

The Relationship Between Alexithymia and Impulsiveness in Adult Attention Deficit and Hyperactivity Disorder



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SUMMARY

Objective: It has been emphasised recently that emotion regulation problems may be the core symptoms of attention deficit hyperactivity disorder (ADHD). In this study, we aimed to determine the incidence of alexithymia, the relationship between alexithymia and impulsiveness, the severity of ADHD, depression and anxiety symptoms in adult ADHD.

Method: All participants were assessed with the Structured Clinical Interview For DSM IV Axis I Disorders (SCID-I); and completed the Toronto Alexithymia Scale (TAS), the Impulsive Behavior Scale (UPPS), the Beck Depression Inventory (BDI), the Beck Anxiety Inventory (BAI), Adult Attention Deficit and Hyperactivity Disorder Self Reporting Scale (ASRS) and the Wender Utah Rating Scale (WURS). The ADHD patients were also assessed with the Diagnostic Interview for ADHD (DIVA) for DSM-5 criteria.

Results: The study included 101 ADHD patients with a mean age of 23.06 ± 4.24 years with 47.5% females, and 100 healthy control individuals with a mean age of 22.76 ± 5.68 years with 50% female participants. Alexithymia incidence was 41.5% in the ADHD group. The increase in the levels of impulsiveness, depression and anxiety correlated with the severity of ADHD symptoms; and impulsiveness predicted alexithymia in the ADHD group.

Conclusion: Alexithymia incidence was higher in the ADHD group. When ADHD and control participants were combined, alexithymic individuals was more associated with impulsivity with frequent display of anxiety symptoms.

Keywords: Attention deficit hyperactivity disorder, alexithymia, impulsiveness

INTRODUCTION

DSM-IV and DSM-5 diagnostic criteria include the symptoms of inattention, hyperactivity, restlessness and impulsiveness under the heading of Attention Deficit Hyperactivity Disorder (ADHD). In recent years, research has highlighted the symptoms of emotional recognition defects, emphasising that emotion regulation problems are characteristic symptoms of ADHD (Corbisiero et al. 2017) which have been included in the psychometric criteria of the Wender-Utah Rating Scale (WURS) designed by Paul Wender who first defined ADHD in adults. These symptoms include temper control, emotional lability and emotional overreactivity/stress intolerance (Retz et al. 2012).

Emotion regulation and emotion identification deficits are also associated with alexithymia (Friedman et al. 2003, Reimherr et al. 2005). The word alexithymia originates from the Greek language meaning absence of words for feelings, but research results have placed alexithymia symptoms under the 4 headings of 'Difficulty to recognise, differentiate and express feelings', 'Lacking capacity for imagination', 'Operational thinking' and 'Externally oriented cognitive style' (Taylor et al. 2013). Although initially proposed to describe the psychosomatic symptoms, alexithymia has been found to affect emotional processing and affective pathologies, has currently been conceptualised as a deficit in the cognitive-experiential component of emotional response and emotion regulation. It is a psychological, neurobehavioral and clinical

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concept with a role in many psychiatric disorders headed by depression and anxiety (Şaşıoğlu et al. 2013). Research has shown its adaptability to and facilitating presence in eating disorder, mood disorder, alcohol addiction, psychosis and various personality disorders (Bankier et al. 2001). The high level of alexithymia observed in eating and sexual function disorders has been attributed to impulsiveness (Beales and Dolton 2001, Karukivi et al. 2010, Madioni and Mammana 2001). Complication of ADHD with impulsiveness and deficits in emotion regulation suggests significant contributions from alexithymia.

Our study was designed on the hypotheses that the incidence of alexithymia is higher in ADHD as compared to healthy control individuals; that the severity of impulsiveness is higher in cases of ADHD comorbid with alexithymia; and that the severities of impulsiveness and alexithymia are correlated. Hence the aims of the study were primarily to determine the presence and the incidence of alexithymia in adults diagnosed with ADHD as compared to healthy control individuals and secondarily to assess the relationship between "alexithymia" and "impulsiveness" together with the relationship of alexithymia with the symptom severity of ADHD, depression and anxiety disorders.

METHOD

Sample

The participants who met the inclusion/exclusion criteria of this study consisted of 101 patients diagnosed with adult ADHD after consulting the Psychiatry outpatient clinic of Haydarpaşa Numune Training and Research Hospital between May 2018 and October 2018 and 100 healthy volunteering hospital staff and students without ADHD and meeting the inclusion/exclusion criteria of the study.

