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MINDFULNESS TRAINING – EFFECT ON ADULTS WITH ADHD AND DEPRESSIVE SYMPTOMS AND THE ROLE OF DIGITAL TECHNOLOGIES

TREINAMENTO DE MINDFULNESS- EFEITO EM ADULTOS COM TDAH E SINTOMAS DEPRESSIVOS E O PAPEL DAS TECHNOLOGIAS DIGITAIS

ENTRENAMIENTO DE MINDFULNESS: EFFECTO EN ADULTOS CON TDAH Y SÍNTOMAS DEPRESIVOS Y EL PAPEL DE LAS TECNOLOGÍAS DIGITALES

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ABSTRACT
Nowadays, more and more people are faced with symptoms of depression. This literature review focuses on adults with ADHD and depressive symptoms and presents the therapeutic technique of mindfulness and its benefits. The purpose of the paper was to add another method of reducing the symptoms of people who suffer from such difficulties in their daily lives. At the same time, the role of new technologies in the solution of mindfulness was also sought because developers and researchers work every day to provide solutions through technology to people who face developmental disorders such as ADHD or medical diseases such as depression. The research question of the work was presented and the contribution of mindfulness training is attributed as an alternative practice with the main axis of shifting the attention of individuals to the situation they are faced with and consequently to the fullest possible ideal awareness and cultivation of positive emotions. The findings identified were very interesting as mechanisms were found that were favored by mindfulness training. The concerns and research data led to the main conclusion that indeed the mindfulness technique can be administered by therapists as a way to reduce the symptoms experienced by adults with ADHD and depression.

KEYWORDS: ADHD. Mindfulness Training. Depressive Symptoms.

RESUMO
Hoje em dia, mais e mais pessoas enfrentam sintomas de depressão. Esta revisão de literatura enfoca adultos com TDAH e sintomas depressivos e apresenta a técnica terapêutica de mindfulness e seus benefícios. O objetivo do artigo era adicionar outro método para reduzir os sintomas de pessoas que sofrem com essas dificuldades em suas vidas diárias. Ao mesmo tempo, buscou-se também o papel das novas tecnologias na solução do mindfulness, pois desenvolvedores e pesquisadores trabalham todos os dias para fornecer soluções por meio da tecnologia para pessoas que enfrentam distúrbios do desenvolvimento, como o TDAH, ou doenças médicas, como a depressão. A questão de investigação do trabalho foi apresentada e atribui-se o contributo do treino de mindfulness como uma prática alternativa com o eixo principal de deslocar a atenção dos indivíduos para a situação com que se deparam e consequentemente para o máximo possível de consciência ideal e cultivo de emoções positivas . As descobertas identificadas foram muito interessantes, pois foram encontrados mecanismos que foram favorecidos pelo treinamento de mindfulness. As preocupações e os dados da pesquisa levaram à principal conclusão de que de fato a técnica de mindfulness pode ser administrada por terapeutas como forma de reduzir os sintomas vivenciados por adultos com TDAH e depressão.

PALAVRAS-CHAVE: TDAH. Mindfulness Training. Sintomas Depressivos.

RESUMEN
Hoy en día, cada vez más personas se enfrentan a síntomas de depresión. Esta revisión bibliográfica se centra en adultos con TDAH y síntomas depresivos y presenta la técnica terapéutica del mindfulness y sus beneficios. El propósito del documento era agregar otro método para reducir los síntomas de las

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personas que sufren tales dificultades en su vida diaria. Al mismo tiempo, también se buscó el papel de las nuevas tecnologías en la solución del mindfulness porque desarrolladores e investigadores trabajan día a día para brindar soluciones a través de la tecnología a personas que enfrentan trastornos del desarrollo como el TDAH o enfermedades médicas como la depresión. Se presenta la pregunta de investigación del trabajo y se atribuye el aporte del entrenamiento en mindfulness como práctica alternativa que tiene como eje principal el desviar la atención de los individuos a la situación que se les presenta y consecuentemente a la mayor conciencia ideal posible y al cultivo de las emociones positivas. Los hallazgos identificados fueron muy interesantes ya que se encontraron mecanismos que se ven favorecidos por el entrenamiento en mindfulness. Las preocupaciones y los datos de la investigación llevaron a la conclusión principal de que, de hecho, los terapeutas pueden administrar la técnica de atención plena como una forma de reducir los síntomas que experimentan los adultos con TDAH y depresión.

