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Relationships between mental toughness, eustress–distress, and mindfulness in adolescents: A network analysis and mediator model testing

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Abstract

The main aim of this study was to investigate adolescents' eustress–distress and mindfulness by examining mental toughness (MT) using network and mediator analyses. The study included 414 adolescents. The results showed that MT was positively related to eustress and mindfulness, but distress was negatively related to MT. Based on the network analysis findings, we tested mindfulness' mediating role in the relationship between eustress–distress and MT. The findings showed that mindfulness played a significant mediating role. However, the mediating role of mindfulness was negative for the relationship between distress and toughness and positive for eustress. These findings advance eustress, distress, and mindfulness as mechanisms for understanding the effects of MT. Considering current knowledge of MT, eustress, distress, and mindfulness, the results are discussed.

KEYWORDS
adolescent, distress, eustress, mediator, mental toughness, mindfulness, network analysis

1 | INTRODUCTION

Stress occurs when people feel that their psychological or physical health is threatened (Atkinson et al., 1996). Stress is the total amount of pressure and requests a person to feel after assessing their capacity, resources, and adaptability (Niemic, 2019). Life in the 21st century includes many stress factors (Lindstrom & Triplett, 2010). Remarkably, the prevalence of stress reached 53% in the general population with COVID-19 (Lakhan et al., 2020).

Adolescence, which refers to the transition period of development, is characterized by multifaceted developmental changes, including physical, social, behavioural, and cognitive changes (Kilford et al., 2016). Globally, one in every six people is an adolescent (WHO, 2021). According to the 2023 data, 16% of Turkey's population comprises adolescents (TÜİK, 2024). Adolescence is a period of life with rapid transitions and significant life changes in development (Newcomb et al., 1981). Meta-analyses of the worldwide prevalence of stress in adolescents show that the prevalence rate in this period ranges between 20% and 45% (Roy et al., 2015). Adolescence is a unique period. Up to 50% of mental health problems observed in adults begin early in life; therefore, improving mental health during this period is critical to preventing mental disorders (WHO, 2021).

Adolescence involves more psychological and sociological challenges than other developmental periods. Exposure to stressful life events during this period is a risk factor for the development of mental disorders (Kingsbury et al., 2020). Stress can cause emotional and psychological problems such as anxiety, depression, eating disorders, anger management, self-injury, and suicidal thoughts in adolescents (Kumaraswamy, 2013). This is evidence that stress makes individuals vulnerable to mental health problems (Goh & Agius, 2010;

Steptoe, 1991). On the other hand, since the functional and structural development of the brain continues during adolescence, it is suggested that stress may also have the potential to alleviate the negative effects of adolescence (Romeo & McEwen, 2006).

Studies conducted in recent years have also addressed stress from a positive perspective. According to this perspective, stress is defined by the concepts of 'eustress' and 'distress', which aim to show the intensity of the stressor rather than the nature of the body's response to the stressor (Bienertova-Vasku et al., 2020). Selye called stress caused by disappointment and failure distress and stress caused by events experienced as pleasant or beneficial eustress, which is the opposite of distress (Selye, 1975). Long-term stress that exceeds the resilience of the organism and can lead to a pathological condition is called distress, and distress occurs because of a negative perception and causes undesirable harmful reactions (Branson, Palmer, et al., 2019; Le Fevre et al., 2003; Wu et al., 2022). Distress is characterized by negative physiological and emotional responses (Bienertova-Vasku et al., 2020) and negative experiences such as turnover, decreased performance, and frustration (Pluut et al., 2022). In contrast, stress that helps people cope with and adapt to stressors is called eustress (Wu et al., 2022). Eustress, which occurs because of a positive perception of stressors (Le Fevre et al., 2003), refers to a desirable, adaptive, and positive psychological response (Branson, Palmer, et al., 2019; Kupriyanov & Zhdanov, 2014; Shen et al., 2020). Eustress is associated with emotional and behavioural characteristics such as positive emotional responses, energy, and willingness to perform (Pluut et al., 2022). How a stressor is perceived, as well as other characteristics related to the stressor (timing, desirability, utility, internal/external, and source of the stressor), varies as to whether a stressor causes eustress or distress response (Le Fevre et al., 2003).