The inclusion criteria of the study for all participants were being within the age range of 18-65 years, having the ability to read and write, consenting to participate in the study and, for the patient group meeting the diagnostic criteria for adult ADHD. The exclusion criteria in the study were having been diagnosed with mental retardation, any psychotic disorder or mood disorder with psychotic features, alcohol, substance use disorder and neurological, severe physical and systemic diseases with clinical and laboratory evidence and using any antipsychotic drug.

Having met the inclusion/ exclusion criteria, the potential participants were included in the study after signing the Informed Volunteer Consent Form.

The patient group were tested on the Diagnostic Interview for ADHD in Adults (DIVA 2.0); and all participants

were scanned for psychiatric disorders on the Structured Clinical Interview for DSM-IV (SCID-I) by the researcher psychiatrist. Determination of the age at disease onset and the number of the symptoms were based on the DSM-5 diagnostic criteria. The healthy controls (HC) were ensured to be free of all psychiatric disorders.

The ADHD and the HC groups completed a Sociodemographic data form, the Toronto Alexithymia Scale (TAS), the Wender Utah Rating Scale (short form with 25 items) (WURS), the Adult ADHD Self-Report Scale Symptom Checklist (ASRS), the UPPS-Impulsive Behaviour Scale (UPPS), the Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI).

The study was approved by the Local Ethics Committee of the Health Ethics University Zeynep Kamil Women's and Children's Diseases Training and Research Hospital.

Data Acquisition

The Sociodemographic data form: The sociodemographic data form, prepared by the researchers, questioned the demographic details and alcohol and substance use by the participants.

The Structured Clinical Interview for the DSM-IV Axis I Disorders (SCID-I): The SCID-I, a clinical interview structured for DSM-IV Axis I mental disorders, was developed by First et al. (1997) to facilitate the systematic scanning of the symptoms and to enhance the validity of the DSM-IV diagnostic criteria. The Validity and reliability of the SCID-I in the Turkish language was carried out by Çorapçıoğlu et al. (1999).

The Diagnostic Interview for Attention Deficit Hyperactivity Disorder (ADHD) in Adults (DIVA-2): The DIVA-2 is a semi-structured diagnostic interview based on the DSM-IV diagnostic criteria for adult ADHD (Kooji and Francken (2010). It was translated to the Turkish language by Mukaddes et al. (2013).

The Adult ADHD Self Report Scale Symptom Check List (ASRS): The ASRS was developed by the World Health Organization (WHO) to screen adults for ADHD symptoms. The 18 items each consisting of 9 items in the two subscales, attention deficit and hyperactivity/impulsiveness of this Likert type scale are scored between 1-4 (American Psychiatric Association 1998). The validity and reliability of the ASRS in the Turkish language was determined by Doğan et al. (2009).

The Wender Utah Rating Scale-25 (WURS): The WURS is a self-report scale developed in 1993 by Wender and Reimherr of the Utah group in order to assess the childhood signs and symptoms of ADHD in adults. The original 61-item scale was

shortened to include the 25 items which best discriminated ADHD from the healthy control. The Likert type items are scored on 5 points, ranging from 0 (=none) up to 4 (=extreme) (Ward 1993). The validity and reliability of the 25-item short form of WURS in the Turkish language was conducted by Öncü et al. (2005) who determined a cut-off score of 36, with a sensitivity of 82.5% and specificity of 90.8% at scores ≥ 36 .

The UPPS Impulsive Behavior Scale (UPPS): The UPPS, developed by Lynam and Whiteside (2001), is a self-report scale with 1-4 Likert type scoring on its 45 items. The option 1 (= 'It doesn't fit me at all') gets a score of 1 and the option 4 (= 'It suits me very well') gets 4 points. Items 22, 37 and 45 are reversed. Its four subscales are on Urgency, Lack of Premeditation, Lack of Perseverance and Sensation Seeking. High scores indicate higher levels of impulsivity. Validity and reliability of the WURS in the Turkish language was conducted by Yargıç et al. (2011).

