ORIGINAL ARTICLE

Attention-Deficit/Hyperactivity Disorder in the Depressed Adult

R. Haro-Silva[1,2], J. L. López-Guerrero[2], F. Mendoza-Esquivel[2], H. Hernández-Rodríguez[1], J. E. Guerrero-De León[1], Ildefonso Rodriguez-Leyva[1,2]

[1]Faculty of Medicine of the Autonomous University of San Luis Potosí, SLP, Mexico, [2]Neurology Service, Central Hospital "Dr. Ignacio Morones Prieto," San Luis Potosí, SLP, Mexico

ABSTRACT

Objective: The aim of the study was to find the prevalence of attention-deficit/hyperactivity disorder (ADHD) in adults with depression while describing demographic data from the people included in this study, reporting the percentage of depressed patients who meet criteria for ADHD, the percentage of inattention and hyperactive/impulsive subtypes of ADHD in depressed adults and to establish the correlation between the severity of depression measured using the Hamilton scale, and the severity of the ADHD symptoms measured using the Adult Self-Assessment Scale. **Materials and Methods:** A cross-sectional study was conducted to estimate the prevalence of ADHD in adults with depression. Two questionnaires were applied to evaluate the patients. The first was the Hamilton D depression scale, and the second, the adult self-assessment scale developed by the working group on ADHD for adults. The sample was obtained by convenience, evaluating all the patients of the affective clinic of the Everardo Neumann Hospital who attended their appointment during the period of patient capture and met the inclusion and exclusion criteria and the data were processed in the SPSS software version 17 in Spanish. **Results:** A total of 50 patients were included, of which 42 were women with an average age of 41.5 years, with a minimum of 18 years and a maximum of 77 years. Of the 50 patients, 9 (18%) met criteria for ADHD according to the Adult Self-Assessment Scale, with $P = 0.006$ when calculating the Z for the prevalence in the general population (calculated at 4.4% 28); of this 18%, 12% were diagnosed as inattentive, and 6% as impulsive. In 9 (18%) of the patients, it was classified as likely ADHD according to the adult self-assessment scale. When the correlation between the Hamilton scale score and the total score in the two sections of the adult self-assessment scale in the entire patient sample was sought, a $r = 0.401824$ was obtained, with a $t = 3.0401$ and a $P = 0.00019$. When correlating the Hamilton scale with the inattention section in the entire patient sample, a $r = 0.3698$, a $t = 2.7578$, was found with a $P = 0.004$. When associating the Hamilton scale with the impulsivity section of the adult self-assessment scale in the entire sample of patients, a $r = 0.3825$, a $t = 2.8685$, was found with a $P = 0.003$. **Conclusions:** There is a higher prevalence of ADHD in depressed patients, being 18%, with a highly significant $P = 0.0001$. Subjects with depression and ADHD have a symptomatology that differs from that presented by subjects who only suffer from one or the other problem. Individuals with ADHD have significantly greater inattention than the depressed.

Key words: Adult self-assessment scale, attention-deficit/hyperactivity disorder, depression, Hamilton D depression scale

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a mental health disorder that occurs in childhood with a prevalence of 3–7% in the school stage. Until the end of the 80s, it was considered as a childhood condition that remitted in the adolescence. In the early 1990s, several authors described that 30–70% of childhood patients diagnosed with ADHD continued to have symptoms in the adolescence stage and the adulthood stage.[1-3] A study in the

Address for correspondence:
Ildefonso Rodriguez-Leyva, Faculty of Medicine of the Autonomous University of San Luis Potosí, SLP, Mexico/Head of the Neurology Service, Hospital Central "Dr. Ignacio Morones Prieto," San Luis Potosí, SLP, México.
E-mail: ildefonso.rodriguez@uaslp.mx

US general population, with a national representative sample of 3199 adults interviewed, revealed a prevalence of ADHD of 4.4%.[4]

ADHD is defined as a multifactorial and clinically heterogeneous disorder that affects different social areas of the patient. Classic symptoms of ADHD include hyperactivity, impulsiveness, and problems focusing on a task. The fourth version of the diagnostic and statistical manual of mental disorders defines two categories of ADHD based on the prevalence of the symptoms: Inattention and hyperactivity/impulsivity. When ADHD began to be described, it was originally thought that this pathology was originated in a behavioral way and that only the psychological field was the predominant one in the development of ADHD. Magnetic resonance-based studies and hypotheses such as neurological disorders have shown that ADHD also has a strong neurobiological component.[1-6]