Distress refers to a negative and unpleasant physical or psychological state that occurs when stress is too intense or persistent; therefore, distress is thought to be associated with diagnosed mental illnesses as well as symptoms such as anxiety and depression that do not meet diagnostic criteria. In contrast to distress, eustress is a positive state that refers to a moderate and acceptable stress level of a shorter duration. This is considered a protective factor against mental illnesses (Wu et al., 2022). In the face of stressful situations, individuals first assess whether the stressful situation threatens their well-being and then focus on what can be done to cope with this situation or event, prevent it, or turn it into an opportunity (Folkman et al., 1986). This process can lead to significant differences in mental health. Although eustress is associated with enhanced well-being (Branson, Palmer, et al., 2019), life satisfaction (O'Sullivan, 2011), and engagement (Pluut et al., 2022), distress is associated with attention disorder (Matthews, 2016), suicidal thoughts (Schutt et al., 1994), depression and anxiety (Terluin et al., 2006), and decreased life satisfaction (Boyraz et al., 2014) can be considered as evidence that stress does not always have negative consequences for mental health.

Adolescence is an essential period in terms of eustress and distress. Studies have shown that eustress and distress differ in adolescents in terms of dimensions such as state of mind, function, perceived efficacy, affect, structure, and connectivity. This highlights the inappropriateness of translating adult-focused stress findings directly to the adolescent context (Branson, Turnbull, et al., 2019). Therefore, it is important to address stress from the perspective of adolescents. Responding to stressors is known to have different effects on adolescents' mental health, and studies have shown that the relationship between distress and well-being in adolescents is mediated through psychological and behavioural variables. Eustress was directly related to increased well-being, and the relationship between eustress and well-being was also mediated by psychological and behavioural variables (Branson, Palmer, et al., 2019). Well-being in adolescents was positively associated with eustress, whereas distress was negatively correlated with eustress-related measures of engagement and happiness (Schulz, 2018). The findings showed that stress in adolescence may have positive outcomes and that the type of stress may produce different outcomes in terms of well-being. Mediating variables play a crucial role in mediating the relationship between stress and positive mental health outcomes.

In recent years, positive psychology studies on individuals' ability to improve their well-being and mental health have been widely used to build awareness and resilience from individual factors in stressful situations (Frydenberg, 2017). In this direction, mental toughness (MT), which is conceptualized as an individual trait that can help buffer the harmful effects of stress and help individuals be relatively less affected by challenging conditions (Crust, 2008), can be considered a protective and preventive factor that may be related to the cognitive evaluation of stress. The impact of stress on emotional and physical health can be devastating (Fink, 2016). In contrast, MT refers to the reduction in distress and the transition from high levels of symptoms to previous levels (Solcova & Tavel, 2017). Mental toughness, which acts as a buffer against the adverse effects of stress (Benjamin & John, 2021), is an essential factor that allows individuals to cope with all the challenges of their professional and personal lives (Smolska, 2021) effectively and successfully. Mental toughness describes characteristics important for dealing with stress and pressure and consists of the dimensions of challenge, commitment, emotion control, life control, confidence in abilities, and interpersonal confidence (Ramshaw & St Clair-Thompson, 2021). Mental toughness, the tendency to exert high effort regardless of circumstances (Perry et al., 2013), maybe a precursor to effective coping in stressful situations. Mental toughness is a positive indicator of mental health (Gucciardi et al., 2017). Higher MT is positively associated with optimism, problem-focused coping (Nicholls et al., 2008), school success (Papageorgiou et al., 2018), and psychological well-being (Stamp et al., 2015), while it is negatively associated with risk perception, paranormal belief (Drinkwater et al., 2019), and burnout levels (Gerber et al., 2015). Findings suggest that MT is associated with various positive psychological traits, more effective coping strategies, and positive educational and mental health outcomes (Crust, 2008; Lin et al., 2017). By contrast, a negative relationship has been observed between MT, stress, and all mental health outcomes (Haghighi & Gerber, 2019). The evidence that MT moderates the relationship between high stress and depressive symptoms in

adolescents (Gerber, Kalak, et al., 2013) and is a source of stress resilience indicates that MT is an essential topic for experts working with adolescent populations (Gerber, Brand, et al., 2013). Findings suggest that MT may facilitate resilience to subjectively perceived stress among nonclinical adolescents and young adults and enable individuals to successfully cope with the pressures and demands of life (Gerber, Brand, et al., 2013). Compared to research with adults, research examining mental resilience in adolescent populations is still in its infancy (McGeown et al., 2017), suggesting a need to focus on mental resilience as a protective factor in adolescents.