PALABRAS CLAVE: TDAH. Entrenamiento Mindfulness. Síntomas Depresivos.

INTRODUCTION

In this review, ADHD, depression, their direct and indirect relationship, and the factors that cause them are observed and analyzed. Subsequently, the reader has the ability to grasp the concept of mindfulness training, its techniques, and the influence it had on the disorders we investigated. It is known that there are basic methods of intervention in this matter that have been studied for years but we wanted to give a different perspective which ultimately placed us in very interesting thoughts. So we tried to prove the existence of other alternative methods of intervention, one of which was mindfulness training, and what would be the benefits that the adults we researched would have. That was the main goal of the current review. The methodology we followed was dictated by our research objective. We collected qualitative and quantitative data that captured the prevailing values for what we examined each time. We, therefore, identified the parameters by which we would test the delivery of mindfulness training to the target population and grouped the topics of interest into categories. Definitions, techniques, and morbidity were some of them. Our main finding proved to be the improvement of mood, memory, and attention through mindfulness in the specific group we tried to investigate.

1. ATTENTION DEFICIT HYPERACTIVITY DISORDER - ADHD

Attention Deficit Hyperactivity Disorder (ADHD) belongs to developmental disorders with the difference that its origin is organic. This disorder has a suppressive effect on the person's general functioning, causing him significant difficulties in his daily life (Young et al., 2013). The careful study of this disorder has brought to light a number of different genetic factors that cause these peculiarities (Lee et al., 2014).

The main symptoms of this disorder are inattention, hyperactivity and constant impulsivity (Larsson et al., 2011). In short, people with ADHD are unable to stay focused on a goal for long. Many times, people with ADHD show moody behavior (Thomas et al., 2015).

There are many elements that have been blamed for the appearance of ADHD. Most research focuses on genetic, hereditary or neurological factors, without this meaning that other elements related to the psychology of the individual and the environment in which he grows up are excluded. Recent

research has linked the presence of ADHD to a lack of serotonin in the human brain (Song et al., 2011).

Regarding the prevalence of the disorder, it occurs in 5-8% of the general population and seems to favor boys over girls (Barkley, 2015). Regarding what happens in the school population, many studies consider that students with ADHD reach 7% of the school population (Nymberg, 2013).

A key element of ADHD is that it presents the characteristic of comorbidity. Thus, it is very likely that many people with this disorder suffer from other disorders, whether they are developmental or emotional. Among the learning difficulties, the most frequently found are dysspelling, dysgraphia, dyscalculia and the most common of all, dyslexia (Owens et al., 2018).

Poor school performance is another issue associated with ADHD and this is mainly due to their distractibility, hyperactivity and impulsivity characteristics.

At the same time, many of the people with ADHD face and experience emotional disturbances, such as secondary depression, intense anxiety, frustration and low self-esteem. Another common finding among individuals with ADHD is aggressive behavior (Miller et al., 2013).

The process of diagnosis in ADHD, as in any other developmental disorder, is considered to be of key importance in dealing with any problems it causes to the sufferer. The DSM diagnostic tool, Scale Diagnostics, Conners ADHD and Wender Utan Rating Scale-WURS are mostly used for its diagnosis (Li & Lee, 2013).

Through these very useful tools the deficits of the disorder are outlined based on the symptoms that appear and from there ways of intervention are suggested. Interdisciplinary collaboration is what will ensure the best possible results (Kooi et al., 2019).

ADHD is one of the disorders that appear from the very young school age. For the successful development of individualized intervention and treatment in ADHD we would say that it is extremely useful to formulate a holistic and interdisciplinary approach. Typically, it will be mentioned that it is of primary importance in the context of the individualized intervention of ADHD that specialties participate, such as for example special educators, occupational therapists, school teachers, child psychiatrists, but also the family of each child with ADHD. In fact, it is established that through this interdisciplinary collaboration, the effective consideration and understanding of the various characteristics of children with ADHD will be achieved to a large and effective extent, while the design of an appropriate personalized intervention program will also be achieved (Szép et al., 2021).

Many practices and various treatments can be applied in the context of an individualized intervention. Such treatments, as suggested by the relevant literature, are those that include modification of the behavior and actions of children with ADHD. Such practices include the application of individual psychotherapy, family psychotherapy, medication, and the development of personalized interventions within the school (Caye et al., 2019).