In general, pediatric patients diagnosed with ADHD may present problems in school performance with difficulty maintaining attention, restlessness and bothering classmates, behaviors referred most of the times by teachers and parents. On the other hand, in adults with ADHD, may include academic, social, work and family disturbances; they make mistakes due to carelessness (attention), have difficulty remaining seated in a meeting (hyperactivity), drive the car at a high speed, and talk excessively (impulsivity) among other symptoms that force the adult to ask for consultation.[7] Some studies show that ADHD in adults is associated with drug and alcohol use. It is also related to antisocial and criminalistics activity.[8] A population study in the U.S. found an odds ratio of 1.5–7.9 for the risk of substance abuse in adults with ADHD.[9,10] Unlike pediatric patients, adults with ADHD tend to have a predominance of inattention over hyperactivity/impulsivity. In addition, patients with ADHD diagnosed before the 7 years of age are more likely to develop a psychological disorder and that could be related to primary ADHD.[11]

Although it is under discussion that ADHD in adults do not have the same work performance as those who do not,[12] Weiss and collaborators[13] have reported that at least 66% of adults diagnosed with ADHD on childhood still present the same symptoms in adulthood. The prevalence of ADHD in adults has been estimated to be 1–6%.[4]

Etiopathogenesis

Initially, the different hypothesis on the etiology of ADHD was based on the existence of possible brain damage, considering natural birth as the crucial moment where lesions (due to hypoxia), or a prenatal encephalopathy may occur.

There is significant evidence that supports that genetic factors are responsible for the beginning of the symptoms and that they are the ones who may lead to psychological manifestations later in life. A study found that these genetic alterations are related to inheritance in up to 60–91% with ADHD. Another study described how genetic factors that contribute to the development of ADHD are associated with antisocial behavior in adults.[8]

A meta-analysis compared several groups of genes associated with ADHD, and even though this study was criticized, Farone *et al*.[14] described an association between a variant in the gene for the Dopamine D4 receptor (DRD4, repetition of the allele 7) that predisposes to the development of ADHD. Possibly there are also environmental factors that promote the development of ADHD such as having a history of smoking mothers during pregnancy and low birth weight.[15,16]

Several authors have centered their studies at dopaminergic systems, more important, at dopamine transport gene (DAT1) and DRD4 due to its relation with the mechanism of action of psychostimulants, which have been used as a treatment for ADHD. Other genes have also been studied (such as DRD5, DRD3, and DRD1), and this has led to an expansion of the putative systems of the neurotransmitters involved.

Other biological environmental factors related to the clinical manifestation of ADHD have been proposed, such as the presence of lead, nicotine consumption and complications during pregnancy; these and other risk factors for hypoxia and subsequent nerve tissue injury. Within this classification, pathological family dynamics have also been related to ADHD. Within Rutter's work, six risk factors are defined in the family environment that may lead to the development of ADHD: (a) Serious marital disagreement, (b) low social class, (c) large family, (d) paternal delinquency, (e) maternal mental disorders, and (f) adoptive home. None of the above factors by itself imply an increased risk of ADHD, but the association of two of them quadruples the psychopathology and therefore, the possibility of developing ADHD. It was Rutter who extrapolated the association of these risk factors with ADHD.[17,18]

With the support of neuroimaging studies, it has been concluded that ADHD is a frontocortical disorder.[17,19] Other studies indicate that the pathophysiology is associated with an alteration of the dopaminergic and/or the noradrenergic systems, supporting these hypotheses with the clinical effectiveness of psychostimulant drugs. To this end, several models have been designed that attempt to give an explanation of the pathophysiology of ADHD, which is now known as the dual model of executive, cognitive, and emotional functions. In general terms, there is a dysregulation rather than a deficit of catecholamines. Thus, it has been suggested that the cognitive malfunction of subjects with ADHD is due to a hypodopaminergic state in the prefrontal cortex, while there is a hyperdopaminergic state in the striatum which causes hyperactivity.[17]

Deficits in executive functions, plus behavioral inhibition and impaired working memory, are the basis of the future for patients with ADHD diagnosed in childhood and adolescence.[20,21] Some authors have thought that the ADHD symptoms are caused by a deficit in cognitive control domains (CCD).[21,22] Occasionally, a repeated inhibitory response has been found in cognitive control in children[21,23] and in adults with this disorder.[23,24]

It is unknown how the inhibition of domains for cognitive control and memory deficit is associated with ADHD symptoms, although they may have common neurobiological features.[23]

