

Relations between Post-traumatic Stress Disorder, Dissociation and Attention-Deficit/Hyperactivity Disorder among Earthquake Survivors

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ABSTRACT

Introduction: There is a burgeoning interest in relations between post-traumatic stress disorder (PTSD) and attention-deficit/hyperactivity disorder (ADHD). Although few studies were conducted, weak evidence was found supporting the hypothesis that ADHD may be a risk factor for the development of PTSD. In addition, there is a paucity of research addressing the relations between dissociation and ADHD. In this study, our aim was to examine the relations between PTSD and ADHD combined with the mediating effect of dissociative psychopathology.

Methods: The participants were 317 undergraduate students, a greater proportion of whom experienced the 2011 Van earthquake (66%). The participants were administered the Posttraumatic Diagnostic Scale, Dissociative Experiences Scale, Adult ADHD Self-Report Scale, Beck Depression Inventory and Beck Anxiety Inventory.

Results: We found that ADHD symptoms and dissociation were significantly associated with PTSD. Considering the multivariate relations between ADHD, PTSD and dissociation, significant associations between PTSD and ADHD resulted from symptom overlaps. However, pathological dissociation mediated the relations between PTSD and ADHD.

Conclusion: We concluded that ADHD comorbidity was not a predominant vulnerability factor for the development of post-traumatic stress response but may be an exacerbating factor after the development of PTSD.

Keywords: PTSD, ADHD, dissociation, depression, natural disaster

INTRODUCTION

In literature, there is an increased interest to document the relations between post-traumatic stress disorder (PTSD) and attention-deficit/hyperactivity disorder (ADHD). Several hypotheses were proposed concerning potential mechanisms underlying the high level of comorbidity of PTSD with other psychiatric disorders such as ADHD. First, individuals with certain psychiatric disorders such as ADHD are at a greater risk for the development of PTSD among the survivors of trauma and these psychiatric disorders may have been present before traumatic experiences (1,2). Second, childhood ADHD functions as a risk factor for trauma exposure, which plays an important role in the later onset of PTSD (3,4). In addition to these hypotheses, childhood traumatic experiences may render survivors more vulnerable to experiencing an exacerbation of ADHD symptoms. Third, the common factor hypothesis postulates that different mental disorders are manifestations of a general latent psychopathology factor. From this view, common personal characteristics such as temperament and personality confer the risk for both ADHD and PTSD (5). Finally, associations between symptoms of PTSD and ADHD are another source of knowledge to better understand the relations between these two disorders.

To date, several studies have examined the associations between PTSD and ADHD. Fumaloro, Fenton (6) examined the comorbidity of PTSD among 117 children who experienced severe child maltreatment and psychological trauma and found that 41 of these children (35%) met the criteria for PTSD. ADHD was a comorbid condition for 15 (37%) of the 41 children with PTSD, whereas the proportion of children with ADHD was only 17% (n=13) among 76 maltreated children without PTSD. Glod and Teicher (7), in a study of the comparison between 19 children with abuse history and 15 children without any prior abuse, found that abused children with PTSD have significantly higher levels of activity, which was similar to those of children with ADHD, with compared with those of both non-abused children and abused children without PTSD. Riggs et al. (8) studied 99 delinquent boys who had conduct disorder and substance use disorder and found that PTSD and ADHD are significantly higher comorbid conditions among depressed boys than those among non-depressed adolescents. Husain et al. (9) also found significant associations of attention deficit symptoms with PTSD symptom severity among children exposed to the Bosnian war.

In literature, studies considering the relationship between PTSD and ADHD among adults were also conducted. Adler et al. (10) assessed the comorbidity of ADHD among 25 male veterans with PTSD and 22 male veterans with panic disorder. The frequency of



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Received: 06.01.2014 **Accepted:** 04.03.2014 **Available Online Date:** 07.07.2015

