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RESEARCH ARTICLE

# Associative Study between ADHD, Anxiety, Depression, Stress and Excess Body weight in Adolescents

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ABSTRACT

Objective: This study aimed to verify the association between Attention Deficit Hyperactivity Disorder (ADHD), Overweight and other mental disorders, such as anxiety, stress and depression. Method: This is a cross-sectional study. A total of 271 adolescents, 105 girls and 166 boys, with an average age of 14.5 + 2.35 years, were evaluated. The Inventory of Childhood and Adolescence behaviors for the prevalence of ADHD, Anxiety, Depression and Stress and for the Index Of body mass were measured body weight and height classified with overweight above the 85th percentile. To verify the association between mental disorders was used the chi square statistical test, because the sample had no normal distribution, the same happened to verify the association Between overweight and the disorders mentioned above. Results: There was a positive association between ADHD and other disorders, with a value of $p < 0.05$, indicating a high probability between ADHD and Stress, Anxiety or Depression. The results show that there was an association between being overweight with depression (residual -2.2, $p = 0.025$), indicating that overweight adolescents were twice as likely to have depression (PR = 2.53), already Related to stress and anxiety, the values found were not statistically significant, $p = 0.249$ and $p = 0.447$, respectively. CONCLUSIONS: The presence of ADHD increases the likelihood of anxiety, depression and stress, and that being overweight increases the likelihood of depressive symptoms.

## Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is classified as a disorder characterized by inattention, impulsivity and / or hyperactivity, with at least some of the symptoms having emerged during childhood or adolescence. It has long been thought to be an exclusive childhood disorder, but it is known that ADHD persists in adult life in more than half of individuals, many will only be diagnosed at this stage of life, and adult prevalence is estimated In 4.4% [1].

In general, children diagnosed with ADHD concurrently present other comorbidities, such as oppositional defiant disorder, conduct disorder, learning disorders, depression and others [2].

A disorder with a high association with ADHD is anxiety, more than 25% of children with ADHD have anxiety disorder as associated comorbidity, and the occurrence increases by about one-third when it comes to adolescents with ADHD.

Anxiety disorder has a major negative impact on quality of life. Treatments with 3 months of Methylphenidate showed a decrease in anxiety and compulsive symptoms and indicated an improvement in the level of quality of life, as well as in the symptoms of impulsivity, hyperactivity and inattention.

ADHD may also be a contributor to overweight and obesity, which are determined by multiple factors, and the hypothesis that ADHD is a contributor shows the importance of its identification and treatment [3-5].

The two main symptoms of ADHD, inattention and impulsivity, may increase the risk of obesity separately and also together, in part due to insufficient dopamine in the brain. These hypotheses are supported by the mode of action of stimulant medications, which reduce appetite and impulsivity, and increase dopamine availability at the synapses by blocking their transport. Finally, patients with ADHD tend to have greater emotional lability than individuals without ADHD [6]. This characteristic makes them more likely to choose foods that are more caloric to meet negative affect [7].

In the study by Fliers et al. (2013) [8], obesity was more prevalent in younger children. This may be due to the gradual effect of ADHD on obesity [9]. When comparing the effects of obesity in both sexes, it is more common in children than in boys. Finally, the many comorbidities cited above related to ADHD, establish a Risk factor for increasing body mass [10].

Recently the meta-analysis of Nigget al. (2016) [9] concluded that there is no discernible association of ADHD with obesity in preadolescents and that in adolescents, the association is greater in girls than in boys, as shown in previous studies, As it is higher in adults.

Some ADHD symptoms that may persist in adulthood include, difficulty in memory, organization and completing tasks, and difficulty in regulating emotions. Consequently, Many ADHD adults develop concomitant depression and anxiety [11]. Thus, early diagnosis of children with ADHD is very important to avoid complications and to achieve a higher quality of life, as well as the evaluation and the search for appropriate treatment programs for those Patients who have already been diagnosed with the disorder. For patients with ADHD and anxiety, the importance of identifying and treating the severity of anxiety symptoms is reinforced, since these affect the prognosis of their disease [12].

