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Comprehensive Psychiatry 55 (2014) 1712–1719

COMPREHENSIVE PSYCHIATRY

www.elsevier.com/locate/comppsych

Emotional lability: The discriminative value in the diagnosis of attention deficit/hyperactivity disorder in adults

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Abstract

Objective: The aim of this study is to assess the discriminative value of emotional lability (EL) in the diagnosis of adults with ADHD.
Methods: A group of adults who met ADHD *DSM-IV* diagnostic criteria (n = 589), a clinical control group (n = 138) and a community control group (n = 98) were compared in EL scores. SCID-I, SCID-II and CAADID were used to select subjects. The specific subscale on EL of the Conners Adult ADHD Rating Scale (CAARS) was used to evaluate EL.
Results: An analysis of the covariance was carried out in order to explore the association between EL, ADHD and comorbidity. The group factor (ADHD, clinical or community group) and the comorbidity factor (presence or absence of other psychiatric disorders different from ADHD) showed to be significant on EL intensity (group: F = 81.78 p = 0.000; comorbidity: F = 25.48 p = 0.000). However, no significant differences were found in the group × comorbidity interaction (F = 1.006, p = 0.366). EL showed a sensitivity of 87.1% and a specificity of 46.6% in discriminating between ADHD patients and subjects with other psychiatric disorders.
Conclusion: EL is specifically related to ADHD and this association is not explained for the presence of other psychiatric disorders. The presence of comorbid disorders is only related to a major intensity of EL.

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a developmental neurobiological disability that appears in childhood and persists into adulthood in at least 57% of the cases causing a significant functional impairment [1–3]. The *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) includes inattention and impulsivity–hyperactivity as core symptoms and defines three predominant cluster of ADHD symptoms: combined ADHD which is the most common, followed by the predominant inattentive symptoms and the hyperactive/impulsive symptoms. Nevertheless, *DSM-IV* and the recent *DSM-5* do not include emotional lability (EL) as diagnostic criteria for ADHD.

Different researchers have drawn attention to the presence of emotional symptoms in adults with ADHD [4]. Barkley's theoretical model has pointed out at the importance of emotional self-regulation as a core symptom of ADHD [5]. Emotional dysregulation was also included in the Utah criteria [6]. According to this approach, deficits in emotional regulation are defined by three domains referring to temper control, affective lability and emotional over reactivity. In the same line, Barkley and Murphy [7] proposed the term "deficient emotional self-regulation" to refer to being quick to get angry or become upset, easily frustrated, overreact emotionally, easily excited, lose temper, argue with others, being touchy or easily annoyed by others and angry or resentful. On the other hand, Brown's model proposes the domain "affective interference" [8] and finally Conners' model adds emotional lability as an emotional feature of ADHD [9].

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http://dx.doi.org/10.1016/j.comppsych.2014.07.001
0010-440X/

Emotional dysregulation [10], emotional impulsiveness [11], mood instability [12] and emotional lability [13] have been used to refer to similar conceptualizations [14–16]. Rösler et al. [17] observed high correlations between the measure of emotional dysregulation (EDS Emotional Dysregulation Scale) and Emotional Lability of the CAARS Scale (Conners Adult Attention Deficit Scale). In the current research, the term EL is used in accordance with Conners' model referring to irritability, unpredictable moods, setting off easily, hot temper, low frustration tolerance and difficulties in anger management [9].

EL has been previously investigated in adults with ADHD [7,18,19] and in children [13,20–31]. It has been associated with several variables of ADHD severity, such as greater ADHD functional impairment [7,32], lower quality of life [33], ADHD persistence [1,11] and higher ADHD severity in childhood [13]. These studies have reported that EL explains part of the functional impairment in ADHD that is not accounted by the core symptoms of inattention and hyperactivity/impulsivity. However, little is known about the significance of this construct in the diagnosis of the disorder.

There is an ongoing discussion whether symptoms of EL should be included as a core symptom to the conceptualization of ADHD. On the one hand, EL has frequently been observed in clinical samples of adults with ADHD [7,18,19]. Moreover, several empirical studies have demonstrated that EL is interlinked to ADHD [18,34]. In the same line, psychopharmacological treatments for ADHD have shown to reduce ADHD symptoms in parallel with EL in adults [17,35–38] and also in children [39,40] suggesting that EL could be an intrinsic symptom of ADHD. Furthermore, recent investigations have found common neuroanatomical substrates underlying ADHD symptoms and EL [41,42]. However, previous reviews reported that EL is present in other disorders such as anxiety, depression, bipolar disorder, oppositional defiant disorder and personality disorders suggesting that EL presents a low specificity as diagnostic criteria for ADHD and that EL constituted a transversal feature in other psychiatric disorders different from ADHD [16,43]. Only one previous study has been published which assesses the predictive ability of EL in the diagnosis of ADHD obtaining a sensitivity of .85 and a specificity of .81 [19]. However, no patients with comorbid conditions or other psychiatric diagnosis different from ADHD were included. Thus, it is still unclear whether EL is attributable to ADHD or if it is a result of the presence of comorbidity.