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comorbid ADHD was significantly higher in the PTSD group ($n=9$; 36%) than that in the panic disorder group ($n=2$; 9%). In another study where the sample was comprised 222 male and female veterans who were exposed to traumatic events, it was found that 54.5% of the sample met the criteria for PTSD at that time and that 11.5% of these participants with PTSD also met the criteria for adult ADHD at that time. The level of trauma exposure and ADHD severity were significant antecedents of PTSD severity. In the study, the authors also examined the covariance structure between four-factor PTSD, including re-experiencing, numbing, hyperactivity and avoidance and three-factor ADHD, including inattention, hyperarousal and impulsivity and found that the measurement model yields excellent fitting. Standardized covariance values pointed out that problems with modulating arousal levels are common to both disorders (11). Biederman et al. (12) compared psychiatric comorbidity, psychosocial, educational and cognitive parameters between 271 youths with ADHD and 230 controls without ADHD of both sexes. ADHD in subjects with PTSD exhibit a greater clinical severity than the remaining subjects in the control and ADHD groups and ADHD is associated with PTSD. However, ADHD in the subjects with PTSD have higher lifetime rates of almost all psychiatric disorders.

Although previous studies generally reported strong connections between PTSD and ADHD, the findings are not unequivocal. Wozniak et al. (13), in a longitudinal study, examined the linkages of ADHD to the risk of trauma, post-traumatic stress and trauma-associated psychopathology. ADHD was not found to be a risk factor for either trauma exposure or PTSD in that study. Ackerman et al. (14) compared the prevalence of PTSD and other diagnoses in a group of 204 sexually and physically abused children, aged 7–13 years. PTSD is significantly comorbid with most affective disorders. However, in the factor analysis of comorbid disorders, PTSD and ADHD could not be classified in the same factors. Ford et al. (15) found that PTSD symptoms are more severe if ADHD and maltreatment co-occurred, whereas the authors accounted for the fact that a significant association between ADHD and PTSD was largely due to overlapping symptoms. This view was replicated by Weinstein et al. (16) who pointed out the high degree of symptom overlap and comorbidity of these two disorders.

Associations between PTSD and dissociative symptomatology are well-elaborated (17,18,19). However, there is a paucity of research examining the connections between dissociation and ADHD. One of the few studies related to the connections between these two disorders demonstrated that abused children have ADHD and a concomitantly exceeding level of dissociation (20). In another investigation, Matsumoto and Imura (21) echoed similar results that a significant linkage between childhood ADHD symptoms and dissociative tendency is found.

Given the inconsistent findings from previous studies of the relations between PTSD and ADHD, further studies are needed to better understand the associations between these two disorders. The aim of this study was to investigate the relationship between PTSD and ADHD symptoms in a community adult sample, an important proportion of who were survivors of the Van earthquake in 2011. We also evaluated the possible mediating role of dissociative tendency between PTSD and ADHD symptoms after controlling the demographic and affective characteristics of the participants.

METHODS

Participants and Procedures

The participants were 317 undergraduates randomly selected from various faculties of the Yüzüncü Yıl University. The participants were

briefly informed about the aim of the study. Each participant gave a written consent. The participants were administered a sociodemographic questionnaire, the Posttraumatic Diagnostic Scale (PDS), Dissociative Experiences Scale (DES), Adult ADHD Self-Report Scale (ASRS), Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI). Their mean age was 22.53 ($SD\pm 2.27$; ranged from 18 to 38) years. Of the sample, 209 participants (65.93%) were survivors of the 2011 Van earthquake. Sixty-five participants (21.1%) were DES-taxon members. The study procedure received an approval from the Yüzüncü Yıl University Ethical Committee.

Psychometric Instruments

Sociodemographic questionnaire: A questionnaire was designed according to the purpose of the study. The sociodemographic questionnaire included questions about age, gender, whether the participants experienced the Van earthquake in 2011 and the last year's grade point average (GPA) as a measure of their academic performance.

Posttraumatic Diagnostic Scale, self-report version: The Posttraumatic Diagnostic Scale, Self-report version (PDS-SR) is a 17-item self-report questionnaire reflecting DSM-IV symptoms of PTSD, which are rated on a four-point Likert-type scale: 0=not at all, 1=a little bit (once a week or less), 2=somewhat (2–4 times a week) and 3=almost always (five or more times a week) (22). It provides the total severity score, three subscale scores of re-experience, avoidance and arousal and demonstrates functional impairment in several areas. Essentially, the initial development of the instrument as PTSD Symptom Scale-Self Report (PSS-SR) reflects an attempt to measure DSM-III-R notion of posttraumatic stress disorder symptoms in response to trauma exposure (23). PSS-SR consisted of 17 items, the same as PDS-SR, but with a little difference being that physiological reactivity on exposure to cue symptoms was involved in the arousal subscale instead of the re-experiencing symptoms cluster. The measure has been shown to be a valid and reliable instrument to assess PTSD in qualitatively different traumatic situations (24,25). The validation study of the Turkish version of PDS-SR in line with the DSM-IV TR notion of PTSD was performed by Aydin et al. (26).