It has recently been suggested that working memory in ADHD has a common pathological complex, which involves the inferior frontal cortex, the frontoparietal cortex, the striatum, and the cerebellum.[23,24] The lack of inhibition in CCD is closely related to the prefrontal ventrolateral nucleus, the anterior cingulate cortex, and the cerebellum in patients with ADHD. With the changes found in ADHD subjects in the prefrontal ventrolateral nucleus, this nucleus has been involved in the persistence of symptoms.[25] A study has raised the possibility of a relationship between prefrontal ventrolateral nucleus and the cerebellum with the dysfunction of this circuit with a role in the development of ADHD. Analyzing a group of affected subjects, a sample of 12 people diagnosed with ADHD was taken by the Department of Psychiatry at the University of Wurzburg, Germany, comparing it against a control group of healthy subjects. The results suggested that healthy adults in the control group have a greater work area compared with adults with ADHD, obtaining $P = 0.001$ considering the cerebellum within the circuits related to the mechanisms of ADHD.[6]

Diagnosis of ADHD in Adults

The clinical manifestations of ADHD include, in addition to cardinal symptoms, neurological soft signs (NSS), which were described by Nichols and Chen as an abnormal functioning of the nervous system, with discrete alterations in motor and sensory functions in the absence of a focal lesion. The origin of NSS is unknown.[26] Some authors have found that NSS are associated with intelligence quotient deficits, hyperactivity, and learning disorders. An association with psychiatric disorders such as depression and ADHD has also been found.[27]

In the absence of a specific biomedical test that diagnoses adult ADHD, assessment scales are excellent diagnostic tools for more general symptoms; the most important is the adult self-assessment scale, the copeland symptom checklist for attention deficit disorders – adult version, the brown attention deficits disorder scale, the Wender-Reimherr Adult attention deficits disorder scale, and Conners' adult ADHD rating scale (CAARS).

Adult self-assessment scale

It is a scale made up of 18 items that can be used as a first self-assessment tool to identify adults who may have ADHD.[28] This was developed by a working group to study ADHD in adults, which includes the New York University Medical Center, the Harvard Medical School, and the Massachusetts General Hospital. On this scale, symptoms are classified according to their frequency: 0 = None; 1 = Rarely; 2 = Sometimes; 3 = Often, and 4 = Very often. Patients can complete the scale in approximately 5 min. Nine items of this test evaluate inattention and the remaining, impulsive hyperactivity. The content of the questionnaire reflects and highlights the importance of DSM-IV, locates the symptoms as well as the limitations of the subject, and facilitates the history for a correct diagnosis. The final score is based on the items, which can be subdivided into two subgroups: Either in the inattentive or the hyperactive/impulsive (using the highest score from the first or second part), and a highly likely diagnosis of ADHD is reached. The scoring scale is divided into a result that describes the patient with an unlikely, probable, or very likely diagnosis of having ADHD. The scale has been validated by the National Comorbidity Survey and by a well-characterized cohort in a population of adults with ADHD.[29]

Copeland symptom checklist for attention deficit disorders – Adult version

This is an excellent aid in assessing whether an adult has characteristic ADHD symptoms. The list covers eight areas, including lack of attention/distraction, impulsivity, activity level problems, noncompliance, poor performance/disorganization/learning problems, emotional difficulties, poor interpersonal capacity, and decreased the ability to do family relationships.[29]

Brown attention deficit disorder scale

It is a frequency scale with 40 points. Like the Wender-Reimherr and Conners scales (described below), this scale explores executive functioning in aspects of cognition that is associated with ADHD. This evaluation has been standardized, validated, and used clinically in the form of self-report.[29]

Wender-Reimherr adult attention deficit disorder scale

This scale is used to measure the severity of the symptoms of adults with ADHD using the Utah criteria, which Wender developed.[30] It measures symptoms in seven categories: Attention difficulties, hyperactivity/agitation, humor, emotional lability, emotional hyperreactivity, disorganization, and impulsiveness. The scale of individual items goes from 0 to 2 (0 = No, 1 = Mild, and 2 = Clearly present) and a summary of each of the seven categories on a scale of 0–4

(0 = No, 1 = Mild, 2 = Moderate, 3 = Quite a lot, and 4 = A lot). It can be especially useful for assessing the mood and lability of ADHD. In fact, a recent study has proven that this scale is an effective measure in the improvement of mood symptoms in a controlled trial of norepinephrine reuptake inhibitors, atomoxetine.[31]

CAARS

This scale is composed of 30 items sorted on a frequency scale. Symptoms are evaluated by a combination of frequency and severity. Patients respond to a Likert type scale (0 = No, never, 1 = A little, occasionally, 2 = Quite, often, and 3 = A lot, very often). The total of the 18 items of the DSM-IV can be extrapolated from the CAARS. It exists in versions of observers and self-report. This scale has also been clinically validated.[32]

ADHD and its Associated Comorbidities

Comorbidities occur in three out of four adults diagnosed with ADHD. The most frequent are affective area disorders (depression, bipolar disorder, and dysthymia) with a prevalence of between 19% and 37%; anxiety disorder (25–50%); and alcohol and other drug abuse (32–53%).[12]