The main objective of the current research was to assess the discriminative value of EL in the diagnosis of adults with ADHD. The present investigation is the first in assessing the discriminative value of EL in the diagnosis of adults with ADHD considering the presence of other psychiatric disorders different from ADHD (Axis I and Axis II comorbidity).

2. Methods

2.1. Participants

The sample consisted of three groups: a group of ADHD patients, a clinical control group and a community control group.

1. ADHD group (n = 589): subjects who met ADHD *DSM-IV* diagnostic criteria in adulthood and in childhood. ADHD patients were recruited through an Adult ADHD Program at a University Hospital in Barcelona, Spain. The ADHD group consisted on patients with the diagnosis of ADHD with and without comorbidity.
2. Clinical control group (n = 138): this group was recruited from outpatient clinic of general psychiatry at the same hospital. The clinical control group was established in order to assess the specificity of emotional lability between the ADHD group and clinical control subjects with other psychiatric disorders different from ADHD.
3. Community control group (n = 98): constituted by general population subjects recruited through advertisements. The objective was to assess non-clinical subjects.

The inclusion criteria for the ADHD group were being older than 18 years and fulfilling *DSM-IV* diagnostic criteria for ADHD [44]. Patients with ADHD and other comorbid disorders: anxiety disorders, mood disorders, substance use disorders (SUD) and personality disorders were included. The ADHD patients with SUD needed to be abstinent for a minimum period of 1 month prior to the study. Exclusion criteria from the ADHD group were intellectual quotient IQ <85, schizophrenia or other psychotic disorders, symptoms of substance intoxication and withdrawal, ADHD symptoms due to mood, anxiety or personality disorders, sexual or physical abuse and neurological or systemic disorders that might explain ADHD symptoms.

The inclusion criteria of the clinical control group were to be out-clinic patients of general psychiatry at the same hospital and over 18 years of age. The exclusion criteria were to have childhood or adulthood *DSM-IV* diagnostic criteria for ADHD, intellectual quotient IQ <85, and schizophrenia or other psychotic disorders and symptoms of substance intoxication and withdrawal.

Finally, the inclusion criteria of the community control group were being over 18 years of age and not having accessed an ADHD program or an out-clinic of general psychiatry. The exclusion criteria were to have childhood or adulthood *DSM-IV* diagnostic criteria for ADHD schizophrenia or other psychotic disorders, to present symptoms of substance intoxication or withdrawal and intellectual quotient IQ <85.

2.2. Procedures

Patients from the ADHD group and the two control groups were recruited during the period running from September 2008 to September 2012. The evaluation was performed before the patients started pharmacological treatment.

A total of 600 patients with an ADHD diagnosis visited in the ADHD program during the study period. Of these patients 589 accepted to participate in the study. On the other hand, 153 patients visited in the out-clinic of general psychiatry, 138 of which participated. As for the community control group, 102 subjects were screened and 98 fulfilled the inclusion criteria. The study was approved by the ethics committee of the hospital and all participants signed an informed consent. Patients receive no funding for their participation in the study.

2.3. Clinical assessment

2.3.1. Adult ADHD

Diagnosis of ADHD was established by senior psychiatrists and psychologists experienced in the diagnosis of adult ADHD. The Spanish version of Conners Adult ADHD Diagnostic Interview for DSM-IV (CAADID part II) was used for the diagnostic of ADHD [45,46]. The CAADID is a semi structured interview that consists of two parts. The first part is divided into four areas: demographic history, psychomotor development, risk factors and comorbidity. It can be completed by the patient or a clinician. The second part is administered by the clinician in order to evaluate the *DSM-IV* criterion of ADHD. Previous studies have observed a high diagnostic reliability between clinicians, a kappa of 1.0 has been obtained in ADHD diagnosis between clinicians with a 95% confidence interval of 0.8–1.0 [47].

Severity of ADHD symptoms in adulthood was evaluated using the following scales:

- ADHD Rating Scale (ADHD-RS) [48]: it is an 18 item scale that assesses the diagnostic criteria for ADHD. The patient rates the frequency of each item in the past 6 months on a 4 point Likert scale (0–3).
- Wender Utah Rating Scale (WURS) was implemented to assess severity of ADHD during childhood [49]. It is a 61 item self-reported scale. Patients are asked to self-report retrospectively ADHD symptoms during childhood.

2.3.2. Emotional lability

This variable was evaluated with the self-reported Conners Adult ADHD Rating Scale-long version (CAARS) [9] which is designed to assess ADHD in adults and includes the following subscales: inattention/memory problems, hyperactivity/restlessness, impulsivity/emotional lability, problems with self-concept, *DSM-IV* inattentive symptoms, *DSM-IV* hyperactive–impulsive symptoms, *DSM-IV* ADHD symptoms total and ADHD index. The CAARS consists of 66 items.