The Toronto Alexithymia Scale (TAS): The TAS was originally developed with 26 items by Taylor et al. (1985) and the 20-item short form was organised by Bagby, Parker and Taylor in 1994. It is a self-rating Likert type scale with 1-5 scoring for each item. The option 'I don't agree at all' gets 1 point and the option 'I totally agree' gets 5 points. Items 4, 5, 10, 18 and 19 are reversed. Its three subscales are on Difficulty in Identifying Feelings, Difficulty in Describing Feelings and Externally Oriented Thinking. High scores indicate the severity of alexithymia. It was adapted to the Turkish language (Güleç et al. 2009) and a cut off point of 59 was determined for the Turkish population (Güleç and Yenel 2010).

The Beck Depression Inventory (BDI): The BDI is a self-report scale developed to measure physical, emotional, cognitive, motivational and psychomotor symptoms in depression. Each item of the scale consisting of 21 items is scored between 0 and 3 (Beck et al. 1961). The validity and reliability study for the BDI in the Turkish language was carried out by Hisli (1988).

The Beck Anxiety Inventory (BAI): The BAI, developed to measure the severity of anxiety symptoms, is a self-report scale with 21 items each scored between 0 and 3 (Beck 1988). The validity and reliability of the version in the Turkish language was carried out by Ulusoy (1998).

Statistical Analysis

The data were analyzed using the SPSS 21.0 statistical software program. Categorical variables were expressed as numbers and percentages; and numerical variables were given by the mean and the standard deviation. Categorical variables were compared using the Pearson Chi-Square test and the Fisher Exact test. The Student t test (independent

sample t test) was used for binary comparison of continuous variables. Relationships between the scale scores were assessed by the Pearson correlation test. Back Ward logistic regression analysis was used to determine the predictors of alexithymia. Significance level was accepted as $p < 0.05$.

RESULTS

The ADHD and the HC groups were demonstrated to be comparable with respect to age ($t=0,437$), gender ($t=0,349$), educational level ($t=0,750$) and the categories of marital status ($t=-1,06$) (all $p > 0,05$) (Table 1). Results on the SCID-I indicated that 35 (34.7%) among the 101 participants with ADHD diagnosis had one and 7 (6.9%) had two comorbid psychiatric disorders not included in the exclusion criteria and with ongoing symptoms, whereas the remaining 59 participants with ADHD did not have any psychiatric comorbidity. The comorbidities were ranked as 21 cases of depression, 8 cases of specific phobia (SP), 7 cases of generalized anxiety disorder (GAD), 6 cases of unspecified anxiety disorder, 2 cases each of anxiety disorder (SAD), obsessive-compulsive disorder (OCD) and panic disorder (PD) and 1 case of post-traumatic stress disorder (PTSD). Statistical evaluation was enabled by combining the cases under the name of anxiety disorders, assuming 28 ADHD patients to have comorbid anxiety disorder.

Table 1. Demographic Features of ADHD and Control Groups

		ADHD Group S=101	Control Group S=100	t	p
		Mean±SD	Mean ±SD		
Age		23.06±4.24	22.76±5.68	0.437	0.663
		n (%)	n (%)		
Gender	Woman	48 (47.5)	50 (50.0)	0.349	0.726
	Male	53 (52.5)	50 (50.0)		
Marital Status	Single	95 (94.1)	90 (90.0)	-1.060	0.291
	Married	6 (5.9)	10 (10.0)		
Education Level	High School and Below	39 (38.6)	34 (34.0)	-0.754	0.452
	University	62 (61.4)	66 (66.0)		

The mean total TAS and UPPS scores of the ADHD group were respectively, 55.09±11.44 and 119.22±16.13, while the corresponding scores of the HC group were respectively, 43.48±8.21 and 95.91±13.85, the differences being statistically significant both on the TAS ($t=7,992$; $p < 0.01$) and the UPPS ($t=10.97$; $p < 0.01$). The BDI, BAI, ASRS and the WURS scores of the ADHD group were also significantly

Table 2. Comparison of ADHD and Control Groups with TAS, UPPS, BDI, BAI, ASRS, WURS Scores

