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Validity and Reliability of the Turkish version of the Wender-Reimherr Adult Attention Deficit Disorder Scale

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ABSTRACT

Objective: The primary aim of this study was to evaluate the validity and reliability of the Turkish version of the Wender-Reimherr Adult Attention Deficit Disorder Scale (WRAADDS).

Method: The study included 146 individuals diagnosed with attention-deficit/hyperactivity disorder (ADHD) and 86 healthy controls (ADHD group: age=24.46±5.82; control group: age=24.91±2.21). In addition to the WRAADDS, the Adult ADD/ADHD DSM-IV-Based Diagnostic and Assessment Scale, the Wender Utah Rating Scale (WURS), and the Hospital Anxiety and Depression Scale (HADS) were administered.

Results: The ADHD group showed significantly higher total and subscale scores on the WRAADDS compared to the control group ($p < 0.001$). Confirmatory factor analysis indicated that the original model demonstrated good fit ($\chi^2=34.392$, df=13, $p=0.001$). Under Factor 1, the dimensions of inattention and disorganization were included, whereas hyperactivity/restlessness, temper, affective lability, emotional overreactivity, and impulsivity were included under Factor 2. In the internal consistency analysis, Cronbach's alpha coefficients were 0.97 for Factor 1 and 0.59 for Factor 2, respectively. The WRAADDS total score showed significant positive correlations with the total scores of other ADHD scales ($p < 0.01$). No significant correlations were found between WRAADDS total score and the anxiety or depression subscales of the HADS ($p > 0.05$).

Conclusion: The Turkish version of the WRAADDS is a psychometrically valid and reliable instrument that comprehensively assesses adult ADHD.

Keywords: Attention deficit hyperactivity disorder, emotional dysregulation, reliability, validity

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is not a condition limited to childhood; rather, it is a neurodevelopmental disorder that can persist throughout the lifespan and lead to significant functional impairments in adulthood (Barkley et al. 2010, Riglin 2016). Inattention, hyperactivity, and impulsivity constitute the three core symptom domains of ADHD. Although ADHD is typically diagnosed in childhood, it persists into adolescence and adulthood in approximately 40–50% of cases. However, symptoms in adulthood may present with a clinical profile that differs from the classical triad observed in childhood (American Psychiatric Association 2013, Brancati et al. 2025). Core symptoms in childhood tend to transform in adulthood, manifesting as prominent difficulties in executive functions and emotion regulation (Barkley 1997, Öncü 2008). Some researchers have even proposed that difficulties in emotion regulation should be considered a fourth dimension of ADHD (Barkley 2010, Faraone et al. 2019). This view is supported by findings indicating that approximately 90% of adults with ADHD experience chronic mood fluctuations and irritability (Kooij et al. 2001, Rösler et al. 2008).

Diagnosing ADHD in adulthood is one of the most critical and challenging steps for clinicians. The near-rule presence of comorbidities in ADHD requires clinicians to exclude numerous conditions with overlapping features, obtain a comprehensive psychiatric history, and conduct a structured

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clinical interview. Due to developmental factors and comorbid conditions, symptoms in adults differ from those observed in childhood; relying solely on DSM or ICD diagnostic criteria may limit assessment to a restricted list of symptoms (Biederman 2004; Asherson et al. 2016).

This awareness, combined with the recognition that adult ADHD is a prevalent condition that significantly impairs functioning and is often underdiagnosed, has led to the development of screening and assessment scales specifically for adults. However, most existing instruments are based on DSM criteria and do not adequately capture emotional and behavioral components (Rösler et al. 2006, Rösler et al. 2010). As longitudinal studies have shown, while problems related to hyperactivity and impulsivity tend to decrease in adulthood, inattention and difficulties in emotion regulation become more persistent; unlike children, adults experience impairments across nearly all areas of life (Taylor et al. 2011, Ramsay 2017).

To address this limitation, the Wender-Reimherr Adult Attention Deficit Disorder Scale (WRAADDS) was developed as a semi-structured clinician-administered interview that evaluates symptoms specific to adult ADHD. WRAADDS is based on the Utah criteria, which include inattention, hyperactivity/restlessness, affective overreactivity, emotional lability, temper, disorganization, and impulsivity (Wender, 1995). Accordingly, in addition to the three core DSM symptom domains (inattention, hyperactivity, and impulsivity), it also assesses domains related to emotion regulation difficulties, such as anger control, emotional instability, and excessive emotional reactivity. In this respect, WRAADDS is a distinctive instrument that captures the emotional components of adult ADHD (Marchant et al. 2013).

However, to date, no Turkish validity and reliability study has been conducted. In Türkiye, the diagnostic process for adult ADHD predominantly relies on self-report scales, and there is a notable lack of a standardized clinician-administered instrument (Öncü et al. 2005, Doğan et al. 2009).