Of these 66 items, 12 correspond to impulsivity/emotional lability: 6 items are related with emotional lability (61, 47, 30, 19, 23, and 8) and 6 items are associated with impulsivity (12, 4, 39, 52, 43, and 35). The emotional labilty factor consisted of the following items: “I am irritable”, “I have unpredictable moods”, “Many things set me off easily”, “I have a hot temper/I lose patience easily”, “I still throw tantrums” and “I get frustrated easily”. Each item is scored on a four point Likert scale ranging from 0 to 3 (0 = “not at all or never“; 1 = “just a little, once in a while”; 2 = “pretty much, often”; 3 = “very much, very frequently”). CAARS is the only psychometric measure validated in Spanish containing specific items to assess EL in adults with ADHD [50]. (Table 1).

2.3.3. Comorbidity

For differential diagnosis and comorbidity assessment, Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders DSM*-IV Axis I (SCID-I) [51] and *Diagnostic and Statistical Manual of Mental Disorders DSM*-IV Axis II (SCID-II) [52] were used.

2.3.4. Intellectual quotient

IQ was screened by Vocabulary and Block Design subtests of the *Wechsler Adult Intelligence Scale 3rd Edition* (WAIS-III) [53]. Patients also completed the Digit Span, Arithmetic, Letter-Number Sequencing and Symbol Search subtests of the WAIS-III.

2.4. Statistical analyses

The internal consistency reliability of the emotional lability factor of the CAARS was assessed using Cronbach’s alpha. An analysis of covariance (ANCOVA) was used in order to analyse the association between EL and ADHD and comorbidity association. Two principal factors were considered, clinical conditions (ADHD vs. clinical control vs. community control) and the comorbidity (with vs. without). The interaction of both principal factors was also analyzed in order to explore if comorbidity has a differential effect between clinical conditions. Age and gender were considered as covariates. The clinic group and community participants were grouped in a non-ADHD group. A logistic regression analysis was performed to determine the capacity of EL to discriminate between ADHD vs. non-ADHD participants. Sensitivity and specificity parameters were calculated. Moreover, differences on EL between the three ADHD subtypes were analyzed considering age and gender as covariates. All statistical analyses were conducted using the SPSS 20.0 software and statistical significance was set at $p \leq 0.05$.

3. Results

3.1. Participant characteristics

Table 2 shows the participant’s demographic and clinical characteristics. Significant differences were obtained

Table 1
Items of emotional lability scales.

CAARS emotional lability subscale items	Wender–Utah emotional subscale items
I am irritable	TEMPER
I have unpredictable moods	Hot tempered
Many things set me off easily	Temper outbursts, losing control Irritable
I have a hot temper/I lose patience easily	AFFECTIVE LABILITY
I still throw tantrums	Quick to get angry/upset
I get frustrated easily	Easily frustrated
DESR scale items	Overreact emotionally
Quick to get angry or become upset	Easily excited
Easily frustrated	Lose my temper
Overreact emotionally	Argue with others
Easily excited by activities going on around me	Touchy or easily annoyed
Lose my temper	I am angry or resentful
Argue with others	EMOTIONAL OVER-REACTIVITY
I am touchy or easily annoyed by others	Feel overwhelmed/frustrated
I am angry or resentful	Feel things very intensely
	Over-react to pressure
	Under stress responsibilities are too demanding
	Pressures or stress causes anxiousness, disorganization

between all groups on age [$F(2.824) = 12.119$ $p < 0, 0005$], gender [$\chi^2(2) = 11.905$, $p = 0.003$], years of education [$F(2) = 12.15$ $p = 0.001$] and presence of other psychiatric disorders [$F(2) = 12$ $p < 0.000$].

Participants in ADHD group were significantly younger ($M = 32.89$, SD = 10.55) than the clinical control group ($M = 34.83$, SD = 11.38) and in the community control group ($M = 38.65$, SD = 13). A high rate of men was observed on the ADHD group (ADHD group = 66.89%; clinical control group = 62.2% and community control group = 48.98%). The ADHD group showed fewer years of education ($M = 11.58$, SD = 6.26) compared to the clinical control group ($M = 11.72$, SD = 4.42) and the community group ($M = 14.04$, SD = 4.22). The clinical control group showed higher rates of unemployment (clinical control group = 21.73%; ADHD group = 19.86% and community group = 15.30%). ADHD patients showed higher prevalence of mood disorders [$\chi^2(2) = 16{,}165$, $p < 0.0005$], more anxiety disorders [$\chi^2(2) = 17.782$, $p < 0.0005$] and SUD [$\chi^2(2) = 25.829$, $p < 0.0005$] than clinical and community control group. The groups did not differ in terms of IQ scores.