		ADHD Group S=101	Control Group S=100		
		Mean ±SD	Mean ±SD	t	p
TAS	Difficulty in Identifying Feelings	18.83±6.24	12.47±4.75	8.131	<0.001
	Difficulty in Describing Feelings	14.61±4.31	10.88±3.42	6.806	<0.001
	Externally-Oriented Thinking	21.53±4.32	20.21±3.35	2.428	0.016
	Total	55.09±11.44	43.48±8.21	7.992	<0.001
UPPS	Lack of Premeditation	25.02±5.93	18.80±4.88	8.115	<0.001
	Urgency	32.51±7.52	25.33 ± 6.52	7.236	<0.001
	Sensation Seeking	33.40±6.68	30.97 ± 6.53	2.612	0.010
	Lack of Perseverance	27.90±4.96	20.80 ± 4.46	10.661	<0.001
	Total	119.22±16.13	95.91±13.85	10.970	<0.001
BDI		17.63 ± 12.30	8.62 ± 8.08	6.144	<0.001
BAI		16.81 ± 12.09	7.45 ± 6.54	6.834	<0.001
ASRS		47.13±11.52	21.92±9.85	16.681	<0.001
WURS		48.19±15.59	16.39±12.03	16.200	<0.001

higher in comparison to the HC group ($t=6.144$; $t=6.834$; $t=16.681$; $t=16.2$, respectively; all $p<0.01$) (Table 2).

Correlation analyses on the TAS and UPPS total and subscale scores of the ADHD group showed significant positive correlations between the TAS total, Difficulty in Identifying Feelings, Difficulty in Describing Feelings subscale scores and the UPPS total score (respectively, $r=0.489$; $r=0.457$; $r=0.481$) and the scores on the UPPS-Lack of Premeditation (respectively, $r=0.351$; $r=0.313$; $r=0.291$), Urgency (respectively, $r=0.569$; $r=0.587$; $r=0.535$) and Lack of Perseverance (respectively, $r=0.335$; $r=0.272$; $r=0.305$). Similarly significant correlations were not found in the ADHD group between the TAS Externally Oriented Thinking score and the UPPS total score; and between

the TAS total and subscale scores and the UPPS Sensation Seeking subscale score (Table 3).

Correlation analyses on the TAS and UPPS total and subscale scores of the HC group also showed statistically significant positive correlations between the TAS total, Difficulty in Identifying Feelings, Difficulty in Describing Feelings subscale scores and the UPPS total score (respectively, $r=0.438$; $r=0.412$; $r=0.361$), Lack of Premeditation (respectively, $r=0.284$; $r=0.265$; $r=0.234$), Urgency (respectively, $r=0.583$; $r=0.495$; $r=0.462$). Similarly significant correlations were not found in the HC group between scores on the UPPS Sensation Seeking, Lack of Perseverance subscales and the TAS (Table 3).

In our study, presence and absence of alexithymia in the ADHD group was determined by taking the TAS cut-off

Table 3. Correlation Analysis of TAS and UPPS Subscales in ADHD and Control Group

TAS		UPPS Total	Lack of Premeditation	Urgency	Sensation Seeking	Lack of Perseverance
Total	ADHD Group	r .489**	.351**	.569**	-.042	.335*
	Control Group	r .438**	.284*	.583**	.032	.181
Difficulty in Identifying Feelings	ADHD Group	r .457**	.313*	.587**	-.024	.272*
	Control Group	r .412**	.265*	.495**	.125	.121
Difficulty in Describing Feelings	ADHD Group	r .481**	.291*	.535**	.008	.305*
	Control Group	r .361**	.234*	.462**	.021	.184
Externally-Oriented Thinking	ADHD Group	r .149	.177	.117	-.062	.159
	Control Group	r .102	.086	.276*	-.196	.121

r : correlation coefficient *; $p<0,05$; **; $p<0,01$

Table 4. Comparison of UPPS, BDI, BAI, ASRS, WURS Averages of Patients with and without Alexithymia in the ADHD Group

		ADHD Group		t-value	p
		Have Alexithymia S=42	Have Not Alexithymia S=59		
		Mean±SD	Mean±SD		
UPPS	Lack of Premeditation	27.33±4.95	23.37±6.06	3.485	0.001
	Urgency	36.69±6.33	29.54± 6.9	5.305	<0.001
	Sensation Seeking	33.21±8.14	33.54± 5.48	-0.242	0.809
	Lack of Perseverance	29.83±4.15	26.52± 5.06	3.477	0.001
	Total	127.07±13.28	112.98±14.93	4.888	<0.001
BDI		22.80±13.03	13.94± 10.37	3.798	<0.001
BAI		22.42±12.92	12.81± 9.74	4.262	<0.001
ASRS		51.23±9.71	44.22±11.89	3.147	0.002
WURS		54±15.44	44.06±14.44	3.308	0.001

score as 59. Those with and without alexithymia had UPPS total scores of, respectively, 127.07±13.28 and 112.98±14.93 ($t=4.888$, $p<0.001$). Participants with ADHD and alexithymia had significantly higher UPPS total score ($t=4.888$, $p<0.001$) and Lack of Premeditation, Urgency and Lack of Perseverance subscale scores as compared to those without alexithymia (respectively, $t=3.485$, $p=0.001$; $t=5.305$, $p<0.001$ and $t=3.477$, $p=0.001$) (Table 4).