The aim of this study is to examine the validity and reliability of the Turkish version of the WRAADDS, and to introduce it into the literature and clinical practice as a diagnostic support tool that provides a comprehensive assessment encompassing emotional and behavioral dimensions for use in the adult population.

METHODS

Participants

The study included patients aged 18–65 years who were diagnosed with ADHD according to DSM-5 and Wender Utah criteria and who presented to the Department of Psychiatry at Ankara University Faculty of Medicine. In addition, a control group consisting of individuals without active psychiatric complaints and not currently using any psychiatric medication was included. The control group was established using a convenience sampling method.

Individuals with intellectual disability (IQ <80), a prior diagnosis of schizophrenia or schizoaffective disorder, or those currently experiencing a depressive, manic, or hypomanic episode of bipolar disorder were excluded from the study. All participants were provided with detailed information about the study, and written informed consent was obtained.

Procedure

The study was reviewed and approved by the Clinical Research Ethics Committee of Ankara University Faculty of Medicine (Approval No: İ04-185-22). Following ethical approval, the original English version of the WRAADDS was independently translated into Turkish by two members of the research team. The preliminary Turkish versions were then administered to a pilot sample consisting of 20 healthy controls and 20 individuals diagnosed with ADHD in order to assess clarity and comprehensibility.

Subsequently, the Turkish versions were back-translated into English by an independent expert. Based on feedback obtained from the back-translation process, necessary revisions were made, and the final version of the scale was established and used by the research team.

After completing the sociodemographic data form, participants were first assessed using the WRAADDS and the Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV by two researchers (SK and İA). Participants were then asked to complete the self-report measures, including the Wender Utah Rating Scale (WURS) and the Hospital Anxiety and Depression Scale (HADS).

Following the initial assessment, 35 participants diagnosed with ADHD were invited to return to the clinic after one or two weeks. To establish inter-rater reliability, these participants were reassessed with the WRAADDS by the other researcher who had not conducted the initial evaluation. For test-retest reliability, 45 participants from the control group were reassessed after one or two weeks, and the WRAADDS was re-administered by the same researcher.

Measures

Wender-Reimherr Adult Attention Deficit Disorder Scale

The Wender-Reimherr Adult Attention Deficit Disorder Scale is a clinician-administered instrument developed to assess the severity of ADHD symptoms in adults. The scale is based on the Utah Criteria used in the diagnosis of adult ADHD. Accordingly, WRAADDS focuses on symptomatology specific

to adulthood rather than childhood symptoms, encompasses a broader range of manifestations, and approaches ADHD from a dimensional perspective.

WRAADDS is a semi-structured scale consisting of 27 items and 7 subdomains that assess ADHD symptoms (Marchant et al. 2013). It evaluates seven domains: inattention, hyperactivity/restlessness, temper, emotional lability, emotional overreactivity, disorganization, and impulsivity. Each domain is scored based on the evaluation of the items under its respective heading (0=absent/not present, 2=clearly present or often true).

Subsequently, a summary score is assigned for each domain based on the severity of symptoms and their impact on functioning (0=none, 4=severe). The summary score is not a simple average of item scores but rather an integration of the extent and severity of impairments within the relevant domain. For example, if only one item is rated as clearly present but this symptom causes significant functional impairment, a summary score of "4" may still be appropriate for that domain.

After evaluating all seven domains, the total score is obtained by summing the domain summary scores. In addition, the scale includes a separate section at the end consisting of nine items assessing oppositional defiant disorder (ODD), scored between 0 and 2 (0=absent/not present, 2=clearly present or often true). The total score for this section is calculated separately from the ADHD domain scores.

Wender Utah Rating Scale

The Wender Utah Rating Scale is a self-report instrument developed by Ward et al. in 1993 to retrospectively assess childhood ADHD symptoms and to aid in the diagnosis of ADHD in adults (Ward 1993). The short form consists of 25 items rated on a five-point Likert scale ranging from 0 (not at all) to 4 (very much). The Turkish version of the WURS includes the following factors: irritability, depression, school problems, behavioral problems/impulsivity, and inattention. The validity and reliability of the Turkish version were demonstrated in a study conducted in 2005 (Öncü et al. 2005).

Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV

The Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV is a self-report scale that screens for ADHD in adulthood according to DSM-IV criteria, assesses symptoms, and determines their severity. It is a Likert-type scale consisting of three subscales: inattention, hyperactivity/impulsivity, and ADHD-related features and problems. The scale was developed by Atilla Turgay in 1998, and its Turkish validity and reliability study was conducted in 2006 (Günay et al. 2005).

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale is a brief self-report instrument developed by Zigmond and Snaith in 1983 to rapidly and reliably assess levels of anxiety and depression (Zigmond and Snaith 1983). The Turkish adaptation of the scale, along with its validity and reliability study, was conducted by Aydemir in 1997, demonstrating its suitability for the Turkish population (Aydemir 1997).