In the ADHD group ($n = 589$), 57.2% of the patients were combined subtypes, 36.3% were inattentive subtypes and 6.45% were hyperactive subtype. Of the ADHD patients, 48.55% had no comorbid disorders and 51.44% of the patients present comorbid disorders: 40.24% had anxiety disorders, 41.76% had mood disorders, 42.78% with substance use disorders and 24.78% personality disorders.

The clinical control group ($n = 138$) consisted of 38.4% of patients suffering mood disorders, 34.06% with anxiety disorders, 29.71 with substance use disorders and 14.49%

Table 2
Participants' characteristics.

Variables	ADHD ($n = 589$)	Clinical ($n = 138$)	Community ($n = 98$)	p
	n (%)	n (%)	n (%)	
Gender				<0.005
Male	394 (66.89)	86 (62.32)	48(48.98)	
Female	195 (33.11)	52 (37.68)	50(51.02)	
Employment				0.035
Unemployed	117 (19.86)	30 (21.73)	15 (15.30)	
Working	378 (64.17)	95 (68.84)	64 (65.30)	
Studying	90 (15.38)	10(7.41)	12(13.19)	
ADHD subtype				
Inattentive	214(36.33)			
Hyperactive	38(6.45)	-	-	
Combined	337(57.22)	-	-	
		-	-	
Other disorders				<0.001
Presence	303 (51.44)	59 (42.75)	22 (22.44)	
Absence	286 (48.55)	79 (52.24)	76 (77.51)	
Type of other disorders				
Mood disorders	246 (41.76)	53 (38.40)	20 (20.41)	<0.001
Anxiety disorders	237 (40.24)	47 (34.06)	18 (18.37)	<0.001
SUD	252 (42.78)	41 (29.71)	18 (18.37)	<0.001
Personality disorders	146 (24.78)	20 (14.49)	6 (6.12)	0.150
	M (SD)	**M (SD)**	**M (SD)**	**p**
Age	32.89 (10.55)	34.83 (11.38)	38.65 (13.00)	<0.001
Years education	11.58 (6.26)	11.72 (4.42)	14.04 (4.22)	<0.001
WURS	50.67 (17.44)	36.71 (18.82)	20.85 (15.62)	<0.001
Rating scale	30.52 (9.66)	16.19 (8.92)	6.91 n6.06)	<0.001

Table 3
The association between EL, ADHD and comorbidity.

Factors	*F*	Sig	Eta squared
Sex	11.857	0.001	0.14
Age	0.308	0.579	0.000
Group	81.785	0.000	0.167
Comorbidity	25.488	0.000	0.030
Group × comorbidity	1.006	0.366	0.002

with personality disorders. In this group 52.24% of the subjects had received no diagnosis of a comorbid disorder.

The community control group (n = 98) was composed of 22.44% of subjects that met criteria for other psychiatric disorders different from ADHD: 20.41% with mood disorders, 18.37 with anxiety disorders, 18.3% with substance use disorders and 6.2% presenting personality disorders. There were 77.51% of the adults who had received no diagnosis of a comorbid disorder.

3.2. Emotional lability and ADHD

Chronbach's alpha was used in order to assess the internal consistency of the items that constituted the emotional lability construct according to the CAARS Scale. Chronbach's alpha for the six items of EL was 0.896 indicating a high internal consistency of the EL construct.

An analysis of the covariance was carried out in order to explore the association between EL, ADHD and comorbidity/other psychiatric disorders. Group × comorbidity interaction was no significant (F = 1.00, p = 0.366). The group factor (ADHD, clinic or community group) and the comorbidity factor (presence or absence of other psychiatric disorders different from ADHD) showed to be significant on EL scores (group: F = 81.78 p < 0.0005; comorbidity: F = 25.48 p < 0.0005). The group factor explained a 16% of the variance of EL, and 30% in the case of comorbidity factor (Table 3). The discriminative value of EL in the ADHD diagnosis was assessed. EL showed a sensitivity of 87.1% and a specificity of 46.6% in discriminating ADHD diagnosis (ADHD vs. other Axis I and Axis II disorders).

In the ADHD group, subjects with comorbidity obtained higher scores on EL than subjects without comorbid disorders (ADHD group mean = 10.82 vs. 8.13). In the clinical control group, subjects with a comorbid psychiatric disorder obtained higher scores on EL than those without a comorbid psychiatric disorder (clinical control group mean = 7.01 vs. 5.47). In the community group, patients with other psychiatric disorders different from ADHD obtained higher scores on EL than those without psychiatric disorders (community group mean = 4.56 vs. 2.15) (Fig. 1).

EL scores from the three ADHD subtypes were analyzed considering age and gender as covariates. A significant association between ADHD subtypes and EL was observed (F = 86.91; p < .0005), showing the combined subtype higher rates on EL (combined subtype: M = 10.68 SD = 4.38; inattentive subtype: M = 7.72 SD = 4.54; hyperactive subtype: M = 8.71 SD = 4.11). No significant differences were observed between the hyperactive and the inattentive subtype (p = 1.000). ADHD subtypes were compared between the two control groups (non-ADHD subjects) in relation to EL scores. Significant differences between the control subjects and each ADHD subtype were observed (p < 0.001), showing the two control groups lower scores on EL than the ADHD group.