Attention Deficit Hyperactivity Disorder (ADHD) is a childhood and pre-adolescent onset clinical condition characterized by attention deficits, hyperactivity, and impulsivity leading to significant impairment in academic/occupational, family, and social functioning (APA, 2013). However, although we focus on the school years, it has been shown that ADHD does not only affect childhood. Indeed, several studies have found that it often persists into adulthood (Barkley et. al., 2002; Kessler et. al.,

2005; Zalsman & Shilton, 2016) with prevalence rates ranging between 1% and 5% (Fayyad et. al. ., 2007). The most important clinical symptoms in adulthood are difficulties in planning/organizing daily activities, an extreme worry and harmful impulsivity, which contribute to the challenge of maintaining stable work and relationships (Kooij & Francken, 2010).

In addition, adults with ADHD often have co-occurring psychiatric disorders (Deberdt et. al., 2015) to the extent that up to two-thirds of adults with ADHD experience at least one comorbid psychiatric condition (Fayyad et. al., 2007). Similarly, ADHD is found in approximately 15% of adults with other psychiatric disorders (Pehlivanidis et. al., 2014). Comorbid disorders often mask the core symptoms of ADHD, resulting in only a minority of these patients being correctly diagnosed and treated. receive appropriate treatment (Gustavsson et. al., 2011).

In addition to comorbid disorders, the presence of different subtypes of ADHD in adults – hyperactive/impulsive, inattentive, and combined subtypes – is a further element of heterogeneity that needs to be recognized in order to guide prognosis and treatment. Recent studies have shown an association between the combined subtype and some indicators of ADHD severity, such as a higher frequency of comorbid disorders (Soendergaard et. al., 2016), substance abuse (Liebrenz et. al., 2015) and neuroticism (Retz – Junginger ,2016) highlighting the importance of subtype classification for prognostic purposes.

2. DEPRESSION

Depression is classified as a mental illness that is still not developmentally or socially determined. We could say that there is coexistence as a mental illness is related to specific areas of the brain and nervous system of the individual and appears in specific social contexts (Galanaki-Baltzaki, 2019).

Depression, as already mentioned, is a psychiatric mood disorder with symptoms such as sadness, fatigue, loss of interest and loss of appetite (World Health Organization., 2020). It is often accompanied by symptoms of anxiety. All of these symptoms can last a long time or get worse so that the person suffering from them is unable to meet their daily needs and responsibilities. The worst case scenario for a person suffering from depression is suicide (Kessing,L., Bukh,J.,Bock,C., Vinberg,M. & Gether U., 2010)

More specifically, when a patient suffers from depression, he presents at least one of the following symptoms, either depressed mood, or loss of interest or pleasure, for most of the day and almost every day. Teenagers and children with depression experience weight loss or gain, changes in their appetite, reduced mood and interest in all activities, insomnia or hypersomnia, fatigue, loss of energy. In addition, they often present reduced ability to think and concentrate, guilt, recurrent thoughts about death (American Psychiatric Association., 2013). Thus, these individuals end up being dysfunctional in the social, professional and personal areas of their lives.

According to the American Psychiatric Association, the DSM-5 (new edition of the Diagnostic and Statistical Manual of Mental Disorders) offers important developments with precise identification in the diagnosis of mental disorders and therefore depression (American Psychiatric Association., 2013).

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According to the DSM-5, depressive disorders are presented as follows:

- Dissociative mood dysregulation syndrome (DMDD)
- Major Depressive Disorder, single and recurrent episodes
- Persistent Depressive Disorder (Dysthymia)
- Premenstrual Dysphoric Disorder
- Depressive disorder due to medication or substance use
- Depressive disorder due to another medical condition
- Other specified depressive disorders
- Unspecified depressive disorders

Neurotransmitters play a very important role in carrying a message from a neuron to a target cell during a synapse. Based on their compositions, they can be classified into various categories such as amino acids, peptides, monoamines, etc. At the same time, neurotransmitters have been shown to be linked to many neurological diseases such as Alzheimer's, Parkinson's and depression.

With regard to the psychiatric disorder of depression, neurotransmitters are actively involved in the regulation of neurogenic hippocampus affecting the effects it will have on the individual's psychosynthesis (Brezun J. & Daszuta A., 1999), (Masuda T, Nakagawa S, Boku S, Nishikawa H, Takamura N, Kato A & et al., 2012). Increased glutamate in the hippocampus is associated with stress-induced depression (Wang MH & An SC., 2009). Furthermore, the percentage of inhibitory amino acid in the brain of depressed patients is reduced to less than half that of healthy subjects (Sanacora G, Mason GF, Rothman DL, Behar KL, Hyder F, Petroff OA & et al., 1999). Monoamine neurotransmitters including hydroxytryptamine (or serotonin), dopamine, noradrenaline, epinephrine, and hydroxyindoleacetic acid have been found to be actively involved in the pathophysiology of depression (Britta Haenischab & Heinz Bönischa, 2011).