Statistical Analysis

As previously described, the original scoring of the scale covers seven domains defined in the Utah Criteria for ADHD. For each participant, the summary score of the items within each domain was considered the score of that domain, and the total scale score was obtained by summing the scores of all seven domains. Statistical analyses were performed using the IBM Statistical Package for the Social Sciences (SPSS) program, version 14 (IBM Inc.).

Sociodemographic variables and clinical characteristics were compared between groups using the independent samples t-test for continuous variables and the chi-square (χ^2) test for categorical variables. Descriptive statistics were presented as frequencies and percentages.

Validity analysis: For discriminant validity, WRAADDS scores were compared between the ADHD and healthy control groups. Since the Kolmogorov-Smirnov test indicated that the data did not follow a normal distribution, the Mann-Whitney U test was applied ($p < 0.01$). For concurrent validity, the relationships between WRAADDS scores and DSM-5 diagnostic criteria, the Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV, WURS, and HADS scores were examined using Spearman correlation coefficients.

Reliability analysis: Internal consistency was assessed using Cronbach's alpha coefficient and corrected item-total (item-rest) correlation coefficients. Item-total correlation coefficients indicate the relationship between each subscale and the total of the remaining subscales. Inter-rater reliability and test-retest reliability were evaluated by calculating Spearman correlation coefficients.

Within the scope of construct validity, confirmatory factor analysis (CFA) was conducted to examine the factor structure of the WRAADDS domains. The analysis was performed using summary scores representing each dimension, in accordance with the original development and scoring approach of the scale. In this approach, each summary score was included in the model as an indicator of its corresponding theoretical construct, and a predefined two-factor model was tested in which summary scores loaded only onto their respective factors (Factor 1: Inattention and Disorganization; Factor 2:

Hyperactivity/Restlessness, Emotional Lability, Emotional Overreactivity, and Impulsivity).

Model fit was evaluated using the chi-square test (χ^2), degrees of freedom (df), and the χ^2/df ratio. The statistical significance of factor loadings was examined using z-statistics, and the proportion of variance explained (R^2) by each factor for the corresponding dimension summary scores was reported. In addition, construct reliability was assessed using Cronbach's alpha (α) coefficients, and average variance extracted (AVE) values were calculated to examine convergent validity. All analyses were conducted using JASP software. The statistical significance level was set at 0.05.

RESULTS

Demographic and Clinical Characteristics of the Participants

A total of 232 individuals were included in the study, comprising 146 participants with ADHD and 86 controls. There was no significant difference between the groups in terms of age (t (230)=-6.91, p=0.49). However, differences in gender distribution ($\chi^2(1)=5.15$, p=0.01) and educational level ($\chi^2(3)=11.33$, p=0.01) were found to be statistically significant. No significant differences were observed between the groups with respect to marital status ($\chi^2(1)=0.54$, p=0.81) or occupational distribution ($\chi^2(5)=10.05$, p=0.07). The results are presented in Table 1.

Among participants diagnosed with ADHD, 39.7% (n=58) reported using stimulant medication, 26.7% (n=39) reported using combination treatment (i.e., more than one type of medication), 11% (n=16) reported using antidepressants, and 1.4% (n=2) reported using non-stimulant ADHD medication. Additionally, 18.5% (n=27) reported not using any medication. Four participants did not respond to this question. None of the participants in the control group reported using psychiatric medication.

Reliability

Internal Consistency Analysis

Internal consistency was evaluated using data obtained from the ADHD group. Corrected item-total (item-rest) correlation coefficients and Cronbach's alpha analysis are presented in Table 2.

Evaluation of the internal consistency of the WRAADDS indicated that all domains had high corrected item–total

Table 1. Demographic characteristics of the participants by group

Variables	ADHD group (n: 146)	Control group (n: 86)	Statistical analysis		p value
Age	24.46(5.82)	24.91 (2.21)	t: -6.91	df: 230	0.49 a
Mean (SD)	18–56	21–34			
Gender n (%)			χ^2:5.15	df: 1	0.01 b
Female	88 (60.3)	50 (58.1)			
Male	58 (39.7)	36 (41.9)			
Marital status n (%)			χ^2:0.54	df: 1	0.81 b
Single	137(93.8)	86(100)			
Married	9 (6.2)	-			
Education Level n (%)			χ^2:11.33	df: 3	0.01 b
Primary school	1 (0.7)	-			
Secondary school	2(1.4)	1 (1.2)			
High school	72(49.3)	24 (27.9)			
University	71 (48.6)	61 (70.9)			
Occupation n (%)			χ^2:10.05	df: 5	0.07 b
Unemployed	3 (2.2)	3 (3.5)			
Student	115 (78.8)	79 (91.9)			
Worker	10 (6.8)	1 (1.2)			
Civil servant	9 (6.2)	2 (2.3)			
Other	9 (6.2)	1 (1.2)			
Psychiatric medication use n (%)		-			
Stimulant	58(39.7)				
Non-stimulant ADHD medication	2(1.4)				
Antidepressant	16(11)				
Combination treatment	39 (26.7)				
None	27(18.5)				

SD: standard deviation; a independent samples t-test; b chi-square test.

correlations (r=0.57–0.83). The highest correlations were observed in the emotional lability (r=0.83) and impulsivity (r=0.83) domains. The results are presented in Table 2.