Mental toughness encompasses proactive and reactive experiences involving stressors of varying intensity, duration, and frequency (Gucciardi, 2017). Individuals with high MT evaluate stressful events with lower stress intensity and higher perceptions of control over the event (Kaiseler et al., 2009). This is theoretically interpreted as individuals with high MT, characterizing stressful situations with pleasant outcomes. Therefore, a positive relationship between eustress and MT is expected, whereas distress and MT are expected to be negatively related. Mental toughness, which can vary according to the stress level, can partially block stress (Benjamin & John, 2021). The findings also support that MT decreases as the threat perception of the stressor increases (Levy et al., 2012). Therefore, a positive evaluation of stress may cause high MT. In contrast, a negative evaluation of stress may lead to adverse mental health outcomes. In other words, positive or negative perceptions of the stressor may affect MT.

Mental toughness, a source of stress resistance during adolescence, is essential for experts working with adolescents (Gerber, Brand, et al., 2013). While individuals who perceive stress positively have higher MT (Levy et al., 2006), MT is lower when perceived negatively (Bacchi & Licinio, 2017; Zou et al., 2016). Studies hypothesize that greater mindfulness provides more accurate perception, reduces negative emotions, and improves vitality and coping (Grossman et al., 2004). For adolescents, mindfulness appears to be an essential component of studies aimed at dealing with stress (Fulambarkar et al., 2023), reducing the harmful effects of stress (Dunning et al., 2022; Newland & Bettencourt, 2020; Reangsing et al., 2021) and higher MT (Yuan, 2021).

Mindfulness focuses on the present moment and involves observing one's experiences without judgement (Frydenberg, 2017). Higher mindfulness helps individuals realistically evaluate stressors, use coping strategies flexibly with awareness of emotions and thoughts, engage in creative problem-solving, and maintain cognitive flexibility (Anisman, 2015). Individuals with high mindfulness are more likely to cope with stressors without experiencing negative psychological and physiological consequences (Ciesla et al., 2012; Frydenberg, 2017). Mindfulness reduces perceived stress and emotional responses to threatening situations (Ajilchi et al., 2019) and enables psychological control and self-regulation (Wang et al., 2021). Moreover, it has been observed that mindfulness has a protective role against both depressive and anxious tendencies in young people (Barcaccia et al., 2022; Yang et al., 2021) and has positive effects such as reducing stress and higher resilience (Erbe & Lohrmann, 2015). In other words, mindfulness may be an effective variable in interpreting stressors; therefore, individuals with higher mindfulness may have more excellent MT in stressful situations.

Mindfulness may influence the relationship between negative factors (e.g., distress) and individuals' mental health outcomes (e.g., MT). Numerous studies have confirmed that mindfulness is a significant variable for positive mental health outcomes in stressful situations (Conversano et al., 2020; O'Connor et al., 2021; Matiz et al., 2020; Wu et al., 2021). Adolescents are uniquely vulnerable to the effects of stress, and it is essential to develop healthy stress reduction skills for adolescents (Erbe & Lohrmann, 2015). Studies have shown that mindfulness is a vital intervention component in improving stress, anxiety, depressive symptoms, and quality of life in clinical and nonclinical adolescent populations (Kallapiran et al., 2015). These findings suggest that mindfulness contributes to MT by enhancing the positive effects of stress and contributes to MT by acting as a buffer against the harmful effects of stress. Thus, mindfulness may be necessary in the relationship between stress and MT. The mediating role of mindfulness in the relationship between eustress–distress and MT has not yet been fully explored. However, mindfulness may contribute to positive outcomes by causing a change in perspective (Shapiro et al., 2006). There are various reasons for the mediating role of mindfulness in these variables. For example, highly mindful individuals can cope with stressors without experiencing negative psychological and physiological consequences (Ciesla et al., 2012). Mindfulness awakens the ability to self-regulate stress through psychological control and regulation (Wang et al., 2021). In addition, mindfulness can reduce negative coping behaviours by improving tolerance to pain and other negative emotions (Wang et al., 2021). Mindfulness practices improve the regulation of emotions (Garofalo et al., 2020; Malik & Perveen, 2023; Pepping et al., 2016), leading to reduced perceived stress (Anastasiades et al., 2017; Zollars et al., 2019) and enhanced ability to withstand psychological pressures (Fino et al., 2021), thereby fostering greater mental resilience and MT. These findings suggest a positive relationship between eustress and mindfulness, and this relationship can be explained by the aspect of mindfulness that contributes to the positive evaluation of stress. However, there is a negative relationship between distress and mindfulness, and the source of this relationship is thought to be that mindfulness contributes to individuals' improved ability to cope with stressful situations.