Although depression and ADHD are presented as separate mental disorders, we already mentioned that they can be present in the same person and significantly affect the patient's quality of life by up to 70%.[1] There are some differences that can help us to diagnose ADHD and depression as independent conditions or as comorbidities, such as the date of onset of symptoms where depression often begins in adolescence while in ADHD usually does in childhood. While depression is usually episodic, ADHD is chronic and persistent over time. Among the most important characteristics to differentiate these pathologies are that depression is an affective disorder, and ADHD is a cognitive disorder. However, these two pathologies can occur together in the same subject, thus worsening the symptoms of depression.[4,33]

According to the few published studies, 9% of children with ADHD meet the criteria for depression, well above the expected prevalence in childhood (2%) and adolescence (4%). The existence of ADHD and depression causes comorbidity that worsens these disorders.[34] In a study of the pathophysiology of ADHD, data from a University Hospital were analyzed by Hesslinger *et al*.[17] comparing two groups. The first consists of patients with ADHD diagnosed when seeking depression and the second by patients with depression who also suffered from ADHD. The prevalence of depression in patients with ADHD was 70% (n = 28). In 5 of 28 patients (17.9), there was a history of affective disorders that did not meet the criteria for depression. While in the group of patients with depression, 42.5% (n = 17) was diagnosed with ADHD. Five of these patients (29.40%) had an associated affective disorder. In another study, it was found that 18.9% of the patients with depression suffered from ADHD, and the prevalence of depression in patients with diagnosed ADHD was 9.4%.[35,36] Another retrospective study conducted in Toronto, Canada, enrolled 399 patients with major depression and bipolar disorder; they were applied the mini-international neuropsychiatric interview-plus looking for ADHD data. The percentage of patients with major depression and bipolar disorder who met the criteria of ADHD in adulthood was 5.4% and 17.6%, respectively.[37] In another clinical study conducted in Boston, a 16% prevalence of ADHD was found in depressed adults. With a consecutive sample of 116 patients.[38]

Problem statement

At present, adults with ADHD are underdiagnosed.[12] Studies in depressed patients are insufficient in the medical literature and even absent for the Mexican population. From what I researched, the prevalence of ADHD in the population of depressed Mexican adult patients remains unknown.

Justification

- The sum of these disorders increases episodic symptoms of depression, decreasing the patient's quality of life.
- Using medical information search engines such as PubMed, Medline, and Medscape, no clinical study was found that reported comorbidity with ADHD in depressed Mexican patients. However, an indexed article was found that studied this relationship, conducted in the US population.
- Knowing the prevalence of this comorbidity for these pathologies (ADHD and depression) would help to raise hypotheses regarding a possible vicious circle between ADHD as a precursor to depression and depression as a masking factor in the diagnosis of adult ADHD.

Objectives

General objective: Find the prevalence of ADHD in adults with depression.

Specific objectives:

- Describe demographic data from the people were included in this study.
- Report the percentage of depressed patients who meet criteria for ADHD.
- Find the percentage of inattention and hyperactive/impulsive subtypes of ADHD in depressed adults.
- Establish the correlation between the severity of depression measured using the Hamilton scale and the severity of the ADHD symptoms measured using the adult self-assessment scale.

Study design

Type of research

This was a observational study.

Type of design
This was a cross-sectional study.

Study characteristics
This study was a descriptive cross-sectional.

MATERIALS AND METHODS

Two questionnaires will be applied to evaluate patients. The first is the Hamilton D depression scale, this scale has 17 items, and is recommended by the Mental Institute of the United States of America. The validation of the Castilian version of this scale was carried out in 1989 by Ramos-Brieva.[34,39-41]

The second questionnaire is the adult self-assessment scale developed by the working group on ADHD for adults, which includes the New York University Medical Center, the Harvard Medical School, and Massachusetts General Hospital. The scale is validated by the National Comorbidity Survey and the WHO.

Place and Duration

- Place – Psychiatric Hospital "Everardo Neumann."
- Duration – Six weeks
- Universe, observation units, sampling methods, and sample size

The sample was obtained by convenience, evaluating all the patients of the affective clinic of the Everardo Neumann Hospital who attended their appointment during the period of patient capture and met the inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

Inclusion criteria

- Patients assessed by a psychiatrist who meets the DSM-IV criteria for depression.
- Patients older than 18 years old.
- Patients with sufficient cognitive status to answer questionnaire questions.
- Signed informed consent.

Exclusion criteria

- Patients with neurologic disorders that preclude the interview.
- Patients who do not meet the diagnostic criteria for depression.
- Patients under treatment with drugs that produce depressive symptoms or attention disorders.
- Patients who have not signed the informed consent.

