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ORIGINAL PAPER

The Link between Post-traumatic Stress Symptoms and Mental Well-being among Adolescent Survivors of the 2023 Türkiye Earthquakes: Internalized and Externalized Problems Acting as Mediators

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Abstract
Post-traumatic stress symptoms are one of the most prominent psychological disorders experienced after earthquakes. Although post-traumatic stress symptoms have been investigated as a negative predictor of adolescents' mental well-being, the role of internalizing and externalizing problems in this connection has not been sufficiently investigated. The present study aims to examine the mediating role of internalizing and externalizing problems in the relationship between posttraumatic stress symptoms and mental well-being in adolescents who survived the earthquake. A total of 498 adolescents, 306 girls and 192 boys, participated in the study. The findings of the study showed that there were significant relationships between the variables. Accordingly, posttraumatic stress symptoms were found to be a significant negative moderator of mental well-being, and internalizing and externalizing problems also played mediating roles in this relationship. According to this, as post-traumatic stress symptoms increase, mental well-being decreases as post-traumatic stress symptoms increase, while the level of internalizing and externalizing problems increases. Therefore, to protect and improve the mental well-being of adolescents who survived the earthquake, it is considered that psychological intervention methods that reduce post-traumatic stress symptoms, internalizing and externalizing problems are important.

Keywords Post-traumatic stress symptoms · Mental well-being · Internalized problems · Externalized problems · Adolescents

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Introduction

On February 6, 2023, two major earthquakes of approximately 7.6 and 7.4 magnitude and dozens of smaller earthquakes that followed affected many provinces in Türkiye, especially Maraş. Official data shows that more than 50,000 people lost their lives, tens of thousands were injured and millions were directly affected (Gokceoglu 2023). This destructive earthquake had a negative impact not only on infrastructure and economy, but also on the mental well-being of survivors. Mental well-being includes happiness, life satisfaction, mental health, as well as resilience, which contributes to the ability of individuals to quickly return to the situation before the trauma they experienced (Baldwin et al. 2021). Studies show that earthquakes can negatively affect not only the physical health but also the mental well-being of adolescents (Tang et al. 2017). Given the critical role mental well-being plays during formative years, it is essential to consider how mental well-being influences various aspects of adolescent development. Adolescents' having high levels of mental well-being is important for their healthy social emotional development as well as their healthy development with the environment (İme 2025a). In addition, there are various problems that threaten the mental well-being of adolescents all over the world and are increasing day by day. Abuse, domestic violence, bullying and exploitation are among the important risks for adolescents' mental well-being (Couturiaux et al. 2021). On the other hand, traumas are also important disasters that affect the mental well-being of adolescents. Natural disasters such as earthquakes negatively affect the mental well-being of adolescents and lead to the development of psychopathological problems such as post-traumatic stress disorder, especially mood disorders such as depression (Tang et al. 2018). Given these impacts, it is likely that adolescents exposed to natural disasters will exhibit post-traumatic stress symptoms, signaling an increased risk of related mood disorders.

Adolescents are among the most vulnerable groups that may be exposed to the negative effects of earthquakes. Adolescents, like adults, can develop various mental health problems after an earthquake. While some of them may have shorter-term reactions, others may show psychiatric problems that persist after the trauma has passed (Bernstein and Pfefferbaum 2018; Powell et al. 2021). Various studies show that earthquakes cause psychological disorders such as depression, anxiety and stress, especially post-traumatic stress disorders in children, adolescents and adults (Tang et al. 2018). Post traumatic stress symptoms are a common problem in adolescents after the earthquake (Jieling and Xinchun 2017). These symptoms may be triggered by the traumatic nature of the event and could be influenced by individual differences in psychological resilience and coping mechanisms. Post-traumatic stress symptoms are a mental problem that some individuals develop after a trauma and are closely related to many mood disorders. Post-traumatic stress symptoms are manifested by the individual experiencing flashbacks as if reliving the trauma after the event, showing symptoms of avoidance of trauma-related memories and over reactivity (Bryant et al. 2017; May and Wisco 2016). Especially after the traumas experienced, previous psychological problems, witnessing the death or injury of someone, being deprived of parental or social support increase the likelihood of adolescents to show post-traumatic stress symptoms (Pinto et al. 2017). In addition to these contributing factors, post-traumatic stress symptoms are seen together with mood disorders such as depression, anxiety and stress in earthquake survivors (Grant et al. 2008). Similarly, Krueger (1999) proposed a model stating that post-

traumatic stress symptoms are also associated with internalizing problems such as anxiety and mood disorders and externalizing problems including antisocial behaviors.