The discriminative value of EL in the ADHD diagnosis was evaluated. EL showed a sensitivity of 87.1% and a specificity of 46.6% in discriminating ADHD diagnosis.

4. Discussion

The current study found that adults with ADHD presented higher levels of EL when compared to clinical control subjects and community subjects. The combined subtype of ADHD was the one with highest EL. Furthermore, our outcomes reported that EL is independent from the presence of other psychiatric disorders different from ADHD. High scores on EL were obtained in ADHD patients with and without comorbidity. Despite this fact, ADHD subjects with comorbidity showed higher rates of EL than those without comorbid disorders suggesting that presence of other disorders contributes to the likelihood of EL.

Previous studies have also found that adults with ADHD present significantly higher rates of EL compared to non-ADHD patients [7,18,19]. Furthermore, regarding the discussion if whether EL is attributable to ADHD or if it could be a result of the presence of comorbidity, we obtained similar results to Surman et al. [18]. We also found that EL is related to ADHD and is not explained by the presence of other comorbid disorders different from ADHD. On the same line, Reimherr et al. [36] observed emotional dysregulation symptoms in their sample in the absence of anxiety or depressive disorders. On the other hand, we found that the presence of comorbidity was

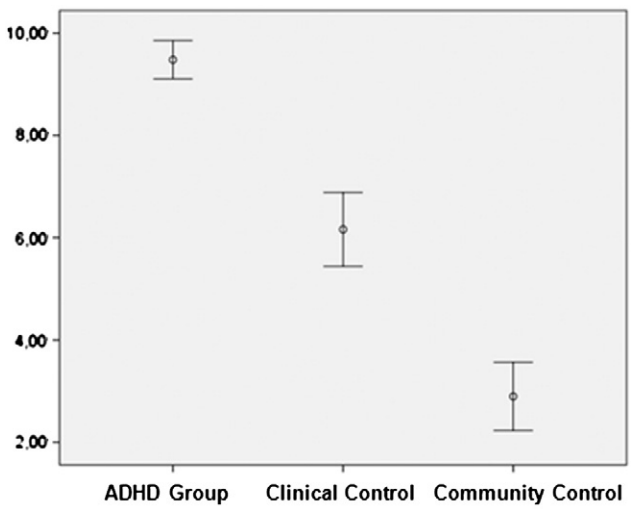

Fig. 1. Mean scores of the three groups on EL.

associated to a higher intensity of EL. Similar results were obtained in children [13]. Nevertheless, in children, EL seems to be more related to oppositional defiant disorder than to ADHD core symptoms [24,32].

In relation to the ADHD subtypes, prior investigations have also reported that the combined subtype is the one with highest scores on EL in adults [36] and also in children [25,28]. No significant differences in EL scores were observed between inattentive and hyperactive/impulsive subtypes. This outcome could mean that EL may be a distinct feature from impulsivity. However, some studies have found a relation between EL and both hyperactivity and impulsivity symptoms in adults [19] and in children [13,30]. Thus, our results could be explained by the presence of some degree of impulsivity that is observed in some patients with ADHD inattentive subtype. Moreover, the construct of EL is also related to some impulsivity dimensions (difficulties in anger management, setting off easily, hot temper, low frustration tolerance). Future research is needed to focus on the hypothesis that EL may be related to some personality profiles and that EL could be a marker of a different subgroup of ADHD patients [34,54]. In the same line, prior research has suggested a possible familiality of ADHD comorbid with deficient emotional self-regulation (DESR) (33).

On the other hand, EL showed a sensitivity of 87.1% in discriminating ADHD patients suggesting that EL is highly frequent in ADHD. Thus, if an individual presents EL symptoms such as low frustration tolerance, irritability or difficulties in anger management, it would be appropriate to screen ADHD as a potential explanation for EL [16,43]. The presence of EL does not exclude the presence of ADHD diagnosis. However, in contrast with Skirrow et al.'s [19] findings, we obtained a low specificity (46.6%) of EL in the detection of ADHD. This result could be explained by the fact that some symptoms of EL can be also present in other psychiatric disorders. This lack of specificity could explain the absence of formal recognition of EL in adult ADHD. However, this lack of formal recognition makes the differentiation of ADHD from other disorders more difficult and could partially explain the under diagnosis of ADHD in adults. Skirrow et al. [19] obtained a higher value on specificity, probably because in their study, ADHD patients with the presence of current axis I or II comorbid psychiatric diagnosis were excluded, the sample was composed by ADHD patients with subsyndromal comorbid symptoms.