There are proponents of the view that depression is based on and correlated with the structure and function of the human brain. The class of these sciences claim and present the biological model of depression.

Different areas of the brain are involved in the psychiatric disorder of depression. Most research has focused on the hippocampus and frontal cortex (eg, prefrontal cortex (PFC)). Based on the normal functions maintained by the hippocampus, impaired hippocampal function may contribute to some of the cognitive abnormalities of depression (Bremner, J.D., Narayan, M., Anderson, E.R., Staib, L.H., Miller, H.L. and Charney , D.S., 200). At the same time, the nuclei (NAc), amygdala and hypothalamus are involved.

There are many connections between these various brain regions. The ventral tegmental area (VTA) provides dopaminergic input to the nucleus accumbens, amygdala, prefrontal cortex, and other somatic structures. Norepinephrine (LC) and serotonin (DR) hydrate all brain regions. (Eric J. Nestler, Michel Barrot, Ralph J. DiLeone, Amelia J. Eisch, Stephen J. Gold and Lisa M. Monteggia., 2002)

In addition, a point in the hypothalamus integrates stress-related information. The hypothalamic adrenal (HPA) axis may contribute to depression not only through important neural inputs but also through enhanced afferents from the hippocampus. Other important inputs are from ascending input to

the hypothalamus and other brain regions via monoamine pathways (Eric J. Nestler, Michel Barrot, Ralph J. DiLeone , Amelia J. Eisch, Stephen J. Gold and Lisa M. Monteggia., 2002).

Furthermore, it should be mentioned that depression, like other mental disorders, can also be due to heredity. If one of the two biological parents suffers from depression or a close relative, it is more likely that a child will present this mental disorder (American Psychiatric Association., 2013).

Depression is not only based on biological factors but there are also environmental/external factors that affect this mental illness. Specifically, environmental/external factors are defined as the family, social, personal environment in which a person lives and experiences certain situations, which can affect their mental state. In addition, it is worth mentioning the point of view of the critics of the biological model who claim that if depression is inherited then both identical twins should develop this disease and not one of them, as may be the case. Supporters of the biological model, who believe that depression is not inherited, but the predisposition to it, come to demolish this point of view. In addition, each person is different, and their character is uniquely structured, so even identical twins do not deal in the same way with an event that may happen in their lives (Kostantakou, 2015).

We conclude that depression is based on and associated with biological factors such as heredity and difficulties that the human brain may experience during certain synapses, without excluding the influence that an external/environmental factor may exert on a person's psychosynthesis. The two views above do not contradict each other but are connected to each other and one influences and changes the other. The relationships that follow are not reciprocating but interactive relationships.

3. METHOD

The method used to collect and manage the data of the bibliographic review involved conducting a narrative review of the literature on interventions about stress management method, mindfulness training and its contribution to people with ADHD and depressive symptoms. Also, the importance of New Technologies in this field, is referred. Every research data used was documented and recorded with the necessary conclusions. Postgraduates Moraiti Ioanna and Anestis Fotoglou, research members of the Net Media Lab together with Dr. Athanasios Drigas, director of the Net Media Lab, collected the data and worked extensively on this type of study. The researchers carried out this research within the framework of the research of the Net Media Lab in Research Center' ‘Democritus’’ NCSR at Department of Informatics and Telecommunications.

4. ADHD AND DEPRESSION

Adults with ADHD are at increased risk for depressive disorders, but little is known about potential cognitive behavioral therapies that could shape some treatment. The research we reviewed highlights the importance of cognitive-behavioral processes in adults with ADHD at risk of developing depression or already experiencing depression. 77 adults diagnosed with ADHD completed self-report questionnaires, diagnostic interviews, and clinician-administered symptom rating scales. Controlling for recent negative life events, dysfunctional behaviors, and cognitive-behavioral avoidance fully accounted for the variance between ADHD symptoms and depressive symptoms. Cognitive behavioral therapy

(CBT)-targeted procedures for depression were associated with symptoms in adults with ADHD. Current CBT approaches for ADHD incorporate active coping skills and cognitive restructuring, and such approaches could be further adapted to address ADHD-depression comorbidity.