The participants of the ADHD group with and without alexithymia scored 22.80±13.03 and 13.94±10.37 respectively, on the BDI and 22.42±12.92 and 12.81±9.74 respectively, on the BAI. The scores of the alexithymic ADHD participants on the BDI ($t=3.798$, $p<0.001$) and the BAI scales ($t=4.262$, $p<0.001$) were significantly higher (Table 4).

The mean ASRS scores of the ADHD group participants with and without alexithymia were respectively, 51.23±9.71 and 44.22±11, the difference in the scores being statistically significant ($t=3.147$, $p=0.002$) (Table 4).

The mean WURS scores of the ADHD group participants with and without alexithymia were respectively, 54±15.44 and 44.06±14.44, the difference in the scores being statistically significant ($t=3.308$, $p=0.001$) (Table 4).

The participants with ADHD were a heterogeneous group, including those previously diagnosed and under treatment and those newly diagnosed and not yet started on treatment. The control group participants were not on any medication. In the

Table 5. Comparison of Depression, Presence of Anxiety and Drug Use in Patients with and without Alexithymia in the ADHD Group

		ADHD Group		t-value	p
		Have Not Alexithymia	Have Alexithymia		
		S (%)	S (%)		
Depression and/or Anxiety Disorder	Yes	20 (57.1)	22 (33.3)	4.87	0.036
	No	15 (42.9)	44 (66.7)		
Drug use	Stimulant	8 (22.9)	28 (42.4)	0.144	0.112
	Antidepressant	7 (20.0)	7 (10.6)		
	Does not use	20 (57.1)	31 (47.0)		

ADHD group, 36 participants were using stimulant drugs, 14 were using antidepressants and 51 were newly diagnosed and drug-free. There was not a significant difference in the use of stimulant and antidepressant drugs use between those with and without alexithymia (Table 5).

The model for the regression analysis carried out to assess the predictors for alexithymia included the dependent variable of alexithymia and the independent variables of gender, ADHD subtype, ADHD symptoms, depression and/or anxiety disorder comorbidity, ADHD treatment and impulsiveness. Increased impulsiveness in the ADHD group was identified as a predictor for alexithymia (Table 6).

Table 6. Regression Analysis and Alexithymia Predictors in the ADHD Group

Variables	β	SH	p	Exp(β)	%95 GA	Nagelkerke R square
UPSS	0.052	0.018	0.004	1.053	1.01-1.09	0.199

β : Regression coefficient; SH: Standard error; Exp (β): Adjusted β ; 95% GA: 95% confidence interval for Exp (β)

Table 7. Regression Analysis and Alexithymia Predictors in the Whole Sample

Variables		β	SH	p	Exp(β)	%95 GA	Nagelkerke R square
Model 1	Grup	2.84	0.586	<0.001	17.14	5.06-58.07	0.275
Model 2	Grup	2.08	0.653	0.001	8.05	2.23-28.95	0.412
	BAÖ	0.08	0.639	<0.001	1.09	1.04-1.13	
Model 3	Grup	1.42	0.648	0.041	4.16	1.06-16.37	0.450
	BAÖ	0.07	0.022	<0.001	1.08	1.03-1.12	
	UPPS	0.04	0.016	0.013	1.04	1.01-1.07	

β : Regression coefficient; SH: Standard error; Exp (β): Adjusted β ; 95% GA: 95% confidence interval for Exp (β)

The alexithymia predictors in the combined ADHD and HC group of participants were assessed by regression analysis using a model inclusive of the alexithymia dependent variable, ADHD presence, the sociodemographic data and the UPPS, BDI, BAI, ASRS, WURS scores as the independent variables. In the entire group of participants, ADHD presence, anxiety level and impulsiveness were determined to predict alexithymia (Table 7).