Adolescence is a period in which social, cognitive, and physical development processes are rapid and therefore many problems are encountered, and internalizing problems are also quite common (Achenbach et al. 2016). Internalizing problems experienced during adolescence related to the trauma experienced include anxiety, depression and constant sadness, which are mostly emotion-based. Internalizing problems in trauma victims are seen as withdrawal, depressive and dysfunctional thoughts, decreased motor skills and avoidance behaviors (Panuccio et al. 2022). Studies show that internalizing problems such as anxiety, depression, fear and withdrawal are common in trauma victims (Wei and Lü 2023). Moreover, internalizing problems are associated with many psychosocial problems, including interpersonal problems, conduct disorders, substance abuse, suicidal tendencies and low school performance (Melkevik et al. 2016). In fact, studies indicate that internalizing problems in adolescence may be predictive of mental health problems in adulthood (Narusyte et al. 2017). Similarly, internalizing problems are negatively associated with physical health and life satisfaction (You et al. 2021). Since internalizing problems are associated with mood disorders and other mental health problems, it is important to investigate them to determine preventive and curative intervention methods.

On the other hand, externalizing problems include aggression-based conduct disorders and oppositional defiant disorder (Fisher et al. 2016). Externalizing problems are an important problem that threatens adolescent mental health and poses a risk for criminal behaviors in the long term along with low school achievement, incompatibilities in social relationships, mental and physical problems (Aebi et al. 2014; Van Wert et al. 2016). Previous studies indicate that dysfunctional family attitudes, exposure to violence and trauma are risks for externalizing problems (Fong et al. 2019). Similarly, the study conducted by Yang et al. (2023) with adolescents states that mood disorders such as depression and anxiety and externalizing problems can also develop in adolescents who survived the earthquake and this situation poses a danger to their mental health. On the other hand, externalizing problems not only affect the current functioning of adolescents, but are also an important risk factor for future problems such as suicidal tendencies, possible patterns of violence against a partner, and substance abuse (Witte et al. 2018). In addition, studies indicate that post-traumatic individuals are more likely to show externalizing problems because they may have problems in emotion-regulation and coping skills (Modecki et al. 2017). Therefore, based on all this information and research, whether externalizing problems pose a risk for the mental well-being of adolescents who survived the earthquake is important for the development of preventive and curative intervention methods.

Present Study

Although earthquakes occur in Türkiye at various times, there are almost no studies on post-traumatic stress symptoms especially in adolescents. Studies to be conducted, especially with adolescents after devastating earthquakes will provide a better understanding of the potential effects of exposure to earthquakes on mental health. Post-traumatic stress symptoms are observed in many survivors after natural disasters such as earthquakes. Some studies with trauma survivors show that internalizing problems such as depression and anxiety

are associated with posttraumatic stress disorder (Spinhoven et al. 2014). On the other hand, there are almost no studies that specifically address the relationship between posttraumatic stress disorder and externalizing problems. On the other hand, trauma victims and exposure to violence have been associated with increased violent tendencies and externalizing problems in adolescents (Carliner et al. 2017). Therefore, filling this gap will contribute to a better understanding of the effects of earthquakes on mental well-being in adolescents who survived the earthquake. Investigating the role of internalizing and externalizing problems in the relationship between posttraumatic stress symptoms and mental well-being will shed light on the development of preventive and curative intervention methods for mental health professionals. Therefore, the aim of the current study is to investigate the mediating role of internalizing and externalizing problems in the relationship between posttraumatic stress symptoms and mental well-being in adolescents who survived the earthquake. In line with this objective, the current study has three main hypotheses. First, posttraumatic stress symptoms will significantly negatively predict mental well-being. Second, internalizing problems will mediate the relationship between posttraumatic stress symptoms and mental well-being. The last hypothesis is that externalizing problems will mediate the relationship between posttraumatic stress symptoms and mental well-being.