Table 3 presents the item-total statistics for the factor scores constituting the two-factor structure identified in the ADHD group (Factor 1: Inattention and Disorganization; Factor 2: Temper, Hyperactivity/Restlessness, Emotional Lability, and Emotional Overreactivity), as well as for the total score. The corrected item-total correlations were found to be r=0.66 for Factor 1 and r=0.91 for Factor 2. Cronbach's alpha coefficients, if the item was deleted, were 0.97, 0.59, and 0.54, respectively. (Detailed information regarding the factor structure is provided below.)

Additionally, the relationships between the WRAADDS domain summary scores and the items constituting these domains in the ADHD group are presented. According to the results of the Spearman correlation analysis, items in all domains showed statistically significant and expected-direction associations with their corresponding domain summary scores (all p <0.01). The results are presented in Table 4.

Table 2. Corrected item-total correlation coefficients and Cronbach's alpha values for WRAADDS

Variable	Scale mean (if item deleted)	Scale variance (if item deleted)	Corrected Item–Total Correlation (if item deleted)	Cronbach's Alpha (if item deleted)
Total of summary scores	14.6979	78.032	1.000	0.594
Inattention total score	17.5263	156.626	0.817	0.897
Hyperactivity/restlessness total score	19.6974	184.907	0.788	0.901
Temper total score	20.6053	201.282	0.569	0.916
Emotional lability total score	19.0395	172.145	0.832	0.894
Emotional overreactivity total score	20.0263	193.599	0.717	0.907
Disorganization total score	18.5395	171.718	0.735	0.903
Impulsivity total score	18.7368	163.770	0.825	0.895
ODD total score	19.3684	184.182	0.597	0.914

Cronbach's alpha coefficients and corrected item-total correlation values for the total of summary scores, the total score of the seven domains, and the ODD total score are presented. The expression "Cronbach's alpha if item deleted" indicates how internal consistency would change if the relevant item were removed from the scale. ODD: oppositional defiant disorder.

Table 3. Corrected item-total correlation coefficients and Cronbach's alpha values for WRAADDS factors

Variable	Scale mean (if item deleted)	Scale variance (if item deleted)	Corrected Item–Total Correlation (if item deleted)	Cronbach's Alpha (if item deleted)
Factor 1	33.30	68.17	0.66	0.97
Factor 2	26.90	33.59	0.91	0.59
Total of summary scores	20.06	21.52	1.00	0.54

Item-total statistics for the factor scores constituting the two-factor structure and the total score of the interviewer-administered form are presented. For each variable, the scale mean and variance if the item was deleted, corrected item-total correlations, and Cronbach's alpha coefficients if the item was deleted are reported.

Table 4. Correlations between WRAADDS domain summary scores and their corresponding items in the ADHD group

Corresponding items	WRAADDS inattention summary score	WRAADDS hyperactivity/ restlessness summary score	WRAADDS temper summary score	WRAADDS emotional lability summary score	WRAADDS emotional overreactivity summary score	WRAADDS disorganization summary score	WRAADDS impulsivity summary score
1	0.586**	0.385**	0.804**	0.664**	0.622**	0.566**	0.512**
2	0.457**	0.660**	0.797**	0.657**	0.569**	0.532**	0.560**
3	0.462**	0.742**	0.774**	0.502**	0.670**	0.511**	0.433**
4	0.378**	—	—	0.464**	—	0.478**	0.383**
5	0.374**	—	—	—	—	—	0.576**

Each column presents the correlation coefficients between the items belonging to the respective domain and the corresponding domain summary score. Only the items constituting the relevant domain are listed under each column. Correlations were calculated using Spearman's ρ coefficients. ** p <0.01.

Inter-rater Reliability

Inter-rater reliability was assessed by including 35 individuals diagnosed with ADHD. A high and statistically significant correlation was observed between the summary scores of the seven domains (ρ=0.893, p <0.01). In addition, a positive and very strong correlation was found between the total scores of the ODD domain of the WRAADDS (ρ=0.992, p <0.01).

Test-Retest Reliability

Test–retest reliability was evaluated in 45 individuals from the control group by both raters (SK and IA) using Spearman correlation analysis. The results indicated a statistically significant positive correlation (ρ=0.667, p <0.01).