In adolescence there is an increase in academic tasks, responsibilities and commitments, this phase change in life can lead to high levels of stress in low-income individuals, stress can lead to a depressive state. Depression and stress levels are higher in Adolescents with ADHD mainly in the individuals that go through some event like the loss of a near entity, financial difficulties and / or school failure. These comorbidities directly affect academic performance and increase stress [13].

It is observed that individuals with ADHD present other problems that bring damage to their life and that may persist in adulthood, whether related to mental health such as presenting high levels of stress, anxiety and even lead to a depressive or, Physical health as problems with body weight.

Based on the above evidence, this study aimed to verify the possible associations between ADHD and other mental disorders, such as anxiety, stress and depression and to verify if the same disorders are associated with being overweight.

**Materials and methods:**

This was a cross-sectional epidemiological study nested in a cohort study [14]. This study was carried out in a mountain town in the south of Brazil, where 271 students from the 9th grade of elementary school enrolled in the daytime of the network schools Municipal level of education in the year 2014. As criteria for inclusion in the research, the age group was 13 to 16 years of age, did not have any complications that prevented the practice of physical activities and agreed to voluntarily participate in the study.

The calculation of the sample used the base number of the Cohort study, which was 1263 adolescents enrolled

in the 9th year of elementary school in municipal schools, based on the average prevalence presented in the literature that is 6% for individuals with ADHD. Using a confidence interval of 99%, a power of 80% and a standard error of 3%, and considering a design effect 2, the random sampling criterion being simple by the identification number of the previous study, a sample was reached Of 268 adolescents. Counting the possible refusals, 321 questionnaires were distributed and of these, 271 accepted to participate in the survey. For this calculation the statistical software OpenEpi version 2.31 was used.

**Table 1:** Associations between ADHD and other disorders

| TDAH | | Stress | Ansiedade | Depressão |
|---|---|---|---|---|
| Sim | N | 6 | 3 | 4 |
| | % | 60 | 30 | 40 |
| | Resíduo | 6,5 | 2,9 | 3,3 |
| Não | N | 14 | 16 | 22 |
| | % | 5,3 | 6,1 | 8,4 |
| | Resíduo | -6,5 | -2,9 | -3,3 |
| QuiQuadrdado de Pearson | p | 0,000* | 0,004* | 0,001* |
| | RP | 26,57 | 6,59 | 7,27 |
| | IC | 6,72 – 105,08 | 1,55 – 27,92 | 1,90 – 27,73 |

* P <0.05 level of significance, PR = Prevalence Ratio; IC = Confidence Interval

To calculate the body mass index (BMI), the body weight was measured through the balance with an accuracy of 100gr, and body stature measured by the stadiometer. Body mass index was obtained by dividing total body mass by height squared (BMI = weight / height2). Obesity and overweight were defined through the cut-off points of BMI for sex and age according to Conde & Monteiro (2006) [15].

The instrument used to verify the symptoms of ADHD, Stress, Anxiety and Depression was the "ChildBehaviorChecklIst" (CBCL), which consists of a questionnaire with a total number of 113 items, 20 questions aimed at assessing the social competence of the child or adolescent, And 93 regarding the evaluation of their behavioral problems. Information is provided by parents. The behavioral profile of the students to be researched applies to the age group from 5 to 18 years, for this, however, the validated Brazilian version of the questionnaire, the Inventory of Behaviors of Childhood and Adolescence was used [16]. At clinical levels, according to the criteria of the instrument itself, are classified as ADHD, Stress, Anxiety and / or Depression. For this study were recorded all the cases that presented symptoms classified as borderlines and clinical according to the instrument itself.

Ethical aspects:

In order to participate in the study, the parents or legal guardians of the students signed the informed consent form, since the instrument for the verification of ADHD, Anxiety, Depression and Stress has been answered by them. In order to verify the BMI, the participants signed the consent form of the previous study [14].

This research was approved by the ethics committee of UFCSPA under the opinion n ° 688.748 / 2014.

Data Processing and Analysis:

The data was stored in a database formatted in EPIDATA and double-typed. After checking the consistency of the data, the bank was exported to the SPSS (Statistical Package for Social Sciences) program, version 22.