Method

Participants and Procedure

The current study was conducted with a group of adolescents affected by the February 6, 2023 earthquakes in Turkey. The study was conducted with high school students who were affected by the earthquake and are currently continuing their education. Informed consent was obtained from all adolescents and their parents and participation in the study was voluntary. The adolescents participating in the study were reached through online methods. The adolescents who participated in the study attend public schools and most of them are in the middle and lower socio-economic status. A total of 498 adolescents participated in the study, of which 192 (38.6%) were boys and 306 (61.4%) were girls. The age range of the participants was between 14 and 18 and the mean age was 15.32 (SD = 1.24).

Measures

DSM-5 Posttraumatic Stress Symptom Severity Scale-Child Form

It was developed by Yalın-Sapmaz et al. (2017) to measure post-traumatic stress symptoms in adolescents and consists of 9 items (e.g. “Have you experienced “flashbacks”, that is, have you suddenly felt or acted as if a stressful experience you had in the past was happening all over again (e.g. re-experiencing parts of the stressful experience by seeing, hearing, smelling or physically feeling them)?”) and has a 4-point Likert structure (O = none, 4 = extreme). A minimum score of 0 and a maximum score of 36 can be obtained from the scale and higher scores indicate an increase in the severity of post-traumatic stress symptoms. Analyses show that the scale is a psychometrically valid ($x^2/df = 2.25$, CFI = 0.95,

TLI = 0.94, SRMR = 0.032, RMSEA = 0.051) and reliable measurement tool (Yalın-Sapmaz et al. 2017). In the current study, the internal consistency coefficient of the scale was found to be sufficient as 0.89.

Internalizing Behavior Screener

The scale developed by Arslan (2021) on the Turkish adolescent population consists of 10 items, two subscales, depression (e.g. "I have no expectations for the future or I feel hopeless") and anxiety (e.g. "I often feel tense and anxious"), and has a 4-point Likert scale (1 = never, 4 = always). Higher scores indicate an increase in internalizing problems. The validity (x^2/df = 1.74, CFI = 0.97, TLI = 0.95, SRMR = 0.034, RMSEA = 0.061) and reliability analyses confirmed that the scale is a valid and reliable measurement tool (Arslan 2021). In the current study, the internal consistency reliability coefficient of the scale was calculated as 0.89.

Youth Externalizing Behavior Screener

The scale was developed by Arslan (2019) on the Turkish adolescent population. The measurement tool, which has a total of 12 items, consists of three sub-dimensions, namely behavioral problems (e.g. "I do not follow prohibitions or rules, I often break them"), attention deficit (e.g. "I am easily distracted and have difficulty concentrating"), and hyperactivity (e.g. "I'm an extremely active person, I can't sit still without moving"), and has a 4-point Likert scale (1 = never, 4 = always). The higher the scores obtained from the scale, the higher the level of externalizing problems. The psychometric properties of the scale confirm that it is a valid (x^2/df = 1.87, CFI = 0.97, TLI = 0.96, SRMR = 0.051, RMSEA = 0.060) and reliable measurement tool (Arslan 2019). In the present study, the internal consistency coefficient of the scale was found to be sufficient as 0.93.

Short Warwick-Edinburgh Mental Well-being Scale

The original scale was developed by Tennant et al. (2007) and İme (2023) conducted the adaptation study into Turkish. The scale, which consists of 7 items (e.g. "I am optimistic about the future") in total, has a single factor structure and a 5-point Likert scale (1 = never, 5 = always). High scores obtained from the scale indicate a high level of mental well-being and a minimum score of 7 and a maximum score of 35 can be obtained. High scores indicate a high level of mental well-being. The psychometric properties of the scale show that it is a valid and reliable measurement tool (x^2/df = 2.68, CFI = 0.94, TLI = 0.92, SRMR = 0.05, RMSEA = 0.05). In the current study, the internal consistency coefficient of the scale was found to be sufficient as 0.86.