Estimates of major depressive disorder (MDD) in samples of adults with ADHD range from 16 to 31 % (Wilens et al. 2008). Conversely, a significant number of adults with depressive disorders also meet criteria for ADHD. The National Comorbidity Survey registry estimated that 9.4% of adults met criteria for MDD and 22.6% met criteria for dysthymia or disorder and concurrent criteria for ADHD (Kessler et al. 2006). According to the research Chronis Tuscano et al. (2010) found that 18.4% of children diagnosed with ADHD at age 4–6 years experienced recurrent depressive disorder by age 18 years. ADHD has also been associated with an increased incidence of suicidality in adolescents and young adults (Biederman et al. 2008; Chronis-Tuscano et al. 2010).

There is evidence that depression-ADHD comorbidity complicates the treatment of both disorders (Biederman et al. 2008; Wilens et al. 2008). In this case, effective pharmaceutical and psychosocial treatments for depressive disorders such as psychotropic drugs are expected, however, a significant percentage of patients do not continue treatment, do not respond to treatment or do not show remission of symptoms (Rush et al. 2006, 2008). Psychiatric confusion is one of the key prognostic factors in the treatment of depression.

The data collected from the above research suggests the importance of treating depression in adults with ADHD as it may be the key for those diagnosed with ADHD and at risk of developing depression. Because there is not much research examining predictors of depression risk in people with ADHD and that many of these studies focus on processes in childhood and that identified predictors are often very difficult to directly modify in treatment due to e.g. stressful events in individuals' daily lives, new research is needed to guide clinicians in designing treatments for the comorbidity of depression - ADHD.

5. DOES ADHD IN CHILDHOOD LEAD TO DEPRESSIVE SYMPTOMS IN ADULT'S LIFE?

Few elements are known about the development and individual course of depressive symptoms in adulthood in those diagnosed with ADHD in childhood.

The article we reviewed examines whether a person's history of ADHD in childhood predicts significant depressive symptoms in adulthood (18–25-year-olds participated). The survey was conducted on 394 participants (205 with ADHD and 189 without ADHD, 348 men and 46 women). Individuals with a history of childhood ADHD had a higher baseline level of depressive symptoms at age 18 and higher levels of depressive symptoms at each age-year in adulthood. History of ADHD in childhood remained a significant predictor of baseline level of depressive symptoms at age 18 after controlling for additional psychiatric diagnoses but not after controlling for concurrent symptoms of ADHD and psychosocial disorder. Participants with a history of ADHD in childhood showed significantly higher levels of depressive symptoms compared to participants without ADHD by age 18 and continued to experience higher levels of depressive symptoms in adulthood.

Children, adolescents, and adults with ADHD may be at high risk for unipolar depressive disorders. (Chronis-Tuscano et al. 2010; Meinzer et al. 2013).

Recent research reports that ADHD and depression are associated and that individuals with a history of ADHD have difficulty navigating developmental tasks in adulthood, as evidenced by low rates of college attendance (Barkley, Fischer, Smallish, and Fletcher 2006; Kuriyan et al. 2013) and high rates of alcohol use disorders etc. These difficulties experienced by individuals with ADHD promote the development and maintenance of depressive symptoms throughout the individuals' adult lives. Apparent comorbidity reports a strong association between ADHD and depression even after controlling for comorbid diagnoses (Meinzen et al. 2013). Other studies support that childhood ADHD significantly predicts persistence of depression and future risk of depression. (Biederman, et al. 1998).

Comorbidity with depression has been found to affect 20–70% of ADHD patients, and comorbidity with anxiety disorders has been found to affect 28–50% of children and adolescents with ADHD (Wilens et al., 2002; Angold et al., 1999; Spencer et al., 1999). On the other hand, among adults with ADHD, 35-50% report symptoms of depression, recurrent brief depression, or full-blown depressive episodes. (Sobanski, 2006; Kooij, 2012)

6. MINDFULNESS TRAINING

Mindfulness is the practice of purposefully turning to the present moment without evaluation (Baer as cited in Kabat-Zinn, 1994). We would say that it belongs to a skill that one develops through meditation or other training.

Mindfulness is derived from sati, an important element of Buddhist traditions, and is based on Zen, Vipassanā and Tibetan meditation techniques (Karunamuni & Weerasekera, 2019).