Variables in the Study

Hamilton D scale

Severity of clinical depression
The word depression comes from Latin depression: Sinking. It is an affective disorder that varies from transient low moods that are characteristic of life itself, to the clinical syndrome.

Operational definition: Any patient who meets a minimum of 8 points on the Hamilton depression scale will be considered symptomatic.

Mild depression
When the person presents some of the symptoms of depression and performing their activities of daily living takes an extraordinary effort.

Operational definition: Patients meet a score of 8–12 points on the Hamilton depression scale.

More than mild depression
It is defined when the symptoms of depression exceed mild depression but do not reach major depression.

Operational definition: Patients who meet a score of 13–17 on the Hamilton depression scale.

Major depression
Major depression is considered a mood disorder with severe and prolonged feelings of sadness with no apparent cause or related symptoms that hinder efficiency.

Operational definition: Patients who meet a score of 18–29 on the Hamilton depression scale.

More than major depression
State that overcomes major depression

Operational definition: Patients who meet a score of 30–52 on the Hamilton depression scale.

Adult self-assessment scale

ADHD
It is a disorder characterized by the presence of inattention, hyperactivity, and/or impulsivity; it regularly occurs before the age of seven.

Operational definition: Patient who has a score of at least 24 points or more in either of the two sections on the adult self-assessment scale.

Probable ADHD
Patient with high suspicion of ADHD but who needs to be assessed with more elaborate neuropsychological tests to confirm the diagnosis.

Operational definition: Patient who has a score of 18–23 points in either of the two sections on the adult self-assessment scale.

ADHD with predominance inattention
Patients diagnosed with ADHD where inattention symptoms outweigh hyperactivity.

Operational definition: Patient who has a 24 or higher score in part A on the adult self-assessment scale.

ADHD with predominance hyperactive/impulsive
Patients diagnosed with ADHD where symptoms of hyperactivity/impulsivity exceed inattention

Operational definition: Patient who has a 24 or higher score in part B on the adult self-assessment scale.

Demographic Variables

Age

Time in years that a person or certain animals or vegetables have lived.

Operational definition: Patients aged 18 years or older.

Gender

Organic condition, male or female, of animals or plants.

Operational definition: Male or female.

Scholarship

Set of courses that a student follows in a teaching establishment.

Operational definition: Degree of schooling, classified in none, primary, secondary, preparatory, and undergraduate or higher.

Human resources

Rubén Haro Silva.

Jorge Arturo Barreras Espinoza.

Material resources

Paperwork.

SPSS software version 17 in Spanish.

Funding

Intern.

Schedule of Activities

Week	Activity
1 (June 28–July 4)	Bibliography review
2 (July 5–11)	Research protocol drafting
3–5 (July 12–October 10)	Data collecting
6 (October 10–November 15)	Results analysis and writing

RESULTS

A total of 50 patients were included, of which 42 were women. With an average age of 41.5 years, with a minimum of 18 years and a maximum of 77 years, finding a standard deviation of 13.52.

About 10% of the patients had no schooling, 36% only with elementary schooling, 20% secondary school, 12% high school, and 22% with a bachelor's degree or higher.

A quarter (26%) of the patients were found without symptoms of depression according to the Hamilton scale, the same percentage (26%) had mild depression, 22% more than mild depression, 24% major depression, and 2% with more than major depression.

Of the 50 patients, 9 (18%) met criteria for ADHD according to the adult self-assessment scale, with $P = 0.006$ when calculating the Z for the prevalence in the general population (calculated at 4.4% 28); of this 18% and 12% were diagnosed as inattentive and 6% as impulsive. In 9 (18%) of the patients, it was classified as likely ADHD according to the adult self-assessment scale.

When the correlation between the Hamilton scale score and the total score in the two sections of the adult self-assessment scale in the entire patient sample was sought, a r = 0.401824 was obtained, with a $t = 3.0401$ and a $P = 0.00019$. When correlating the Hamilton scale with the inattention section in the entire patient sample, a r = 0.3698, a $t = 2.7578$, was found with a $P = 0.004$ [Figure 1]. When associating the Hamilton scale with the impulsivity section of the adult self-assessment scale in the entire sample of patients, a r = 0.3825, a $t = 2.8685$, was found with a $P = 0.003$ [Figure 2].