Data Analysis

Before starting the data analysis, the relationships between variables, the reliability of the scales and whether the data were normally distributed were tested. It was observed that skewness values ranged between −0.16 and 1.41 and kurtosis values ranged between −0.81 and 1.43. According to Tabachnick (2007), skewness and kurtosis values should be distrib-

uted between −1.5 and 1.5 for normal distribution and in this context, it was determined that the data showed normal distribution. After the basic analyses, the mediating role of internalizing and externalizing problems in the relationship between post-traumatic stress symptoms and mental well-being was analyzed using PROCESS macro for SPSS program. In this context, Hayes (2017) model 4 was used. Model 4 is a model that allows the analysis of multiple mediating variables between the dependent variable and the independent variable (Hayes 2017). To calculate indirect effects between variables, 5000 bootstrap samples were utilized to establish 95% confidence intervals (CI). If the CI values are below or above zero, the model is significant. As seen in Table 2, LLCI and ULCI are both below zero.

Results

Correlations

As seen in Table 1, the relationships between the study variables of post-traumatic stress symptoms, mental well-being, internalizing and externalizing problems are statistically significant (p<.001). Accordingly, there is a significant negative relationship between post-traumatic stress symptoms and mental well-being (r=-.15, p<.001). As expected, post-traumatic stress symptoms have a significant negative relationship with internalizing problems (r=.44, p<.001) and externalized problems (r=.39, p<.001). Finally, internalized problems (r=-.27, p<.001) and externalized problems (r=-.32, p<.001) had a significant negative relationship with mental well-being.

Mediational Analyses

As presented in Fig. 1, the relationship between post-traumatic stress symptoms and mental well-being is significant (β = −0.15, p<.001). In addition, all path coefficients between the variables were also significant (p<.001). Accordingly, post-traumatic stress symptoms significantly predicted internalizing problems (β=0.44, p<.001) and externalizing problems (β=0.39, p<.001). Finally, internalizing problems (β = −0.20, p<.001) and externalizing problems (β = −0.30, p<.001) were found to be significant negative predictors of mental well-being.

Table 2 presents the findings regarding the indirect effects of the mediating variables. It includes standardized Beta coefficients and their corresponding 95% confidence intervals (CI).

Table 2 also shows the indirect role of post-traumatic stress symptoms on mental well-being through internalized problems (β=−0.068, SE=0.014, p<.001) and externalized problems (β=−0.002, SE=0.003, p<.05).

Table 1 Descriptive statistics, and bivariate correlations between variables

Variables	1	2	3	4	α	Mean	SD	Skewness	Kurtosis
1.Post Traumatic Stress	-				0.93	1.36	0.48	1.21	1.43
2. Mental Well-Being	−0.15**	-			0.86	3.13	0.99	−0.16	−0.63
3.Internalized problems	0.44**	−0.27**	-		0.89	2.22	0.80	0.35	−0.81
4.Externalized problems	0.39**	−0.32**	0.46**	-	0.93	1.58	0.73	1.41	1.24

**p<.001

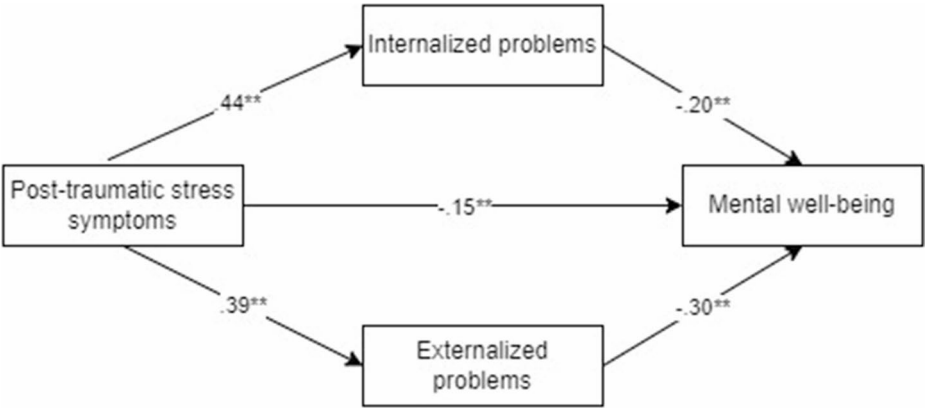

Fig. 1 Parallel multiple mediation role of internalized and externalized problems in the link between post-traumatic stress symptoms and mental well-being. $^{**}p<.001$

