes (American Psychiatric Association; DSM-5 Task Force, 2013).

Associated Consequences

As it has already been mentioned, the development of children and adults with ADHD may have negative manifestations to their daily life and their overall reality as human beings. One of the main secondary outcomes of the disorder is academic performance and learning difficulties due to the lack of motivation and cognitive skills (Birchwood and Daley, 2012). Because of the inattentive element of the disorder, children experience issues with spelling and maths among others (Costa et al., 2014). As stated by teachers, ADHD adolescents tend to turn in 12% fewer homework assignments, a fact that is directly affecting their grades (Langberg et al., 2015).There is often an overlap between behaviour problems and language impairment, which is also the case here. Most children with ADHD are identified with language or communication needs concerning primarily the semantic and pragmatic aspects of language (Helland, Helland and Heimann, 2012). Those difficulties many times remain masked and their identification is crucial.

Social functioning is also a usually impaired skill in ADHD individuals. Distorted perception (Fuermaier et al., 2017), feeling withdrawn, reserved and inhibited (Marshall et al., 2013; Tye et al., 2013) and high levels of self-restrain (Jarrett, 2016) on the one hand and overt aggression on the other (Marshall et al., 2013), may explain why ADHD children have been identified as being both the victims and the bullies towards their peers (ŽIc Rali?, Cvitkovi? and ŠIfner, 2016). The elevated risk for these children for unfair treatment and harassment at the same time shows that when they experience aggressive attitudes, either verbally or physically, due to their social deficits, they react with the exact same behaviour (ŽIc Rali?, Cvitkovi? and ŠIfner, 2016). Behaviour problems, however, may be evident to those children because of their inability to build expectations about a new setting they enter, having as a result inappropriate actions (Van Hulst et al., 2017).

Apart from the academic and social aspect, sleep problems are found to be also one of the secondary consequences of the disorder. Lycett et al. (2014), in their cohort study presented that sleep difficulties in children with ADHD may be persistent and cause additional conditions like problems expressing their emotions or even lead to a more severe display of the disorder. The concerning issues are that children refuse to accept going to bed and when they eventually do, they face several matters like nightmares and other disturbances and they have trouble getting a calm full night’s sleep (Hvolby, 2014; Kirov and Brand, 2014). Specifically, except for resisting falling asleep and being afraid of the darkness, they may also frequently move, sweat

while sleeping or even sleepwalk (Kirov and Brand, 2014).

The importance of a peaceful and uninterrupted sleep is known to help with memory, emotional control and various key skills of development (Kirov and Brand, 2014). Therefore, the treatment of sleep disturbance is not only recommended but it can also be beneficial for their life and behavioural status (Hvolby, 2014; Kirov and Brand, 2014). However, it should be noted that some of the effects are also result of the medication itself. Interestingly, Kirov and Brand's review (2014) discussed that in children with the combined subtype sleep problems are even more prevalent and Hvolby (2014) pointed out that the association between sleep and the disorder is bidirectional.

A central related feature of the disorder is emotional dysregulation (Shaw et al., 2014; Van Stralen, 2016).Difficulties with emotional control and internalizing and externalizing behaviours such as gloom, melancholy or aggressiveness are associated with ADHD (Van Stralen, 2016). Apart from the lack of controlling their emotions, unconscious mind-wandering is troubling people suffering with ADHD in their everyday life (Seli et al., 2015). One more factor affecting their daily activities is low working memory. Impaired encoding processes is a well-documented issue among ADHD individuals (Lenartowicz et al., 2014; Kim et al., 2014) while low working memory seems to be a stronger predictor than behaviour for academic underachievement (Simone, 2017) as children are not able to store and process data for a certain duration having as a result losing them (Orban, 2017).

Another commonly related condition, often seen as having a bidirectional link with ADHD, is obesity and lack of exercise (Khalife et al., 2014). The authors after conducting a longitudinal research, state that "childhood ADHD symptoms prospectively predict adolescent obesity" and "physical inactivity" (Khalife et al., 2014: 430). The explanation given is that, due to the inattentive characteristics, children are not able to engage and concentrate in such activities and thus, they end up gaining more weight. Consequently, a recommendation for an emphasis on physical education in schools but also monitoring the weight of ADHD children from an early age is the closing remark of the study (Khalife et al., 2014). Accordingly, Cortese et al. (2016), with a systematic review and meta-analysis, support this view, noting that the prevalence of obesity in participants with ADHD had an increase between 40 and 70% and that it starts from early childhood.

Following weight gain and physical inactivity, a commonly associated effect that can also be a cause for the above is motor impairment. Poor motor skills seem to be increasingly linked to the disorder, as ADHD children need more planning time especially when decisions are made or complicated tasks are required (Kaiser, 2015). Motor deficits tend to be more severe for children of the inattentive type (Kaiser, 2015), while many pieces of research disagree with the association of ADHD and motor problems because of the co-occurrence of developmental coordination disorder (Goulardins et al., 2017). Due to motor impairment, children with ADHD are facing handwriting and letter legibility difficulties. Speed of writing, as well as the effectiveness of medication, still need further research (Brossard-Racine et al., 2012).

Accidents are commonly associated with ADHD through the literature. Reckless driving, speeding and careless mistakes create the profile of a lot of ADHD drivers, who can end up causing transport accidents (Madaan and Cox, 2017; Chang et al., 2014). The increased frequency of driving errors, along with the high numbers of traffic violations, in comparison to healthy individuals, are related to their visual inattentiveness, even though they themselves

seem to underestimate the degree of this problem, as seen in their self-reports (Fuermaier et al., 2015). On the other hand, the picture changes when we look closely and reflect on the type of violations as well as what is triggering those behaviours, as we realize that all these mistakes are unconscious and not on purpose. Although distractions and speeding are definitely escalated, drunk driving is never higher than controls, showing that perhaps positive feelings of freedom and escaping from the disorder is what makes them speed (Vaa, 2014). A positive finding is that medication can help reduce the risk of car accidents (Chang et al., 2014; Fuermaier et al., 2015).

Unfortunately, more serious risks are involved when looking at the possible associations of the disorder. A recent review of the literature (Giupponi et al., 2018) found links with suicidal behaviour although the results should be carefully interpreted as the studies are heterogeneous and other confounding factors may also be present. Moreover, an analysis of four-year national data in the USA presents higher odds of accidental deaths among ADHD individuals, a result that supports the view that ADHD adds to mortality levels (London and Landes, 2016). What is more, two longitudinal studies, one examining children from 5 to 18 years old, and the other adolescents to early adulthood (25 years old), concluded that substance use (SU) is more prevalent to ADHD participants as they tend to smoke cigarettes and marijuana more regularly, and start drinking from a younger age (Sibley et al., 2014; Molina et al., 2018). A qualitative approach to the topic, interviewing the individuals themselves, showed that the need to appear normal and feel accepted was their reason for high SU (Nehlin, Nyberg and Öster, 2014).