DISCUSSION

Kyrstal (1979) stated that not being aware of emotion can contribute to behaving uncontrollably. It was argued in the context of the theory of affect regulation that alexithymia presents as the negative effect of the biological component of the affect and would either result in somatic symptoms or be discharged through actions when the cognitive regulation is weak (Taylor et al. 1999). In our study, significant positive correlations were detected between the UPPS total and the Lack of Premeditation, Urgency and Lack of Perseverance subscale scores (all $p < 0.05$) with the total score on the TAS and the scores on the subscales Difficulty in Identifying Feelings and Difficulty in Describing Feelings (all $p < 0.05$) (Table 3). In the literature, a similar investigation was not found on these two symptom dimensions of ADHD.

Research has demonstrated emotion recognition defects in the facial expressions of children and adults with ADHD in comparison to control individuals (Rappoport et al. 2002, Pelc et al. 2006, Sinzig et al. 2008). It has been suggested that the early or current characteristics of adults diagnosed with ADHD predict emotion processing/alexithymic features of childhood and ongoing ADHD symptoms (Edel et al. 2015). The defects of identifying facial expression of emotion by children with ADHD were found to be mostly due to ADHD symptoms (Sinzig et al. 2008). Emotion recognition errors in adult ADHD were attributed particularly to impulsiveness (Fasmer et al. 2015).

Problems of identifying and describing feelings were demonstrated by assessments on the WURS in a recent

study on the parents of children with severe ADHD (Güleş et al. 2018). In our study, ASRS and WURS scores were significantly higher in ADHD participants with alexithymia ($t=3.147$, $p=0.002$) in comparison to those without alexithymia ($t=3.308$, $p=0.001$) (Table 4). On the basis of these data, it may be proposed that these individuals have problems in identifying and describing their feelings from childhood onwards since it was found that the ASRS scores on adult ADHD symptoms and the WURS scores on childhood ADHD symptoms were high in adult ADHD patients with alexithymia. Further, the existence of these alexithymic features can be shown as one of the problems experienced in social, relationship and professional fields.

While the prevalence of alexithymia is shown to range between 6.7% and 18.8% in community-based studies, this reaches much higher levels in psychiatric patient populations (Solmaz et al. 2000). The incidence of alexithymia among young individuals of our country was recently reported to be 19% (Uzal et al. 2018). In our study, the frequency of alexithymia was found to be 4% in the HC group. Screening for psychiatric disorders in order to include healthy individuals and selection of participants with higher level of education as compared to other studies conducted may explain the low incidence of alexithymia in the HC group.

A study without experimental controls made in Germany on alexithymia, emotion processing and social anxiety in 73 adult ADHD patients reported the incidence of alexithymia to be 22.2% and the 5% and 4.6% prevalences of alexithymia among the males and females respectively, in the general population (Mattila et al. 2007). In our study, the incidence of alexithymia in the ADHD group was found to be 41.5%.

An investigation on alexithymia, emotional dysregulation, impulsiveness and aggression showed that alexithymia correlated significantly with impulsiveness and had an effect on aggression (Velotti et al. 2016). In our study, a significant positive correlation was found between the total score of alexithymia and impulsiveness in both the ADHD group and the HC group ($p < 0.01$) (Table 3). In the ADHD group,

significant positive correlations were found between the scores on the TAS subscales (Difficulty in Describing Feelings and Difficulty in Identifying Feelings) and the scores on the UPPS subscales (Urgency, Lack of Premeditation, Lack of Perseverance) (Table 3).

In the HC group significant positive correlations were found between the scores on the TAS subscales (Difficulty in Identifying Feelings and Difficulty in Describing Feelings) and the scores on the UPPS subscales (Lack of Premeditation and Urgency) (Table 3). Observing more correlations between the symptoms of alexithymia and impulsiveness in the ADHD group as compared to the HC group suggested that alexithymia may have a role in the formation of problems related to ADHD. Both in the ADHD and the HC groups significant correlations were not determined between the alexithymic symptom scores and the scores on the UPPS Sensation Seeking subscale (Table 3). Although not statistically significant, a negative correlation was observed between the TAS total score and the score on the UPPS Sensation Seeking subscale in the ADHD group. Sensation is a positive and pleasant sensory experience that can improve performance (Brooks 2014). The demonstration that alexithymia is associated with positive emotions in the negative direction and negative emotions in the positive direction (Motan and Gençöz 2007) Therefore, the negative correlation between alexithymia and Sensation Seeking is an explainable result.