To verify the association between ADHD, Stress, Anxiety and Depression Pearson's Chi square was used, because the sample had no normal distribution, the same happened to verify the association between Overweight and the above disorders.

Results

The sample totaled 271 participants, with a mean age of 14.5 + 2.35 years. An association was made between adolescents with and without ADHD with adolescents who presented the clinical presence of Stress, Anxiety and Depression, as shown in (Table 1) (Annex 1). A positive association between ADHD and the other disorders was observed, with a statistically significant value at p <0.05. The prevalence ratio points out that adolescents who have ADHD have a high likelihood of experiencing Stress, Anxiety or Depression.

In order to verify an association between problems with body weight and other psychological disorders, it was also verified if there is association between excess

**Table 2:** Association between overweight and other mental disorders

| Excesso de Peso | | Stress | Ansiedade | Depressão | TDAH |
|---|---|---|---|---|---|
| Sim | N | 7 | 6 | 11 | 4 |
| | % | 10,6 | 9,1 | 16,7 | 6,1 |
| | Resíduo | 1,2 | 0,8 | 2,2 | 1,4 |
| Não | N | 13 | 13 | 15 | 6 |
| | % | 6,3 | 6,3 | 7,3 | 2,9 |
| | Resíduo | -1,2 | -0,8 | -2,2 | -1,4 |
| QuiQuadrdado de Pearson | p | 0,249 | 0,447 | 0,025* | 0,240 |
| | RP | 1,75 | 1,48 | 2,53 | 2,14 |
| | IC | 0,67 – 4,59 | 0,54 – 4, 05 | 1,10 – 5,83 | 0,58 – 7,83 |

* P <0.05 level of significance; PR = Prevalence Ratio; IC = Confidence Interval

weight, stress, anxiety, depression and ADHD as presented in (Table 2), (Annex 1).

The results demonstrate that there was an association between being overweight with depression (residue - 2.2, p = 0.025), that is, overweight adolescents presented more than double the prevalence for depression than those with adequate weight. Regarding stress, anxiety and ADHD, the values found were not statistically significant (p = 0.249, p = 0.447 and p = 0.240, respectively), which shows that there is no association between being overweight with stress or anxiety and ADHD.

Discussion:

One of the most significant symptoms in ADHD is the attention deficit, the difficulty of maintaining the concentration for longer periods, and it is during this phase of adolescence , That the individual enters the school period more complex, with more disciplines, more responsibilities, and it is also in this period that some charges related to the future of the adolescent begin to emerge, such as which profession to choose, what faculty, what will make of his life in the phase Adult These aspects are contributing to the increase of anxiety and may cause anxiolytic crisis causing academic and personal injury [17,18].

Eliaet et al. [19] investigated 342 children diagnosed with ADHD and the study found that generalized anxiety disorder was one of the disorders with the highest prevalence of ADHD (15.2%), with children with predominance of Hyperactivity having A prevalence of 22.2%, and those with predominance of Attention Deficit 18.6%. Another disorder with a high prevalence in children with ADHD was depression with 21.6% of the sample, and in 20.8% of the children with a predominance of deficit of Attention and 19.4% with predominance of Hyperactivity.

The present study identified a positive association with the level of significance of (p = 0.001), for association between ADHD and depression. The prevalence of depressive disorders in adolescents has increased significantly, according to Yang et al. [20] in a study that aimed to verify the implications of ADHD symptoms, anxiety and depression in the quality of life of adult individuals who had these symptoms in childhood, what was found is that when the symptoms are persistent, In any of the disorders, this impairs the quality of life in adulthood. Strohmeieret al. [21]. In his study evaluated adults with symptoms of ADHD, anxiety and depression and found that adults with ADHD have a strong positive correlation with cognition problems, ie the effects of ADHD bring cognitive impairment in the Future, anxiety and depression are no longer correlated with cognitive disorders.

Anxiety, depression and ADHD show a familial characteristic, Segnreichet al. [22]. Found a strong association in mothers who had one of the disorders

mentioned above with their children presenting ADHD, since in their parents this influence was not significant. Mothers with symptoms of attention deficit were correlated with their children's symptoms of inattention, hyperactivity and anxiety. In the case of mothers with anxiety, these were correlated with symptoms of inattention in the children. The study concludes that the three disorders are correlated with The family, more with the mothers than with the parents, but does not affirm genetic characteristics due to the limitations of the study.