There are several limitations to the present investigation. It was not possible to compare the variable EL between ADHD subjects and subjects with personality disorder, such as borderline personality disorder (BPD) due to a reduced number of personality disorders was obtained. Thus, the high EL score of the ADHD group was not explained by the presence of BPD. Finally, the assessment of EL was only self-reported and future investigations need to include clinically reported symptoms. Despite these limitations, it is important to draw attention to the fact that structured interviews for the assessment of comorbidity (SCID-I, SCID-II) were used. Structured evaluations for differential diagnosis are needed and it has not always been considered in some prior research [7,11].

Different scales have been used in previous studies such as: The Emotional Dysregulation Scale (EDS) derived from Wender–Reimherr Adult Attention Deficit Disorder Scale (WRAADDS) [10] Emotional impulsiveness Scale [11] RATE-S (Rating Scale ADHD Training Evaluation–Self-Report) [55], Affective Lability Scale [56] and Brown ADHD rating scales [8]. Nonetheless, most of these scales include symptoms that are related to impulsivity. Therefore, there is a need of develop psychometric measures designed to evaluate EL and impulsivity as separate features on adults with ADHD. The different scales that are used to measure EL and the different terms of emotional dysregulation complicate the comparison between studies on this topic.

Despite these limitations, the sample of the current research is the largest in the studies on EL in adults with ADHD. The findings showed a high sensitivity of EL in the diagnosis of ADHD and pointed out that EL is a significant symptom in adults with ADHD. The presence of comorbid disorders was only related to a major intensity of these EL symptoms. Therefore, it seems that EL is a specific feature of ADHD and it is not merely a consequence of the presence of other comorbid disorders.

Acknowledgment

Financial support was received from Plan Nacional sobre Drogas, Ministerio de Sanidad y Política Social (PND 0080/2011), the Agencia de Salut Pública de Barcelona and the Department de Salut, Government of Catalonia, Spain; Instituto de Salud Carlos III-FIS (PI 11/01629) and a grant from the Agressotype Research Program. RV is a recipient of a Rio Hortega contract from the "Instituto Carlos III, Ministerio de Ciencia e Innovación", Spain.

References

[1] Biederman J, Petty CR, Woodworth KY, Lomedico A, Hyder LL, Faraone SV. Adult outcome of attention-deficit/hyperactivity disorder: a controlled 16-year follow-up study. J Clin Psychiatry 2012;73:941-50.
[2] Biederman J, Petty CR, O'Connor KB, Hyder LL, Faraone SV. Predictors of persistence in girls with attention deficit hyperactivity disorder: results from an 11-year controlled follow-up study. Acta Psychiatr Scand 2012;125:147-56.
[3] Biederman J, Petty CR, Fried R, Doyle AE, Spencer T, Seidman LJ, et al. Stability of executive function deficits into young adult years: a prospective longitudinal follow-up study of grown up males with ADHD. Acta Psychiatr Scand 2007;116:129-36.
[4] Retz W, Stieglitz R-D, Corbisiero S, Retz-Junginger P, Rösler M. Emotional dysregulation in adult ADHD: what is the empirical evidence? Expert Rev Neurother 2012;12:1241-51.
[5] Barkley RA. Deficient emotional self-regulation: a core component of attention-deficit/hyperactivity disorder. J ADHD Relat Disord 2010;1:1-30.
[6] Wender PH. Attention-deficit hyperactivity disorder in adults. New York: Oxford University Press; 1995.