Frequent diagnoses of comorbid psychiatric disorders are known in ADHD. In our study, the incidences of depression and anxiety disorders detected by the SCID-I were, respectively 20.7% and 27.7%. The comorbidities of depression and/or anxiety disorder were more common ($t=4.87$, $p=0.036$) in the alexithymic participants of the ADHD group as compared to those without alexithymia (Table 5). Our results totally agree in demonstrating that depression and anxiety disorders are the most frequently observed psychiatric disorders with alexithymia.

Investigation of the relationship between alexithymia and anxiety symptoms has shown higher anxiety scores in subjects with alexithymia than in subjects without alexithymia (Mortan et al. 2014). In accordance with the literature, our demonstration of higher depression and anxiety levels in the ADHD group participants with alexithymia suggests that alexithymia provides a basis for the development of depression and anxiety disorders. Given these observations, clinicians encountering alexithymic symptoms in ADHD cases with pronounced symptoms of impulsiveness should investigate the possible comorbidity of depression and/or anxiety and in the pronounced presence of depression and/or anxiety comorbidities in ADHD cases, they should search for the characteristics of alexithymia.

Another point to be emphasised is the effect on alexithymia of the drugs used in psychiatric disorders. In our study, antipsychotic drug use was one of the exclusion criteria, considering that antipsychotic drugs could cause a condition similar to alexithymia. It was observed in follow-up studies by others that alexithymia scores decreased significantly with antidepressant treatment of patients diagnosed with depression (Honkalampi et al. 2000, Luminet et al. 2001). In our study, 14 (13.8%) of participants in the ADHD group were on antidepressants, 36 (35.6 %) were on stimulant drugs while 51 (50.4%) were not drug users group and significant differences were not observed between participants with and without alexithymia in the use of antidepressant or stimulant agents ($t=0.144$, $p=0.112$) (Table 5). Depression or anxiety disorders are the leading psychiatric disorders seen with alexithymia in ADHD as also indicated by results of our study.

Although not differing with respect to the incidence of antidepressant usage, the more pronounced symptoms of depression and/or anxiety disorder in cases of ADHD with alexithymia suggests that presence of alexithymia may decrease the benefit of antidepressant treatment possibly by causing resistance to antidepressant treatment. A pilot study with 10 cases of adult ADHD on the effect of stimulant drugs on alexithymia reported statistically significant decreases in ADHD symptoms and alexithymia scores after 6 months of follow-up. In our study, a significant difference was not found on stimulant use between the participants with and without alexithymia in the ADHD group ($t=0.144$, $p=0.112$) (Table 5). These differences in results may be attributed to variables including the type of stimulant drug, its dosage and the treatment duration. Also, this may be due to the cross-sectional design of our study and/or the small number of participants in the study by Matuszak et al. (2013). It is evident that more studies investigating the effect of drug therapy on alexithymia in ADHD are needed.

Using regression analysis in our study to determine the predictors of alexithymia in the ADHD group showed that increased impulsiveness was predictive for alexithymia (Table 6). Finally, regression analysis carried out to determine the alexithymia predictors in the combined ADHD and the HC groups showed increased impulsiveness and anxiety levels to be significant predictors of alexithymia (Table 7).

Having a cross-sectional design, the use of self-report screening scales, presence of the comorbidities of depression and anxiety disorders and the heterogeneity of the ADHD group participants with respect to antidepressant and stimulant drug use are among the limitations of our study. It is necessary to emphasize that the results of our study with ADHD cases admitted to the psychiatric outpatient clinic will not represent the whole adult ADHD population. Also,

not excluding personality disorders can be seen as a limitation which should be taken into consideration in similar studies in the future.

CONCLUSION

The results of our study, aiming to investigate the relationship between alexithymia and impulsiveness in adult ADHD, are important since there is not a similar study in the literature. The correlations between symptoms of alexithymia and impulsiveness in both the ADHD and HC groups may suggest that alexithymia, shown to be one of the emotion regulation problems, makes individuals more impulsive. Also, consideration of the comorbidity of alexithymia in ADHD cases can contribute to understanding better both the patients and the disorder that causes deterioration in social relationships and functionality.

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