It is known that depressive disorder is often associated with anxious symptomatology, and causes or triggers are most often linked to stressful experiences, however, Dave et al. [23]. suggests that stressful events in patients with underlying anxiety disorders may induce immune changes similar to those in other inflammatory diseases with acute superimposed stress and chronic anxiety. This may explain the known association between stress and clinical adverse reactions, such as exacerbation of asthma and autoimmune disease, as well as acute cardiovascular events.

Another positive association found in this study was ADHD and stress with a significant value of $p < 0.0001$. Stress can be occasioned by events, non-resilient behavioral reactions to certain life events. The individual's resilience is what will determine how to deal with stressful events, it is known that several factors are stressful at this stage of life such as tests and school exams, concerns about the future, lifestyle, difficulty in controlling weight, Among others. When there is no capacity to manage stress, often a depressive picture is established, generating a new problem and making a vicious circle difficult to leave without a specific treatment [24]. In a study by Moksnes et al. [25], where they verified the stress and emotional state of adolescents, taking into account anxiety, depression and self-esteem, it was found that girls have higher levels of stress, anxiety and depression than boys. Presented higher scores for self-esteem. The study points to a strong inverse association for self-esteem and anxiety and depression. There is a paucity of studies regarding ADHD and stress at any stage of life. Studies addressing this issue address the stress of parents or caregivers of the child or the child. Adolescent with the disorder, but study evaluating the association or the relationship between ADHD and stress in adolescents was not found.

Romeo [26] investigated in the literature the neural development of adolescents' brains related to stress and what they could conclude was that adolescence is a period of significant neural maturation, mainly in the limbic and cortical regions, causing sensitivity to events Stressors are increased, giving rise to other dysfunctions such as anxiety, depression, drug abuse and schizophrenia, thus highlighting the importance of care and greater attention to symptoms and reactions exacerbated stressful events of life.

Excess weight, obesity or difficulty controlling weight are stressful factors, but the study presented here did not show an association between being overweight and stress. Anxiety is regularly pointed out by overweight people as a cause for abusive eating behaviors, compulsive behaviors, thus leading to weight gain, but anxiety has also not been shown to be associated with being overweight. Depression, on the other hand, showed a positive association between being overweight and having depression [27].

The results found in the present study point to a well studied and difficult clinical diagnosis such as ADHD, which, according to the data presented, is associated with anxiety, depression and stress. These results demonstrate how much care is needed in the treatment of patients diagnosed with ADHD, and the behavioral reactions in the school environment as well as in the social and family environment.

Social and physical factors such as being overweight also bring harm to the health of individuals because, in addition to possible physical problems such as heart problems, diabetes and other diseases, there is also concern for mental health.

Some studies indicate that overweight adolescents suffer more bullying in the school environment, and this is a stressful event that causes anxiety and can lead to depressive symptoms [14,28].

In this study, a positive association between depression and being overweight was found with a value of ($p =$

0.025), which means that problems with body weight may also be associated with depressive disorders.

The study by Marmorstein et al. [29]. Point out the association of early depression in girls leading to obesity in the future, as well as obesity in late adolescence with adult depression, but suggest that more studies need to be done to better elucidate the mechanism between one and Another, and the differences between the sexes. Roberts and Duong [30], found no association between body weight and depression, but they suggest that cases involving depression and overweight are more related to body image, body satisfaction than weight itself. Limitations of this study, it is pointed out the reverse causality, present in the cross-sectional delineations. And that memory bias may also have occurred in the CBCL questionnaire that was answered by the parents.

Conclusion: It is concluded that anxiety, depression and stress are positively associated with ADHD, indicating a greater probability that the individual with the disorder develops other mental health problems. The second conclusion of this study is that overweight was associated with depression, pointing to the relationship between physical and mental health.

More studies need to be done to verify the relationship of one disorder with another, if the individual who has depression, anxiety or stress can have ADHD, and verify the causality between depression and being overweight.

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