Table 2 Indirect effect of post-traumatic stress symptoms on mental well-being via internalized and externalized problems

Path	Indirect effects	SE	Boot LLCI	Boot ULCI
Post-traumatic stress symptoms → Internalized problems → Mental well-being	−0.074	0.023	−0.123	−0.030
Post-traumatic stress symptoms → Externalized problems → Mental well-being	−0.099	0.023	−0.146	−0.055

Discussion

Previous studies reveal that there are a wide range of factors affecting the mental well-being of earthquake survivors. As earthquakes affect all age groups, adolescents are one of the most vulnerable groups affected by earthquakes (Rezayat et al. 2020). Since adolescence is both a period of identity formation and a critical period for social and emotional development, this period is important for both their own and social mental health. The present study demonstrates the link between post-traumatic stress symptoms and mental well-being in adolescent earthquake survivors. Furthermore, the current study shows that internalized and externalized problems mediate the link between post-traumatic stress symptoms and mental well-being. Accordingly, it can be said that as post-traumatic stress symptoms increase, mental well-being levels of adolescents decrease. In addition, it can be said that adolescents with post-traumatic stress symptoms are more likely to show internalizing and externalizing problems.

Confirming the first hypothesis, the first finding of the study showed that post-traumatic stress symptoms were a significant negative predictor of mental well-being. Previous studies indicate that many adolescents show post-traumatic stress symptoms after traumas (Zhou et al. 2017). As a matter of fact, post-traumatic stress symptoms are one of the most common psychopathological problems after traumas. The study conducted by Ozdemir et al. (2015), which supports the findings of the current study, reveals that there is a significant relationship between post-traumatic stress symptoms and hopelessness and suicidal tenden-

cies. Similarly, the study conducted by İme (2025b) with earthquake survivors reveals the negative relationship between psychological distress and resilience and points out that stress symptoms pose a risk for mental health. In addition to psychological problems, developmental problems are also observed in adolescents exposed to earthquakes. After the earthquakes, many young people show symptoms of depression and anxiety as well as post-traumatic stress symptoms (Tang et al. 2017). Intense anxiety, depression and post-traumatic stress symptoms that occur after traumas negatively affect quality of life, social relationships and can damage self-perception (Grant et al. 2008). Studies conducted with adolescents also reveal the relationship between post-traumatic stress symptoms and academic achievement, depression and social isolation (Al-Alawi et al. 2025). In this context, post-traumatic stress symptoms can be seen not only as short-term psychological problems but also as a risk factor that threatens adolescent mental well-being in the long term. Therefore, for adolescent mental health and healthy societies, therapeutic mental health interventions that will reduce post-traumatic stress symptoms for adolescents, like all groups, are important.

The findings confirming the second hypothesis of this study suggest that internalizing problems play a mediating role between post-traumatic stress symptoms and mental well-being. Accordingly, as post-traumatic stress symptoms increase, adolescents' internalizing problems increase and as internalizing problems increase, adolescents' mental well-being levels decrease. Previous studies supporting the findings of the current study indicate that internalizing problems cause adolescents to isolate themselves from their environment, they become lonely, their anxiety symptoms increase and their mental well-being decreases (Barbieri and Mercado 2022; Kelly et al. 2015). Traumas such as earthquakes frequently cause post-traumatic stress symptoms along with many mental problems in adolescents. Adolescents may react to natural disasters by developing depression and anxiety reactions (Guerra et al. 2018; Tang et al. 2018). The study by Felix et al. (2011) shows that internalizing problems are common in those exposed to traumas and are accompanied by post-traumatic stress symptoms. Similarly, these problems are accompanied by social phobia and separation anxiety (Danneel et al. 2019). As stated by Bonanno et al. (2010), traumas cause stress, learned helplessness and depressive symptoms in individuals. Again, the meta-analysis study conducted by Tang et al. (2014) indicates that natural disasters are closely related to depression and the mental well-being levels of victims decrease. All these studies support the findings of the current study and show that increased post-traumatic stress symptoms are positively associated with increased internalizing problems and increased internalizing problems are associated with lower levels of mental well-being. Therefore, the implementation of intervention methods that prevent and improve internalizing problems in adolescents who survived the earthquake is important for their mental well-being.