Validity

Discriminant Validity

According to the results of the Mann-Whitney U test, the ADHD group had significantly higher WRAADDS total and domain summary scores compared to the control group (all p <0.001). The most pronounced differences between the ADHD and control groups were observed in the domains of inattention (Z=-9.689), hyperactivity/restlessness (Z=-10.990), and impulsivity (Z=-10.483). In addition, a significant difference was observed between the two groups in the ODD category (Z=-8.490, p <0.001). Furthermore, Mann-Whitney U values were found to be 1351.000 (Z=-10.0655, p <0.001) for Factor 1 and 655.50 (Z=-11.326, p <0.001) for Factor 2. These results indicate statistically significant differences between the groups in terms of both factor scores. The results are presented in Table 5.

Factor Analysis

In the analysis, the two-factor structure obtained by including the theoretically defined summary scores of the scale in the model was tested. Confirmatory factor analysis results indicated that the model demonstrated a good fit (χ^2=34.392, df=13, p=0.001). Examination of factor loadings showed that all domain summary scores loaded significantly onto their respective factors (all p <0.001).

The factor loadings for the inattention and disorganization domains under Factor 1 were found to be high, whereas

Table 5. Comparison of ADHD and control groups according to WRAADDS domains and subscales (Mann-Whitney U test)

Variables	Mean ± SD (Min - Max)	Mann-Whitney U	Wilcoxon W	Z	p (2-tailed)
Total of seven domain summary scores					
Patient	20.06±4.63 (7–27)	223.000	1213.000	-5.405	<0.001
Control	6.03±7.02(0–25)				
Inattention Summary Score					
Patient	3.56±0.76(1–4)	1745.000	5400.000	-9.689	<0.001
Control	1.03±1.99(0–4)				
Hyperactivity/Restlessness Summary Score					
Patient	2.86±1.02(0–4)	956.500	4694.500	-10.990	<0.001
Control	0.68±0.91(0–4)				
Temper Summary Score					
Patient	2.01±1.27(0–4)	1851.500	5592.500	-9.281	<0.001
Control	0.34±0.68(0–4)				
Emotional Lability Summary Score					
Patient	2.98±1.02(0–4)	1538.500	5279.500	-9.769	<0.001
Control	0.98±1.44(0–4)				
Emotional Overreactivity Summary Score					
Patient	2.51±1.19(0–4)	1860.000	5515.000	-9.022	<0.001
Control	0.81±0.98(0–4)				
Disorganization Summary Score					
Patient	3.26±0.99(0–4)	1733.500	5474.500	-9.468	<0.001
Control	1.22±1.79(0–4)				
Impulsivity Summary Score					
Patient	2.87±0.97(0–4)	1196.500	5474.500	-10.483	<0.001
Control	0.84±1.53(0–4)				
Factor 1					
Patient	6.83±1.43 (2–8)	1351.00	5006.00	-10.065	<0.001
Control	2.60±3.54 (0–17)				
Factor 2					
Patient	13.23±3.68 (2–20)	655.500	4310.500	-11.326	<0.001
Control	3.71±3.80 (0–20)				

The results of the Mann-Whitney U test comparing the measurement domains between the ADHD and control groups are presented. Significant differences were found between the groups in all domains and in the total score (p <0.001).
WRAADDS: Wender-Reimherr adult attention deficit hyperactivity disorder scale; SD: standard deviation.

the factor loadings for the domains under Factor 2—hyperactivity/restlessness, temper, emotional lability, emotional overreactivity, and impulsivity—ranged from moderate to high. The significant covariance between the factors (covariance=0.443, p <0.001) indicates that the two factors are related yet distinguishable constructs.

The average variance extracted (AVE) values calculated to assess convergent validity were 0.468 for Factor 1 and 0.377 for Factor 2. These findings suggest that the factor structure of the scale is generally supported at an acceptable level.

Correlations Between WRAADDS and ADHD Scales in the ADHD Group

In the ADHD group, generally significant and positive correlations were observed between WRAADDS and the WURS subscales. The total score of the seven WRAADDS domain summaries showed moderate positive correlations with the depression (ρ=0.399, p <0.01), irritability (ρ=0.343, p <0.01), and behavioral problems (ρ=0.343, p <0.01) subscales of the WURS.

Factor 1 scores demonstrated significant correlations particularly with the inattention (ρ=0.369, p <0.01) and depression (ρ=0.290, p <0.01) subscales of the WURS. Factor 2 scores, on the other hand, were positively associated with the irritability (ρ=0.339, p <0.01) and depression (ρ=0.370, p <0.01) subscales.

In contrast, no significant relationship was found between the school problems subscale and the WRAADDS total or factor scores (p >0.05). The results are presented in Table 7.