If only the subgroup of patients with ADHD diagnosis by the adult self-assessment scale is taken, and correlate it with the total score of the Hamilton scale and the total score in the two sections of the adult self-assessment scale with a r = 0.5915, with $t = 1.9411$, a $P = 0.04$ is obtained [Figure 3]. When correlated in this same sample, the Hamilton with the adult self-assessment scale inattention section score, a r = 0.7288, a $t = 2.81$ with $P = 0.01$ was obtained [Figure 4]. When correlating the Hamilton scale with the adult self-assessment

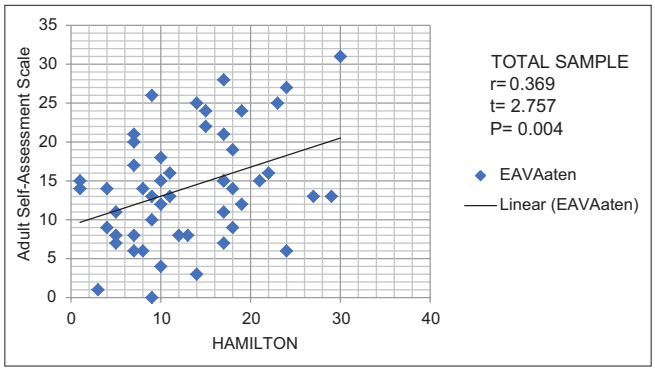
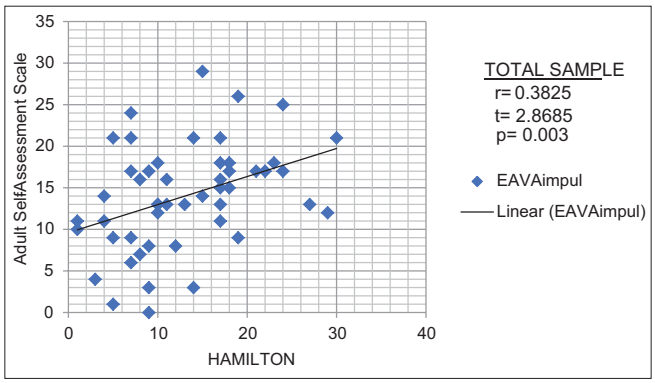


Figure 1



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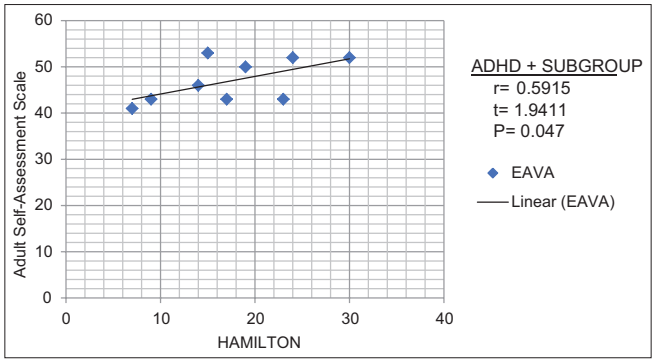

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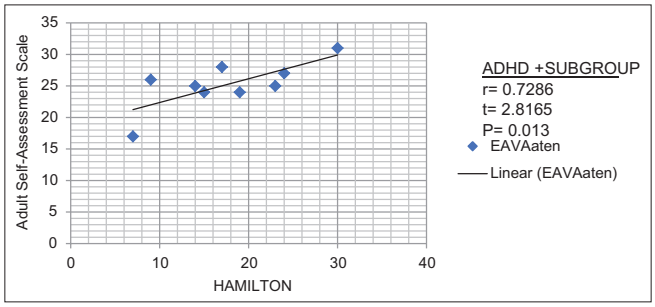

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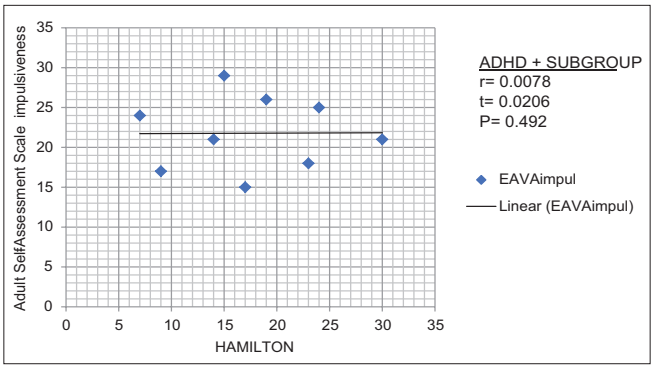

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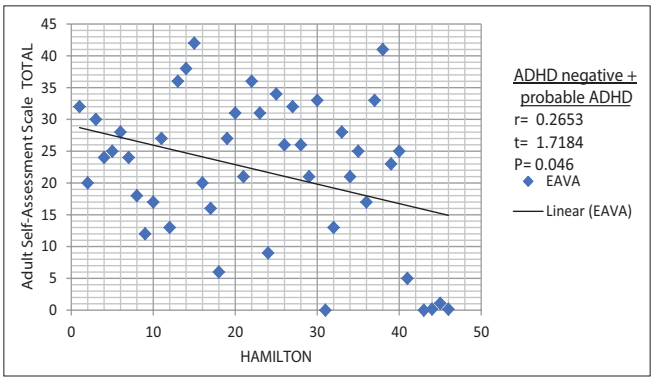