The final finding of the study, which confirmed the third hypothesis, showed that externalizing problems mediated the relationship between post-traumatic stress symptoms and mental well-being. Accordingly, as post-traumatic stress symptoms increase, adolescents are more likely to show externalizing problems and their mental well-being levels decrease. Previous studies supporting the findings of the current study indicate that externalizing problems are considered as behaviors that violate social rules and harm others and are frequently seen together with internalizing problems such as anxiety and depression (Arslan 2019). Externalizing problems in adolescents often damage their relationships with the environment and this damage negatively affects their overall school and life success (Kulkarni et al. 2021). The study conducted by Panuccio et al. (2022) on trauma victims shows that trau-

mas cause post-traumatic stress symptoms, adolescents develop emotional and behavioral symptoms due to the trauma experienced, and they show more aggression due to problems in impulse control. Adolescents who have problems with their environment also have lower school achievement, damaged friendships and increased mental health problems (Ng-Knight et al. 2019). As a matter of fact, the study conducted by Carliner et al. (2017) indicates that externalizing behaviors that increase during adolescence may be higher in trauma-victim adolescents. Therefore, all these findings indicate that post-traumatic stress symptoms that develop in adolescents who survived the earthquake are associated with increased externalizing problems in adolescents and that high externalizing problems pose a risk for their mental well-being. For this reason, it is evaluated that the adaptation of psychological intervention methods that prevent and improve externalizing problems in adolescents who survived the earthquake will be beneficial for their mental well-being.

Practical Implications

The findings of this study show that there is a negative relationship between posttraumatic stress symptoms and mental well-being and that internalizing and externalizing problems mediate this relationship. The findings suggest that adolescents with high posttraumatic symptoms may have decreased mental well-being with emerging mental health problems. In addition, the findings indicate that adolescents with high posttraumatic stress symptoms may show internalizing and externalizing problems and their mental well-being levels may decrease due to these problems. Therefore, it is thought that giving importance to the implementation of educational policies and psychological intervention methods that prevent and threat posttraumatic stress symptoms, internalizing and externalizing problems in adolescents who survived the earthquake will contribute positively to their mental well-being levels.

Limitations

Although the present study is an important study conducted with earthquake survivors, it has some limitations. First, since the study was conducted with cross-sectional data, it is not possible to establish a cause-and-effect relationship between the study variables. Therefore, longitudinal studies are recommended to understand the causal links between the study variables. Dyadic studies can also be conducted to determine the relationships between study variables according to parents and children. Secondly, although the study was conducted with 498 adolescents, millions of adolescents were affected by the February 6 earthquakes. Therefore, studies can be conducted with larger samples. Thirdly, since the study was based on the participants' answers to the questionnaires, it may be impossible to eliminate social favorability and prejudice. In addition, although the scales used are valid and reliable measurement tools, they may not address all the feelings and thoughts of the participants. In this context, qualitative studies are also recommended.

Conclusion

The current study firstly reveals the negative relationship between post-traumatic stress symptoms and mental well-being in adolescents who survived the earthquake. It also shows that internalizing and externalized problems have a mediating role in this relationship. These findings indicate that the higher the post-traumatic stress symptoms of adolescents after the earthquakes, the lower their mental well-being levels, and that increased post-traumatic stress symptoms and internalized and externalized problems are parallel and related to low mental well-being. Therefore, it is considered that preventive and curative psychological intervention methods are important for a healthy adolescence period, which is very important for identity development. Because it is thought that reducing post-traumatic stress symptoms, internalized and externalized problems is critical not only for the adolescent's own healthy development but also for healthy social development.

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Data Availability The data used in the study can be requested from the corresponded author upon reasonable request.

Declarations

Ethical Standards The researcher declares that he carried out the study by adhering to the ethical rules that must be followed in human experiments as stated in the Helsinki Declaration of 1975. The current study was conducted in accordance with the permission granted by Necmettin Erbakan University Social Sciences and Humanities Scientific Research Ethics Committee.

Informed Consent All participants participated in the study voluntarily and informed consent was obtained from all of them.

Conflict of interest The related authors declare that there is no conflict of interest.

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