In the ADHD group, significant relationships were found between the WURS subscales and the WRAADDS domains. The strongest association was observed between WURS Inattention and WRAADDS Inattention (ρ=0.374, p <0.01). In addition, the WURS Irritability and WURS Depression subscales showed moderate and statistically significant correlations with the WRAADDS domains of Temper, Emotional Lability, and Emotional Overreactivity (ρ=0.259–0.389). The results are presented in Table 8.

Table 6. Confirmatory factor analysis results for the WRAADDS scale

Factor	Summary scores	Factor loading	R^2	AVE
Factor 1	Inattention	1.000	0.487	0.468
	Disorganization	0.960***	0.450	
Factor 2	Hyperactivity/Restlessness	1.000	0.408	0.377
	Temper	0.590***	0.142	
	Emotional lability	1.143***	0.533	
	Emotional overreactivity	0.939***	0.360	
	Impulsivity	1.040***	0.442	

***p <0.001. Factor loadings are unstandardized coefficients. R^2 values indicate the proportion of variance in each dimension explained by the corresponding factor. AVE: average variance extracted.

Table 7. Spearman correlation coefficients between WRAADDS and WURS subscales in the ADHD group

Variables	WRAADDS Total of Seven Domain Summary Scores	Factor 1	Factor 2
WURS total score	0.417**	0.320**	0.383**
WURS irritability	0.343**	0.188*	0.339**
WURS depression	0.399**	0.290**	0.370**
WURS school problems	0.158	0.137	0.135
WURS behavioral problems	0.343**	0.233**	0.336**
WURS inattention	0.282**	0.369**	0.215

Spearman's rho correlation coefficients (ρ) and *p <0.05, **p <0.01 (statistically significant). WURS: Wender Utah rating scale; WRAADDS: Wender-Reimherr adult attention deficit disorder scale.

Table 8. Spearman correlation coefficients between WRAADDS domains and WURS subscales in the ADHD group

Variables	WRAADDS Inattention	WRAADDS hyperactivity/ restlessness	WRAADDS temper	WRAADDS emotional lability	WRAADDS emotional overreactivity	WRAADDS disorganization	WRAADDS impulsivity	WRAADDS ODD total score
WURS irritability	0.173*	0.206*	0.333*	0.152	0.259**	0.110	0.151	0.337**
WURS depression	0.284**	0.255**	0.150	0.389**	0.270**	0.195*	0.203*	0.230**
WURS school problems	0.157	0.107	0.099	0.177*	0.104	0.068	0.060	0.147
WURS behavioral problems	0.202*	0.260**	0.222**	0.261**	0.136	0.177*	0.298**	0.304**
WURS inattention	0.374**	0.213*	0.089	0.173*	0.108	0.264**	0.189*	0.074

Spearman's rho correlation coefficients (ρ); *p <0.05, **p <0.01 (statistically significant). WURS: Wender Utah rating scale; WRAADDS: Wender–Reimherr adult attention deficit disorder scale.

In the ADHD group, significant and positive correlations were found between WRAADDS and the subscales of the Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV using Spearman correlation. The total score of the seven domains of WRAADDS showed moderate to high positive relationships with the total score of the inventory (ρ=0.682, p <0.01), the problems subscale (ρ=0.665, p <0.01), the inattention subscale (ρ=0.524, p <0.01), and the hyperactivity/impulsivity subscale (ρ=0.501, p <0.01).

According to the analysis results, Factor 1 showed significant positive relationships with the inventory inattention (ρ=0.513, p <0.001), hyperactivity/impulsivity (ρ=0.301, p <0.001), and problems (ρ=0.489, p <0.001) subscales. A significant positive correlation was also found between Factor 1 and the inventory total score (ρ=0.508, p <0.001).

When the relationships between Factor 2 and other variables were examined; it was observed that there were significant and positive correlations with the inventory inattention (ρ=0.455, p <0.001), hyperactivity/impulsivity (ρ=0.501, p <0.001), and problems (ρ=0.639, p <0.001) subscales. A strong correlation was also found between Factor 2 and the inventory total score (ρ=0.651, p <0.001).

In addition, the correlations between WRAADDS domains and the subscales and total score of the Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV are shown in Table 9. The inventory problems subscale showed significant correlations with WRAADDS emotional lability (ρ=0.511, p <0.01), emotional overreactivity (ρ=0.499, p <0.01), and disorganization (ρ=0.400, p <0.01). The inventory hyperactivity/impulsivity subscale showed significant positive relationships with WRAADDS impulsivity (ρ=0.492, p <0.01) and hyperactivity/restlessness (ρ=0.453, p <0.01). The inventory inattention subscale showed significant correlations with WRAADDS disorganization (ρ=0.470, p <0.01) and impulsivity (ρ=0.382, p <0.01).