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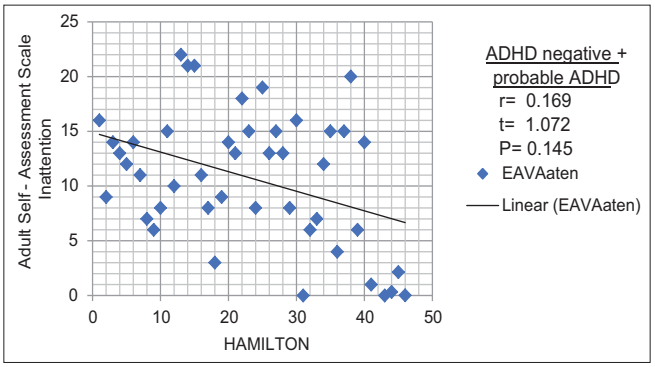

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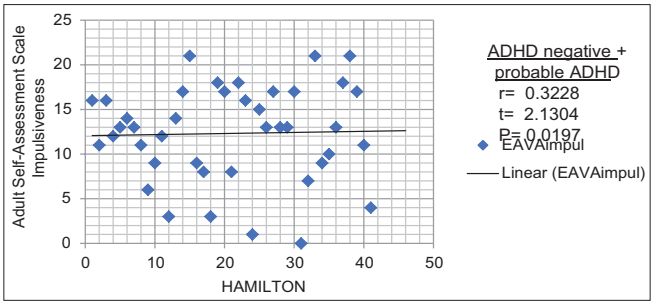

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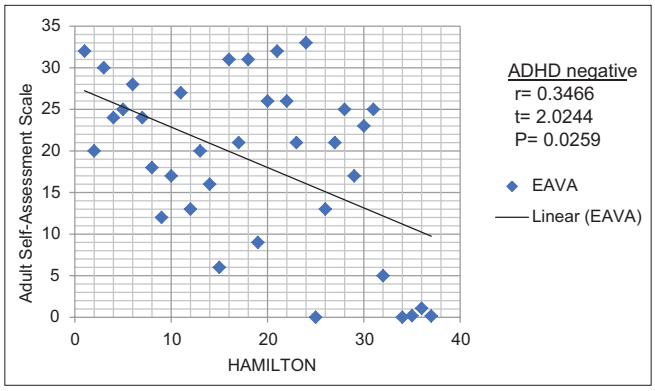

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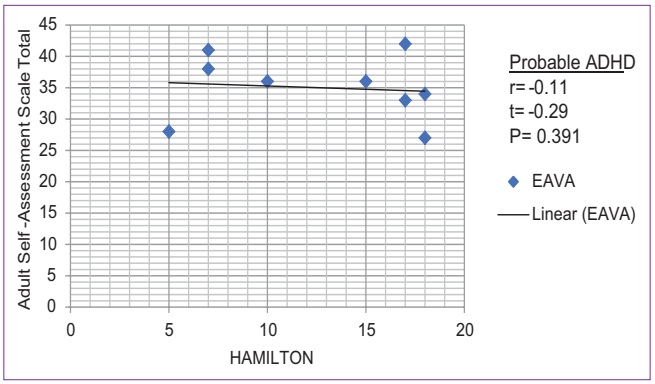

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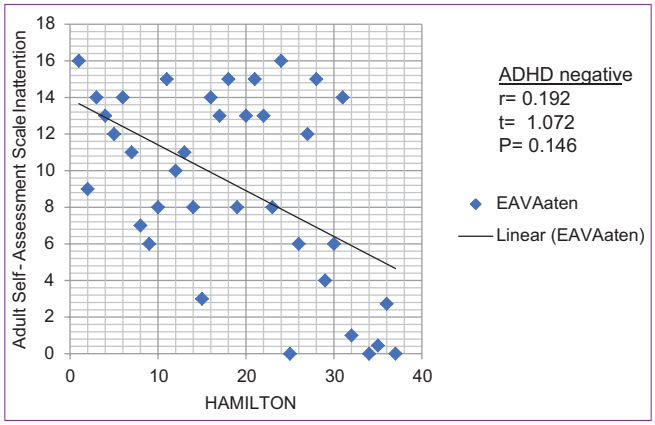