Although definitions and techniques of mindfulness are wide-ranging, (Thompson, 2020) Buddhist traditions explain what constitutes mindfulness, such as how past, present, and future moments arise and cease as momentary sensory impressions and mental phenomena (Anālayo, 2003)

Those who have contributed to the popularity of mindfulness in the modern Western context include Thích Nhất Hạnh, Herbert Benson, Jon Kabat-Zinn, Richard J. Davidson, and Sam Harris (Harrington & Dunne, 2015).

Clinical psychology and psychiatry since the 1970s have developed a number of mindfulness-based therapeutic applications to help people experiencing a variety of psychological conditions.

Mindfulness practice has been used to reduce depression, anxiety as well as in the treatment of drug addiction. Programs based on mindfulness models have been adopted in schools, prisons, hospitals, veterans' centers, and other settings, and mindfulness programs have been implemented for additional outcomes such as healthy aging, weight management, athletic performance, helping children with special needs, and as an intervention during the perinatal period (Harrington & Dunne, 2015).

Clinical studies have documented the benefits of mindfulness on both physical and mental health in different categories of patients as well as healthy adults and children.

Research studies have shown a positive relationship between trait mindfulness (which can be cultivated through the practice of mindfulness-based interventions) and psychological health.

Mindfulness practice appears to provide therapeutic benefits for people with psychiatric disorders, including moderate benefits for people with psychosis. Mindfulness-based interventions can enhance trait mindfulness and reduce worry. In addition, mindfulness practice can be a preventive strategy to stop the development of mental health problems (Tang & Leve, 2016).

However, excessive attention can have harmful effects, such as worsening anxiety in people with high levels of self-focus or awareness of their body or emotions.

There is also evidence to suggest that engaging in mindfulness meditation can affect physical health. For example, the psychological habit of repeatedly dwelling on stressful thoughts appears to intensify the physiological effects of the stressor (as a result of continuous activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis) with the potential to lead to physical clinical manifestations that related to health.

Furthermore, research shows that mindfulness can favorably affect the immune system as well as inflammation, which can consequently affect physical health, especially when you consider that inflammation has been linked to the development of several chronic health conditions (Scott-Sheldon et al., 2020).

There are several exercises designed to develop mindfulness meditation, which can be aided by guided meditations. As forms of self-observation and self-awareness, these methods increase body awareness, so they are usually beneficial to people with low self-awareness or low awareness of their body or emotional state, and can cause anxiety, distress, flashbacks, pain, and even and cause substance abuse in individuals who are highly focused on themselves, their bodies, and their emotions (Britton & Willoughby, 2019).

One method is to sit in a straight-backed chair or cross-legged on the floor or on a cushion, close the eyes and pay attention to either the sensations of the breath near the nostrils or the movements of the abdomen as you breathe in and out. In this meditation practice, one does not try to control one's breathing, but simply tries to be aware of the natural process/rhythm of one's breathing (Kabat-Zinn, 2013). When engaged in this practice, the mind often wanders to other thoughts and associations, and if this happens, one passively notices that the mind has wandered, and in an accepting, nonjudgmental way, returns to focus on the breath.

In body scan meditation attention is directed to different areas of the body and noting the sensations of the body occurring in the present moment. One could also focus on sounds, sensations, thoughts, feelings and actions happening in the present. In this regard, a famous exercise, introduced by Kabat-Zinn in his MBSR program, [68] is the conscious tasting of a raisin, in which a raisin is carefully tasted and eaten. By enabling reconnection with internal cues of hunger and satiety, mindful eating has been proposed as a means of maintaining healthy and mindful eating patterns (Kabat-Zinn, 2013).

Other approaches include practicing yoga asanas while observing the body's movements and sensations and walking meditation (Kabat-Zinn, 2013).

The mechanisms that make people less or more mindful have been less researched than the effects of mindfulness programs, so we don't know much about what the relevant components of mindfulness practice. For example, meta-analyses have shown that mindfulness practice increases

mindfulness compared to active control groups. This may be because we don't know how to measure awareness. It could also be that mindfulness is dose-dependent and increases with more experience. To address this, Bergomi et al. (2015) found that results provide evidence for associations between self-reported mindfulness and meditation practice and suggest that mindfulness is particularly associated with ongoing practice in the present, rather than accumulated practice over years.