Correlations between WRAADDS subscales and HADS subscales in the ADHD group

The total score of the seven domains of WRAADDS did not show a significant relationship with the HADS anxiety (ρ=-0.028, p >0.05) and depression (ρ=-0.149, p >0.05) subscales. Factor 1 scores showed a weak but significant negative correlation with the HADS depression subscale (ρ=-0.215, p=0.010), however, no significant relationship was found with the anxiety subscale (ρ=0.024, p=0.775). Factor 2 scores were not found to be related to either the HADS anxiety (ρ=-0.046, p=0.584) or depression (ρ=-0.116, p=0.168) subscales.

Effect of age and gender on WRAADDS scores in the ADHD group

According to the results of the Spearman correlation analysis, no significant correlations were found between age and WRAADDS inattention (ρ=-0.004, p=0.965), hyperactivity/restlessness (ρ=-0.004, p=0.963), temper (ρ=-0.118, p=0.159), emotional lability (ρ=0.099, p=0.235), emotional overreactivity (ρ=-0.038, p=0.653), disorganization (ρ=0.148, p=0.075), impulsivity (ρ=0.184, p=0.026), ODD total score (ρ=-0.123, p=0.140), total score of the seven domains (ρ=0.071, p=0.397), Factor 1 (ρ=0.107, p=0.199), and Factor 2 (ρ=0.049, p=0.559) in the ADHD group.

According to the results of the Mann-Whitney U test conducted by gender, no statistically significant differences were found between WRAADDS total and subscale scores, the total score of the seven domains, and factor scores; the results are presented in Table 10.

Table 9. Spearman correlation between the subscales of the Adult ADHD diagnostic and evaluation inventory based on DSM-IV by Atilla Turgay and the WRAADDS domains and total score in the ADHD group

WRAADDS domains	Inattention	Hyperactivity/impulsivity	Problems	Total score
Inattention	0.354**	0.280**	0.388**	0.397**
Hyperactivity / restlessness	0.266**	0.453**	0.390**	0.434**
Temper	0.269**	0.242**	0.373**	0.355**
Emotional lability	0.343**	0.309**	0.511**	0.494**
Emotional overreactivity	0.259**	0.243**	0.499**	0.443**
Disorganization	0.470**	0.221**	0.400**	0.425**
Impulsivity	0.382**	0.492**	0.391**	0.483**
ODD total score	0.237**	0.322**	0.347**	0.359**
WRAADDS total score of seven domains	0.524**	0.501**	0.665**	0.682**

Spearman's rho correlation coefficients (ρ); *p <0.05, **p <0.01 (statistically significant). WRAADDS: Wender-Reimherr adult attention deficit disorder scale.

Table 10. Mann-Whitney U test results for WRAADDS domains and subscale scores by gender

Variables	Gender	Mean ± SD (min -max)	Mann-Whitney U	Wilcoxon W	Z	p
Total summary score	Female	20.50±4.48 (7–27)	2199.000	3852.000	-1.255	0.210
	Male	19.40±4.83 (7–25)				
Inattention summary score	Female	3.62±0.68 (2–4)	2353.000	4064.000	-1.000	0.317
	Male	3.46±0.86 (1–4)				
Hyperactivity/restlessness summary score	Female	2.84±1.01 (1–4)	2424.500	6340.500	-0.354	0.723
	Male	2.89±1.02 (0–4)				
Temper summary score	Female	2.07±1.27 (0–4)	2314.500	3967.500	-0.805	0.421
	Male	1.91±1.27 (1–4)				
Emotional lability summary score	Female	3.09±0.93 (0–4)	2186.500	3839.500	-1.371	0.170
	Male	2.80±1.14 (0–4)				
Emotional overreactivity summary score	Female	2.63±1.13 (0–4)	2133.500	3786.500	-1.565	0.118
	Male	2.31±1.25 (0–4)				
Disorganization summary score	Female	3.35±0.92 (0–4)	2262.000	3915.000	-1.106	0.269
	Male	3.12±1.08 (0–4)				
Impulsivity summary score	Female	2.87±0.96 (1–4)	2400.000	6316.000	-0.471	0.638
	Male	2.85±0.98 (0–4)				
ODD total score	Female	4.96±3.63 (0–15)	2491.500	4144.500	-0.067	0.947
	Male	4.96±3.64 (0–16)				
Factor 1	Female	6.97±1.26 (4–8)	2282.500	3935.500	-0.973	0.331
	Male	6.61±1.65 (2–8)				
Factor 2	Female	13.52±3.64 (2–20)	2236.500	3889.000	-1.106	0.269
	Male	12.78±3.74 (4–18)				

Values represent statistics from the Mann-Whitney U test. The grouping variable is gender. $p < 0.05$ was considered statistically significant.

DISCUSSION

In this study, the validity and reliability of the Turkish version of the WRAADDS were tested, and it was demonstrated that the scale has sufficient psychometric properties for assessing adult ADHD.