Dissociative Experiences Scale: The Dissociative Experiences Scale (DES) is a 28-item self-report questionnaire developed for screening dissociative experiences in a community sample (27). The Turkish version of DES was demonstrated to have good reliability and validity, almost equal to its original form (28). Factor analysis showed that the measure has three subscales of depersonalization and derealization, amnesia and absorption and imaginative involvement (29,30). DES-taxon proposed by Waller et al. (31) includes eight items of DES, an indicator of a proneness to develop dissociative disorders has prevalent use. DES-taxon membership was determined following the formulations of Waller and Ross (32); one was assigned to the DES-taxon membership if his or her computed probability, which was engendered from his or her item responses, exceeded a critical threshold score of 0.90.

Adult ADHD Self-Report Scale: ASRS was developed by the World Health Organization (WHO) and the Workgroup on Adult ADHD (33). The instrument has eighteen questions containing DSM-IV-TR criteria for ADHD. Each question is rated on a five-point Likert scale (never, rarely, sometimes, often and very often). The validity and reliability study of the Turkish version of the scale was conducted by Dogan et al. (34). The authors suggested a two-factor solution, complying with DSM-IV diagnostic criteria for ADHD, that nine items were clustered in the attention deficit dimension and that the remaining nine items were clustered in hyperactivity/

Table 1. Pearson product–moment correlation coefficients

	PTSD global	Re-experiencing	Avoidance	Hyperarousal
DES total	0.40**	0.35**	0.37**	0.36**
DES-absorption	0.42**	0.36**	0.37**	0.39**
DES-amnesia	0.30**	0.27**	0.29**	0.24**
DES-depersonalization/derealization	0.36**	0.31**	0.33**	0.31**
Attention deficit	0.40**	0.31**	0.38**	0.38**
Hyperactivity/impulsivity	0.43**	0.34**	0.39**	0.42**
Beck anxiety inventory	0.55**	0.45**	0.52**	0.50**
Beck depression inventory	0.38**	0.27**	0.40**	0.34**
Grade point average	−0.19**	−0.13*	−0.17**	−0.21**

*p<0.05; **p<0.01. DES: dissociative experiences scale; PTSD: post-traumatic stress disorder

impulsivity dimension. Internal consistency for the attention deficit subscale was $r=0.82$ and for the hyperactivity/impulsivity subscale was $r=0.78$.

Statistical Analysis

First, we computed descriptive statistics for the sample. Univariate relations between psychological variables were assessed by utilizing the Pearson product–moment correlation coefficients. The scale scores of the participants were separately compared between groups including the participants with DES-taxon membership and those with no membership using one-way analysis of variance (ANOVA) models. In the final analysis, a multivariate analysis of covariance (MANCOVA) model was conducted to assess the multivariate associations of PTSD symptoms with ADHD, depression, anxiety and demographic characteristics as well as the mediational effect of DES-taxon membership between PTSD symptoms and independent variables. The significance threshold was set at $p<0.05$.

RESULTS

The relations of PTSD symptoms with dissociation subtypes, ADHD, anxiety, depression and academic success were evaluated by running Pearson product–moment correlation analysis. Age did not significantly link to PTSD symptoms. The DES total and subscale scores were significantly correlated with the PDS total and subscale scores. The participants who reported elevated scores on the PDS total and subscale scores also reported greater scores on the attention deficit subscale of the adult ADHD scale as well as the hyperactivity/impulsivity subscale. Significant correlations of PTSD symptoms with BAI were computed. Relatively lower correlations were found between the BDI and PDS subscales. Significant relations between PTSD symptoms and GPA scores of the participants were mild. The results are presented in Table 1.

Sixty-five participants (21.1%) belonged to the dissociative taxon. The participants involved in the DES-taxon membership were considered to experience dissociative symptoms at a considerable level to meet a clinical dissociative disorder. To primarily understand the differences on the severity scores of PTSD and ADHD between individuals who have DES-taxon membership and those with no membership, we ran one-way ANOVA models. The participants who had DES-taxon membership reported significantly higher scores on the PDS subscales, more severe attention deficit and hyperactivity/impulsivity subscale scores and elevated levels of anxiety and depression as compared with those of non-dissociative individuals. Dissociative participants were also academically less competent in terms of GPA scores than non-dissociative individuals. The findings are given in Table 2.