Some research into other mechanisms has been done. One study conceptualized such mechanisms in terms of competition for attention. In a test of this framework, mindfulness was found to be associated (as predicted) with having an activated intention to be mindful, with feeling good, and with not being rushed or too busy. As for the relationship between feeling good and being mindful, a different study found that causality likely works both ways: feeling good increases awareness, and mindfulness increases feeling good. (Gotink et al., 2016).

We understood in the previous section the review of what mindfulness really is and what its functions are. Therefore, in order to have a correct clinical picture of adults with ADHD, with symptoms of depression, a proper evaluation should be done, so as to separate the difficulties that will arise, and to structure a proper intervention program. At this point, we must emphasize that this situation can face complications, and this is because a large percentage of people with ADHD suffer from one or more psychiatric disorders. (Agnew-Blais, J. C., Polanczyk, G. V., Danese, A., Wertz, J., Moffitt, T. E., & Arseneault, L. (2018).

Through the literature review, it was observed that there are many forms of treatment that greatly help adults with the symptoms we mentioned above. An important place among them is medication, especially in the United States of America, and psychological treatments such as cognitive behavioral therapy and supportive guidance (Fayyad J, Sampson NA, Hwang I, et al, 2017) In recent years, a technique has been developed which succeeded and penetrated many of the above approaches, mindfulness which, as we will see below, provides very important help to deficiencies that the adults we study have. An important element that we should not neglect is the reliability of the therapists who perform this technique. The research proved very helpful as it was realized that the treatments of the technique, we present should be applied by specialist psychologists and psychotherapists both with several years of experience in the diagnosis and treatment of adults with ADHD and at least five years of experience in leading groups of dialectical behavior therapy and more specifically skills training mindfulness and other groups based on it such as mindfulness-based cognitive therapy for patients with depression.

A mechanism that forms the basis of the relationship between ADHD and depression is the regulation of emotions, i.e. the internal and external processes involved in the initiation, avoidance, inhibition, maintenance and regulation of the form, intensity of situations, internal emotions, physiological processes of attention related with the feeling. (Durbin and Shafir 2008; Feng et al. 2009) Thus, difficulties with emotional regulation underlie depression in youth. Furthermore, it was observed that difficulties in this area precede the development of depression, a very important finding in understanding and having an early diagnosis and treatment in this area. (Diler, R. A., Daviss, W. B., Lopez, A., Axelson, D ., Iyengar, S.) Birmaher, B. 2007) The review also found that the mechanism is involved in ADHD in

the form of tedious tasks such as copying a building with bricks from a photograph. Inability to continue construction and emotional difficulty such as outburst of negative emotion and inability to control important functions such as executive (problem solving, focused attention) were noted. In addition, a very special feature was observed that should be mentioned. Aggression in adults with this specific neurodevelopmental disorder was an important differentiator of emotion. The greater the aggression, the higher the level of affect disturbance observed. It becomes clear how important and helpful to therapists, teachers and parents is the two-way relationship of the mechanism of emotion that explains this comorbidity given that emotional regulation is responsible for the development of depression and young people with ADHD present difficulties in the ability to regulate emotions them as we will see in photo 1. Feng, X., Keenan, K., Hipwell, A., Henneberger, A., Rischall, M., Butch, J., et al. (2009). The review process, therefore, showed us and helped us to understand the relationship between adults with depression and ADHD with an important pillar that mediates emotional regulation and significant difficulties in identifying and self-regulating their emotions.

At this point, the effect of mindfulness training on this important factor that mediates between the two disorders, emotional regulation, will be emphasized. The participants were adults who had not previously attended such an intervention and were healthy individuals without smoking or alcohol habits. The procedure included the administration of questionnaires (Freiburg Mindfulness Inventory, Positive, and Negative Affect Scale, Rumination-Reflection Questionnaire as well as the Stroop test) which they should complete before during, and after the end of the intervention process. All participants in the training group had to complete the mindfulness program and record their daily practice on sheets during the 8 weeks of training. The intervention process included body scan meditation and mindful movement in sitting meditations focusing on breathing, body sensations, sounds, thoughts, and open awareness with the aim of being aware and accepting difficult experiences.