[7] Barkley RA, Murphy K. Deficient emotional self-regulation in adults with attention-deficit/hyperactivity disorder (ADHD): the relative contributions of emotional impulsiveness and ADHD symptoms to adaptive impairments in major life activities. J ADHD Relat Disord 2009;1:5-28.
[8] Brown TE. Attention deficit disorder scales. USA: The psychological corporation; 1996 [1996].
[9] Conners CK, Erhardt D, Sparrow E. Conners Adult ADHD Rating Scales. North Tonawanda: Multihealth system; 1999.
[10] Reimherr FW, Wender PH, Marchant BK, Strong RE, Hedges DW, Preston G. The Wender–Reimherr Adult Attention Deficit Disorder Scale as a research tool. Poster present. Am. Coll. Neuro- Psychopharmacol. Annu. Meet. December 7–11; 2003.
[11] Barkley RA, Fischer M. The unique contribution of emotional impulsiveness to impairment in major life activities in hyperactive children as adults. J Am Acad Child Adolesc Psychiatry 2010;49:503-13.
[12] Gudjonsson GH, Sigurdsson JF, Adalsteinsson TF, Young S. The relationship between ADHD symptoms, mood instability, and self-reported offending. J Atten Disord 2013;17:339-46.
[13] Sobanski E, Banaschewski T, Asherson P, Buitelaar J, Chen W, Franke B, et al. Emotional lability in children and adolescents with attention deficit/hyperactivity disorder (ADHD): clinical correlates and familial prevalence. J Child Psychol Psychiatry 2010;51:915-23.
[14] Martel MM. Research review: a new perspective on attention-deficit/hyperactivity disorder: emotion dysregulation and trait models. J Child Psychol Psychiatry 2009;50:1042-51.
[15] Corbisiero S, Stieglitz R-D, Retz W, Rösler M. Is emotional dysregulation part of the psychopathology of ADHD in adults? Atten Defic Hyperact Disord 2013;5:83-92.
[16] Skirrow C, McLoughlin G, Kuntsi J, Asherson P. Behavioral, neurocognitive and treatment overlap between attention-deficit/hyperactivity disorder and mood instability. Expert Rev Neurother 2009;9:489-503.
[17] Rösler M, Retz W, Fischer R, Ose C, Alm B, Deckert J, et al. Twenty-four-week treatment with extended release methylphenidate improves emotional symptoms in adult ADHD. World J Biol Psychiatry 2010;11:709-18.
[18] Surman CBH, Biederman J, Spencer T, Miller CA, McDermott KM, Faraone SV. Understanding deficient emotional self-regulation in adults with attention deficit hyperactivity disorder: a controlled study. Atten Defic Hyperact Disord 2013;5:273-81.
[19] Skirrow C, Asherson P. Emotional lability, comorbidity and impairment in adults with attention-deficit hyperactivity disorder. J Affect Disord 2013;147:80-6.
[20] Banaschewski T, Jennen-Steinmetz C, Brandeis D, Buitelaar JK, Kuntsi J, Poustka L, et al. Neuropsychological correlates of emotional lability in children with ADHD. J Child Psychol Psychiatry 2012;53:1139-48.
[21] Melnick SM, Hinshaw SP. Emotion regulation and parenting in AD/HD and comparison boys: linkages with social behaviors and peer preference. J Abnorm Child Psychol 2000;28:73-86.
[22] Biederman J, Petty CR, Day H, Goldin RL, Spencer T, Faraone SV, et al. Severity of the aggression/anxiety–depression/attention child behavior checklist profile discriminates between different levels of deficits in emotional regulation in youth with attention-deficit hyperactivity disorder. J Dev Behav Pediatr 2012;33:236-43.
[23] Connor DF, Ford JD. Comorbid symptom severity in attention-deficit/hyperactivity disorder: a clinical study. J Clin Psychiatry 2012;73:711-7.
[24] Anastopoulos AD, Smith TF, Garrett ME, Morrissey-Kane E, Schatz NK, Sommer JL, et al. Self-regulation of emotion, functional impairment, and comorbidity among children with AD/HD. J Atten Disord 2011;15:583-92.
[25] Maedgen JW, Carlson CL. Social functioning and emotional regulation in the attention deficit hyperactivity disorder subtypes. J Clin Child Psychol 2000;29:30-42.
[26] Walcott CM, Landau S. The relation between disinhibition and emotion regulation in boys with attention deficit hyperactivity disorder. J Clin Child Adolesc Psychol 2004;33:772-82.
[27] Braaten EB, Rosén LA. Self-regulation of affect in attention deficit-hyperactivity disorder (ADHD) and non-ADHD boys: differences in empathic responding. J Consult Clin Psychol 2000;68:313-21.
[28] Jensen SA, Rosén LA. Emotional reactivity in children with attention-deficit/hyperactivity disorder. J Atten Disord 2004;8:53-61.
[29] Spencer TJ, Faraone SV, Surman CBH, Petty C, Clarke A, Batchelder H, et al. Toward defining deficient emotional self-regulation in children with attention-deficit/hyperactivity disorder using the Child Behavior Checklist: a controlled study. Postgrad Med 2011;123:50-9.
[30] Crundwell RMA. An initial investigation of the impact of self-regulation and emotionality on behavior problems in children with ADHD. Can J Sch Psychol 2005;20:62-74.
[31] Harty SC, Miller CJ, Newcorn JH, Halperin JM. Adolescents with childhood ADHD and comorbid disruptive behavior disorders: aggression, anger, and hostility. Child Psychiatry Hum Dev 2009;40:85-97.
[32] Biederman J, Spencer TJ, Petty C, Hyder LL, O'Connor KB, Surman CB, et al. Longitudinal course of deficient emotional self-regulation CBCL profile in youth with ADHD: prospective controlled study. Neuropsychiatr Dis Treat 2012;8:267-76.
[33] Surman CBH, Biederman J, Spencer T, Miller CA, Petty CR, Faraone SV. Neuropsychological deficits are not predictive of deficient emotional self-regulation in adults with ADHD. J Atten Disord 2013 [Epub ahead of print].
[34] Surman CBH, Biederman J, Spencer T, Yorks D, Miller CA, Petty CR, et al. Deficient emotional self-regulation and adult attention deficit hyperactivity disorder: a family risk analysis. Am J Psychiatry 2011;168:617-23.
[35] Reimherr FW, Williams ED, Strong RE, Mestas R, Soni P, Marchant BK. A double-blind, placebo-controlled, crossover study of osmotic release oral system methylphenidate in adults with ADHD with assessment of oppositional and emotional dimensions of the disorder. J Clin Psychiatry 2007;68:93-101.
[36] Reimherr FW, Marchant BK, Strong RE, Hedges DW, Adler L, Spencer TJ, et al. Emotional dysregulation in adult ADHD and response to atomoxetine. Biol Psychiatry 2005;58:125-31.
[37] Marchant BK, Reimherr FW, Halls C, Williams ED, Strong RE, Kondo D, et al. Long-term open-label response to atomoxetine in adult ADHD: influence of sex, emotional dysregulation, and double-blind response to atomoxetine. Atten Defic Hyperact Disord 2011;3:237-44.
[38] Kooij SJJ, Bejerot S, Blackwell A, Caci H, Casas-Brugué M, Carpentier PJ, et al. European consensus statement on diagnosis and treatment of adult ADHD: the European Network Adult ADHD. BMC Psychiatry 2010;10:67.
[39] Childress AC, Arnold V, Adeyi B, Dirks B, Babcock T, Scheckner B, et al. The effects of lisdexamfetamine on emotional lability in children 6 to 12 years of age with ADHD in a double-blind placebo-controlled trial. J Atten Disord 2013 [Epub ahead of print].
[40] López FA, Childress A, Adeyi B, Dirks B, Babcock T, Scheckner B, et al. ADHD symptom rebound and emotional lability with lisdexamfetamine dimesylate in children aged 6 to 12 years. J Atten Disord 2013:1-10 [Epub ahead of print].
[41] Herrmann MJ, Biehl SC, Jacob C, Deckert J. Neurobiological and psychophysiological correlates of emotional dysregulation in ADHD patients. Atten Defic Hyperact Disord 2010;2:233-9.
[42] Sonuga-Barke EJS. The dual pathway model of AD/HD: an elaboration of neuro-developmental characteristics. Neurosci Biobehav Rev 2003;27:593-604.
[43] Philipsen A. Differential diagnosis and comorbidity of attention-deficit/hyperactivity disorder (ADHD) and borderline personality disorder (BPD) in adults. Eur Arch Psychiatry Clin Neurosci 2006;256(Suppl):i42-6.