MANCOVA was performed to assess whether DES-taxon membership resulted in any differences on the PTSD symptom clusters while age, gender, experiencing earthquake, anxiety, depression, attention deficits, hyperactivity/impulsivity and GPA were utilized as covariants. A MANCOVA model also enabled jointly evaluating the multivariate effects of independent variables on a set of dependent variables, which this study were the PTSD symptom dimensions. Additionally, the model derived partial relations of dependent variables with predictors adjusting for the effects of either dependent or independent variables. The main effects of pathological dissociation were highly significant for the intrusions, avoidance and hyperarousal subscale scores of PDS. Among covariates, the BAI scores were significant antecedents of intrusions, avoidance and hyperarousal subscales as well. The severity of depressive symptomatology was a significant covariant for the avoidance symptoms. The attention deficits scores significantly linked to the avoidance subscale, whereas the hyperactivity/impulsivity scores linked to the hyperarousal subscale as covariates. Gender and experiencing the earthquake were the covariates of the intrusions scale of PDS in the model. The findings are presented in Table 3.

DISCUSSION

The Pearson product–moment correlation coefficients provided evidence for significant relations of a typical triad of the PTSD symptom dimensions with dissociative symptomatology, ADHD, anxiety and depression. The associations of the severity of the PTSD symptoms with the dissociation and ADHD dimensions were average as the connections with depression and anxiety. In the further analyses, ANOVA models revealed that in comparison to the non-DES-taxon membership group, individuals with a tendency of dissociative pathology also reported a greater severity of the PTSD symptoms, higher scores on the attention deficit and hyperactivity/impulsivity components of the adult ADHD Scale and elevated levels of anxiety and depression. These results were not surprising because research has consistently demonstrated significant linkages between PTSD symptoms and dissociative symptomatology (18,19,35). These findings were also consistent with literature where both PTSD and dissociative symptoms are significantly associated with deteriorations in ADHD symptom severity as well (9,10,12,21). However, although it seems that ADHD is a significant risk factor for exacerbating the symptoms of PTSD and dissociative experiences, to the best of our knowledge, it would not make sense to obtain significant univariate linkages between these pathology clusters because etiological factors playing a role on the development of PTSD and ADHD are quite different and significant relations between the symptoms of these two psychopathologies are suggested to be interpreted with caution because of extreme symptom overlaps (15,16,36).

Table 2. Scores of psychological variables according to the dissociation status

	No membership		DES-taxon membership		F	df	P	Partial η^2
	Mean	SD	Mean	SD				
Posttraumatic diagnostic scale								
PTSD global	14.82	10.07	22.00	12.35	23.206	1, 300	0.000	0.072
Re-experiencing	4.47	3.51	6.77	4.29	19.593	1, 300	0.000	0.061
Avoidance	5.58	4.16	8.34	5.47	19.238	1, 300	0.000	0.060
Hyperarousal	4.76	3.62	6.89	3.94	16.773	1, 300	0.000	0.053
Dissociative experiences scale								
DES total	15.74	9.33	46.98	14.24	449.968	1, 306	0.000	0.595
Absorption	21.69	12.83	48.19	15.69	198.210	1, 306	0.000	0.393
Amnesia	9.98	9.27	44.60	17.79	457.985	1, 306	0.000	0.599
Depersonalization/derealization	11.47	10.06	47.95	16.91	488.237	1, 306	0.000	0.615
Adult ADHD self-report scale								
Attention deficit	12.95	5.23	15.57	7.10	10.832	1, 302	0.001	0.035
Hyperactivity/impulsivity	13.40	4.98	16.32	6.85	14.819	1, 302	0.000	0.047
Beck anxiety inventory	36.11	10.95	41.09	13.91	9.410	1, 306	0.002	0.030
Beck depression inventory	12.22	9.67	18.00	12.95	15.698	1, 306	0.000	0.049
Grade point average	70.38	9.19	63.85	9.12	26.036	1, 306	0.000	0.078

SD: standard deviation; DES: dissociative experiences scale; PTSD: post-traumatic stress disorder; ADHD: attention-deficit/hyperactivity disorder