It is estimated that approximately two-thirds of individuals with ADHD exhibit impairments in emotional regulation capacity (Surman et al. 2013, Shaw et al. 2014). Such impairments have been reported to be associated with more severe clinical presentations, an increased risk of psychiatric comorbidities, and significant impairments in overall functioning (Rosello et al. 2020, Welkie et al. 2021, Mayer et al. 2022, Sanabra et al. 2022).

Since ADHD is a clinical diagnosis, it may sometimes pose challenges for clinicians or lead to certain aspects being overlooked. In our country, one of the limited options that can be used for semi-structured ADHD assessment is the DIVA 2.0 (Diagnostisch Interview Voor ADHD bij Volwassenen) diagnostic interview (Kooij and Francken, 2010). Although this interview is based on DSM symptoms and evaluates inattention and hyperactivity/impulsivity domains comparatively across both childhood and adulthood, its failure to assess symptom domains such as emotional lability—particularly relevant for functioning in adulthood—and the lengthy duration of the assessment limit its clinical utility.

Unlike DSM-5-based or childhood-symptom-based assessment tools, WRAADDS differs as a diagnostic support tool by additionally evaluating difficulties in emotion regulation, temperament characteristics, and emotional overreactivity. This approach not only facilitates a more comprehensive characterization of the disorder but also provides an assessment that can be used in the treatment and follow-up of cases.

In addition, unlike self-report scales used to assess ADHD, the clinician scores the form together with the patient by considering functionality and symptom severity through the semi-structured format of the instrument, which provides a transparent evaluation.

In our study, it can be stated that WRAADDS strongly discriminates individuals with ADHD, and this difference is statistically significant both for the total of the summary scores and for each of the seven core domains. In addition, the results of the internal consistency analysis evaluated with Cronbach's alpha indicate that the scale has high internal consistency. Our findings also demonstrated that WRAADDS

consistently measures ADHD symptoms independently of the evaluator, as shown by the inter-rater reliability analysis, and that similar results were obtained for test–retest analyses.

In the original scale, the first factor includes domains related to emotional dysregulation (temper, emotional lability, and emotional overreactivity) as well as hyperactivity/restlessness, whereas the second factor includes the domains of inattention and disorganization, and the impulsivity domain was found to be similarly associated with both factors (Marchant et al. 2013). Confirmatory factor analysis was conducted to test structural validity and model fit. Our data showed good agreement with the factor structure of the original scale. The findings indicate that the original factor structure of the scale can also be used in the Turkish sample.

In our study, ADHD symptoms were assessed using two different scales: the WURS and the Adult ADHD Diagnostic and Evaluation Inventory Based on DSM-IV. Following correlation analyses, the presence of correlations between both total scores and relevant subscales is one of the indicators of the reliability of the scale. However, the weak to moderate correlations between the subscales of the WURS and WRAADDS may be due to the fact that the WURS evaluates childhood symptoms.

It has been reported that nearly 80% of adults diagnosed with ADHD have at least one comorbid psychiatric disorder (Sobanski et al. 2007, Seo et al. 2022, Faraone et al. 2023). Considering this high comorbidity rate, not excluding ADHD cases with anxiety and/or depression diagnoses from the analyses is important in terms of reflecting the clinical reality of the sample. However, the lack of statistical significance in the relationships between the HADS subscales and WRAADDS, except for the weak correlation between Factor 1 and the HADS depression subscale, may indicate that the scale has the potential to distinguish ADHD-specific symptoms rather than symptoms of other conditions. Nevertheless, the absence of subgroup analyses based on comorbid diagnoses may be considered a limitation that restricts a more detailed interpretation of this relationship.

In addition, no significant differences were found between genders in WRAADDS scores, and no correlations were detected between age and any parameter. These findings suggest that WRAADDS can assess adult ADHD symptoms relatively independently of demographic variables such as age and gender and may serve as a consistent measurement tool across different demographic groups.

LIMITATIONS AND CONCLUSIONS

Our study has several limitations. Only individuals diagnosed with ADHD who presented to the outpatient clinic of the Department of Psychiatry at Ankara University Faculty of Medicine were included in the study. In our study, the ADHD subtypes according to DSM-5 were not specified. In addition, medication use and comorbid diagnoses in the ADHD group were not evaluated. Furthermore, considering that WRAADDS includes emotional dimensions, the absence of a comparison group consisting of individuals diagnosed with bipolar disorder constitutes a limitation in terms of evaluating the discriminative power of the scale for this group. In future studies, the inclusion of such comparison groups may provide important contributions to both clinical practice and research. The healthy control group was recruited using convenience sampling. The differences between the groups in terms of gender and marital status may be due to the sample size or the use of convenience sampling for the control group. However, this does not change the significance of the results.

In conclusion, the Turkish version of WRAADDS can be considered a valid and reliable scale and an appropriate tool for use by clinicians both in practice and in future studies.

The Turkish version of WRAADDS can be obtained by contacting the authors.

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