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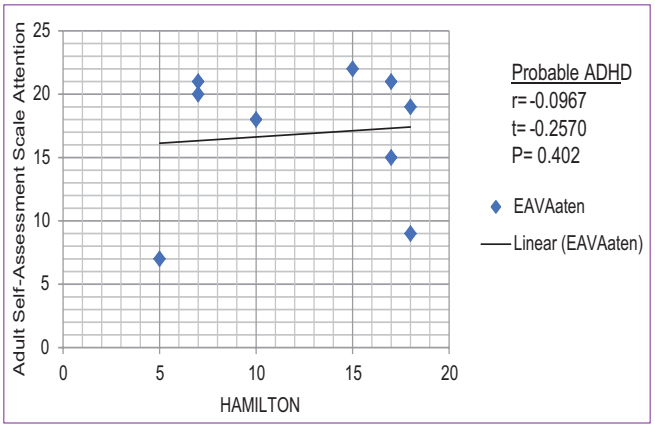

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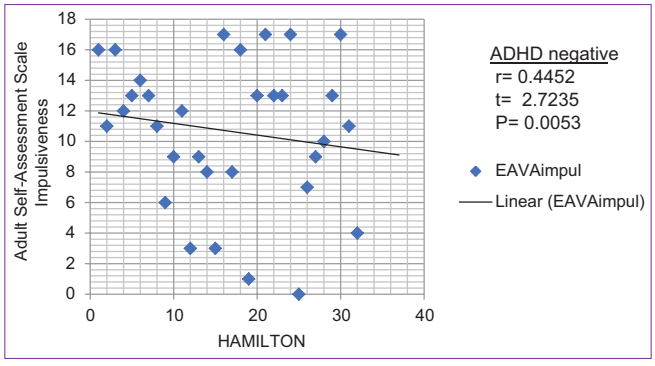

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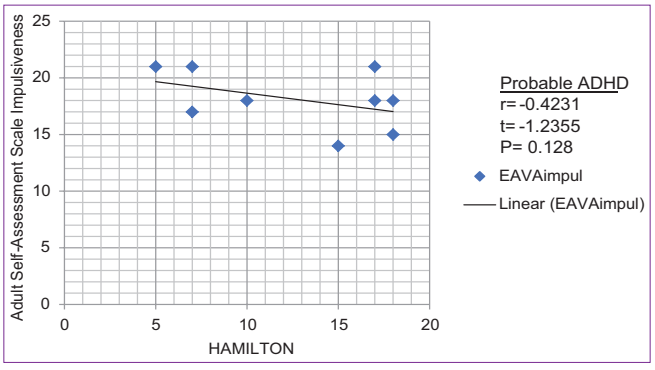

Figure 14

scale impulsivity section score, a r = 0.0078 was obtained and *t* = 0.0206 with a p of 0.49 [Figure 5].

Studying the subgroup of patients without ADHD due to the adult self-assessment scale, which includes the ADHD negative patients and the likely ADHD: The total Hamilton was correlated with the total adult self-assessment scale, with a r = 0.2653, a *t* = 1.7184, with a *P* = 0.046 [Figure 6]. The Hamilton correlation with the adult self-assessment scale inattention section score had a r = 0.169, a *t* = 1.072, with *P* = 0.145 [Figure 7]. The Hamilton correlation with the adult self-assessment scale impulsivity section score had a r = 0.3228, a *t* = 2,130, with a *P* = 0.02 [Figure 8].

In the subgroup of ADHD-negative patients by the adult self-assessment scale, the correlation between Hamilton score and the adult self-assessment scale total was calculated with a r = 0.346, a *t* = 2.02, with a *P* = 0.02 [Figure 9]. The correlation between Hamilton and the adult self-assessment scale attention section had a r = 0.192, a *t* = 1.072, with a

$P = 0.146$ [Figure 10]. The correlation between Hamilton and the impulsivity section of the adult self-assessment scale had a r = 0.445, a $t = 2.72$ with a $P = 0.005$ [Figure 11].

In the subgroup of patients with probable ADHD due to the adult self-assessment scale, the correlation between the Hamilton and total adult self-assessment scale scores was calculated with a r = -0.11, a $t = -0.29$ with a non-significant $P = 0.391$ [Figure 12]. The correlation between Hamilton and the adult self-assessment scale inattention section had a r = 0.096, a $t = 0.257$, with a significant $P = 0.402$ [Figure 13]. The correlation between Hamilton and the adult self-assessment scale impulsivity section had a r = -0.423, a $t = -1.2355$, with $P = 0.128$ [Figure 14].

CONCLUSIONS

There is a higher prevalence of ADHD in depressed patients, being 18%, with a highly significant $P = 0.0001$.

Subjects with depression and ADHD have symptomatology that differs from that presented by subjects who only suffer from one or the other problem. Individuals with ADHD have significantly greater inattention than depressed.

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