Table 3. Multivariate covariance analysis (MANCOVA) with subscale scores of PDS as dependent variables according to the DES-taxon membership status

	Dependent	Mean square	F (1, 289)	p	Partial η^2
DES-taxon membership	Re-experiencing ^A	78.765	7.395	0.007	0.025
	Avoidance ^B	74.884	5.210	0.023	0.018
	Hyperarousal ^C	39.646	4.005	0.046	0.014
Covariates					
Beck anxiety inventory	Re-experiencing	312.811	29.370	0.000	0.092
	Avoidance	494.998	34.440	0.000	0.106
	Hyperarousal	310.735	31.393	0.000	0.098
Beck depression inventory	Avoidance	85.752	5.966	0.015	0.020
Adult ADHD self-report scale					
Attention deficits	Avoidance	63.098	4.390	0.037	0.015
Hyperactivity/impulsivity	Hyperarousal	50.424	5.094	0.025	0.017
Gender	Re-experiencing	60.815	5.710	0.018	0.019
Earthquake	Re-experiencing	74.203	6.967	0.009	0.024

^AAdjusted R²=0.26; ^BAdjusted R²=0.32; ^CAdjusted R²=0.30. DES: dissociative experiences scale; PDS: posttraumatic diagnostic scale; ADHD: attention-deficit/hyperactivity disorder

Therefore, in the further analysis, complex relations between PTSD, ADHD and dissociative psychopathology utilizing the ANCOVA model demonstrated that individuals more prone to dissociative disorders exhibited exacerbation of all PTSD symptoms, including re-experiencing, avoidance and hyperarousal. Anxiety was also a significant covariate for all three PTSD symptom clusters. Depression was only an important covariate for avoidance. The attention deficit scores of the participants were found to be a significant covariate of the avoidance symptoms; on the other hand, hyperactivity/impulsivity was a significant covariate of the

hyperarousal subscale. The multivariate results of this study echoed the previous findings by Ford et al. (15) and Biederman et al. (12) and supported the hypothesis that having ADHD is a risk factor for elevation in PTSD symptoms; however, these elevations seem to be more related to symptom overlaps that probably emerged from the increased activation of the sympatric system in both these psychopathologies. ADHD seems to not be a significant antecedent of PTSD status; rather, it appears to be a general risk factor for PTSD symptom severity (16,36). We found that pathological dissociation was a mediator variable between the PTSD

and ADHD symptoms, which was a preliminary finding considering the relations between these two diagnostic categories. However, adult ADHD was not a significant risk factor for the development of dissociative psychopathology.

To date, this was the only study considering relationships of academic competence in terms of GPA with PTSD and DES-taxon membership, which is an indicator of dissociative disorders among a group to which a precedence exposed a severe earthquake. We observed significant negative correlations between the GPA scores of the participants with PTSD symptoms, but the strength of these relations were weak. Furthermore, the participants more prone to develop some type of dissociative disorders exhibited significantly lower academic competence than those who reported lower dissociative symptomatology. However, effect size was also mild (8%). Absorption, amnesia and depersonalization/derealization are the components of dissociative experiences (37). Executive functions are also thought to be associated with complex cognitive skills encompassing strategizing, abstract reasoning, internal ordering, controlled attention, self-monitoring and self-serving behavior (38). These skills play a very important role in students' learning processes (39). Although there have been suggestions that dissociative experiences fundamentally comprise cognitive processes, few studies have investigated the relationship between dissociative and executive functions and significant associations between these two phenomena were found (38,40,41). In the present study, in line with the previous findings, academic competence was significantly associated with pathological dissociation and the severity of PTSD symptoms, but the associations were not strong. Additionally, these mild relations between academic competence and PTSD symptoms became unsubstantial when adjusted for other psychological variables in a MANCOVA model.

This study has several limitations. First, we collected data from a sample of those who experienced the earthquake in 2011. Hence, caution should be taken when generalizing the current findings to survivors of other types of trauma or community samples. Second, given the type of screening instruments, which were self-reported psychometric measures, these relations should be reconsidered using psychiatric interviews to prove more reliable and valid for these variables. Finally, the design of this study was cross-sections that further investigations making use of a longitudinal design in clinical and non-clinical samples would ensure a more comprehensive understanding of these relations.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

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