The results of the review done on the effect of mindfulness training on the emotional regulation pillar were very significant and interesting. After the 8-week program, awareness, the level of individual mindfulness and the regulation of anxiety, depression and rumination were effectively improved. Thus, with the balance brought about in the mood, the goal of emotional regulation examined above was significantly improved. selective attention as well as improving the ability of adults to complete the said test. (Moore and Malinowski, 2009)

In addition, another mechanism was identified which has a direct relationship between ADHD and depression, working memory. Results were found that support the notion that there may be a relationship between depressive symptoms and cognitive functioning. (Snyder, 2013) Deficits in memory accuracy were detected in the process of encoding, storing and updating stimuli. (Harvey et al., 2005). Overactivity in the prefrontal lobe was found in attentional tasks, suggesting a compensation to overcome deficits in working memory processing. In ADHD these symptoms are more evident in the clinical picture as the mechanism of attention and memory in brain function are inextricably linked. Also, working memory deficits in this neurodevelopmental disorder are related to hyperactive behaviors and movements and to difficulties in social communication and interaction. (Curtis & D'Esposito, 2003)

At this point, we will refer to the effectiveness of mindfulness training in this executive function.

Our sample was 20 ADHD adults who were tested in mindfulness training and tested twice. The program lasted ten days and immediately after its end and at a distance of seven days, the exact same procedure was repeated. The Method used for this purpose included the process of being aware of their natural breathing process. (Kabat-Zinn, 2013) For this purpose, five self-report inventories and two performance measures were used to investigate the possible relationship between mindfulness and executive functioning and more specifically working memory. One of the above was the Attentional Awareness Scale (MAAS; Brown & Ryan, 2003) which helped measure the individual's frequency and strength of awareness. Additionally, the Digit Span Backward (DSB) subscale of the Wechsler Adult Intelligence Scale, 3rd edition (WAIS-III The Psychological Corporation, 1997) was administered to provide a better insight into working memory. The review found an increase in working memory in adults who attended the mindfulness program as well as improved attention during the task. (Baer, 2003; Bishop et al., 2004). As a result, the processing speed of the work and the cognitive mechanism in general increased.

7. THE ROLE OF DIGITAL TECHNOLOGIES

Living in the age of technology it is beneficial to highlight the ways in which technology can enhance people's mindfulness.

The difficulty that people today have in concentrating is much the same when people are diagnosed with ADHD. Focusing attention is difficult because of the many things that people are asked to do at the same time and also because of the continuous use of mobile phones. The antidote to distraction is digital awareness which involves developing good smartphone habits that allow users to train their memory and attention and focus for long periods of time. Some important practices that users can follow to achieve their maximum concentration and overall productivity during the day through mobile devices are presented below.

First, people can start tracking how much time they spend on their device screens in an effort to minimize that time. For this reason, a number of online tools such as Screen Time and Digital Well Being have been created with the aim of helping users spend less time on their devices and detect cases of addiction. Accordingly, it is suggested by major psychotherapist companies that users get away from their devices one day a week in order to devote time to their people and to their personal peace of mind.

On the other hand, there are also many internet applications which aim to present ways in which users will invest in the good habits of their daily lives such as quality sleep, healthy eating, mindfulness exercises and gentle exercise exercises, ways which combined have been shown to produce significant benefits in both depression symptoms and ADHD symptom reduction.

8. RESEARCH CASE – RESEARCH QUESTIONS

The main research hypothesis of the present paper is defined as follows. Are ADHD and depression related? Can Mindfulness Training improve a person's daily life?

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9. CONCLUSION

As the research question was posed, it was divided into 5 main pillars for collecting data and finding relevant research reports. Summarizing the data of this review, the findings for further research are extremely important and interesting. The research questions asked derived the findings analyzed in the above chapters. In conclusion, it is encouraging that cognitive functions such as memory and attention were tested and improved using mindfulness training as well as emotion regulation. After the above study, it is clear that other efforts must be made in the field we have studied in order to cover any gaps that exist. It would be useful in the next steps to investigate the potential influences of mindfulness on other neurodevelopmental disorders such as autism spectrum disorder and to further identify brain mechanisms underlying the relationship between mindfulness and adults with ADHD.

Finally, we emphasize the significance of all digital technologies in the field of education and in ADHD training, which is highly effective and productive and facilitates and improves assessment, intervention, and educational procedures via mobile devices that bring educational activities everywhere[59-62], various ICTs applications that are the main supporters of education[63-75], and AI, STEM, and ROBOTICS that raise educational procedures to new performance levers[76-87] and friendly Games[88-90]. Additionally, the development and integration of ICTs with theories and models of metacognition, mindfulness, meditation, and the cultivation of emotional intelligence[91-119], as well as with environmental factors and nutrition[55-58], accelerates and improves more than educational practices and results, especially in mindfulness training and ADHD, treating.

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