[44] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington: American Psychiatric Association; 2000.
[45] Epstein JN, Johnson DE, Conners C. Conners' Adult ADHD Diagnostic Interview for DSM-IV. North Tonawanda, NY: Multihealth system; 2001.
[46] Ramos-Quiroga JA, Bosch R, Richarte V, Valero S, Gómez-Barros N, Nogueira M, et al. Criterion and concurrent validity of Conners Adult ADHD Diagnostic Interview for DSM-IV (CAADID) Spanish version. Rev Psiquiatr Salud Ment 2012;5:229-35.
[47] Ribasés M, Hervás A, Ramos-Quiroga JA, Bosch R, Bielsa A, Gastaminza X, et al. Association study of 10 genes encoding neurotrophic factors and their receptors in adult and child attention-deficit/hyperactivity disorder. Biol Psychiatry 2008;63:935-45.
[48] Dupaul GJ, Power T, Anastopoulos A. ADHD Rating Scale-IV: Checklists, norms, and clinical interpretation. New York: Guilford; 1998.
[49] Ward MF, Wender PH, Reimherr FW. The Wender Utah Rating Scale: an aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. Am J Psychiatry 1993;150:885-90.
[50] Amador-Campos JA, Gómez-Benito J, Ramos-Quiroga JA. The Conners' Adult ADHD Rating Scales—Short self-report and observer forms: Psychometric properties of the Catalan Version. J Atten Disord 2012:1-9 [Epub ahead of print].
[51] First M, Gibbon M, Spitzer R. Entrevista clínica estructurada para los trastornos de personalidad del eje II del DSM-IV. Barcelona: Masson; 2003.
[52] Spitzer R, Robert L, Gibbon M. SCID-I, versión clínica. Entrevista clínica estructurada para los trastornos del eje I del DSM. Barcelona: Masson; 1996.
[53] Wechsler D. Wechsler Adult Intelligence Scale–Revised. Psychological Corporation.Wechsler Adult Intelligence Scale (WAIS-III). 3rd Ed. San Antonio, TX: Psychological Corporation; 1981.
[54] Reimherr FW, Marchant BK, Olsen JL, Halls C, Kondo DG, Williams DERJ. Emotional dysregulation as a core feature of adult ADHD: Its relationship with clinical variables and treatment response in two methylphenidate trials. J ADHD Relat Disord 2010;1:53-64.
[55] Young S, Ross RR. R&R2 for ADHD youths and adults: a prosocial competence training program. Otawa Ontario: Cognitive Center of Canada; 2007.
[56] Oliver MNI, Simons J. The affective lability scales: development of a short form measure. Pers Individ Differ 2004;37:1279-88.