Therefore, it is essential to identify protective and preventive factors that can buffer the negative impact of stress on young people's psychological problems. People with high MT are generally able to move on with their lives without suffering harmful psychological and physiological injuries from stressful events (Rzeszutek et al., 2017). Adolescence is an exciting period for MT because developmental transitions from adolescence to adulthood are essential points for the onset or end of psychopathology (Gerber, Kalak, et al., 2013). Between 10% and 20% of adolescents worldwide experience a mental health problem each 12 months. Mental health problems effect adolescents' potential to live a fulfilling and productive life. In recent years, mindfulness-based studies aiming to build MT and increasing protective factors in adolescents have been

implemented in adolescent populations in both MT-building and treatment contexts (Sapthiang et al., 2019). Research on the link between eustress–distress and MT can help understand the relationships to inform future treatment efforts. Therefore, it is crucial to identify the characteristics that help explain the impact of stress on adolescent MT.

This study aimed to (1) examine whether there is a relationship between eustress–distress, MT, and mindfulness and (2) reveal the mediating role of mindfulness in the relationship between eustress–distress and MT. Network analysis was used to test the above hypotheses to identify the relationships, nodes, and clusters between variables. To date, research has not provided information about the positions of the nodes in the network. We go beyond traditional correlation analysis and focus on network analysis to allow for more details on the degree of correlation, their position in the network, and centrality measures.

A network analysis perspective views behaviours and their consequences as interaction phenomena. Network analysis provides a robust methodology for exploring these relationships (Hevey, 2018). In this approach, psychological concepts are seen as causally connected constructs, and the connections between these constructs can be represented and examined using network analysis techniques (Borsboom & Cramer, 2013). Variables are considered components in a network, and those close to each other in the network structure will have an increased tendency to synchronize (Borsboom et al., 2011). By visualizing the complex ways variables interact, network analysis offers deeper insights than other approaches, focusing on the function of variables rather than just the relationships between them (Borsboom, 2017) and examining how structural features beyond individual relationships impact behaviour (Wellman, 1983). While correlation analysis measures the linear relationship between variables, network analysis investigates the formation of a network of interactions to reveal more complex and dynamic relationships between data and the function of variables rather than just their relationships (Schmittmann et al., 2013). By treating variables as independent constructs with causal power in the network model, network analysis allows for the visualization of how specific variables are activated and structured. It also provides the opportunity to adapt the resulting dynamic interaction network for applications related to psychological processes by professionals (De Schryver et al., 2015). Network analysis allows for the revelation of structures and relational properties, modelling dynamic processes within systems, and gathering scientific evidence for causal relationships with a processual approach (Borsboom et al., 2011; De Schryver et al., 2015). Therefore, in this study, the dynamic relationship pattern between variables was attempted to be revealed using the network analysis, and a conceptual model was proposed.

In network analysis, nodes and edges exist in the network. The variables in the research were within a circle, and the relationships were presented through edges (Love et al., 2019). In psychology research, nodes can indicate various structures, such as stress or peer pressure. Sometimes, the subscales of a variable can also form nodes (Hevey, 2018). The edges represent lines that show the relationships between the nodes. Thicker edges in the network represent strong correlations, and thinner ones represent poor correlations. The green and red edges indicate positive and negative correlations, respectively. The absence of an edge between the two nodes indicates no significant relationship. In network analysis, centrality measures such as betweenness, closeness, and strength are reported. These measures help determine the nodes' centrality by showing their network connectivity. Strength is the sum of the strengths of all the links of a node in the network and indicates that the node is more centralized. Betweenness represents the shortest paths between two nodes passing through the node. Closeness is the inverse sum of the shortest paths from one node to all other nodes (Wagenmakers et al., 2020). Moreover, emerging literature focuses on network analysis in many disciplines, including positive psychology (e.g., Di Blasi et al., 2021; Papageorgiou, Benini et al., 2019; Papageorgiou, Gianniou et al., 2019). It also examines the mediating role of mindfulness in the relationship between eustress–distress and MT based on reports in the literature on the conditions under which the variables may be related. Based on these hypotheses, a conceptual model was proposed (see Figure 1). Therefore, the results of this study make essential contributions to the fields of counseling and positive psychology. In this way, professionals interested in adolescents' mental health and well-being aim to increase evidence-based actions to increase the chances of young people's development through practices that can potentially improve young people's development (Bowers et al., 2014).

2 | METHODS

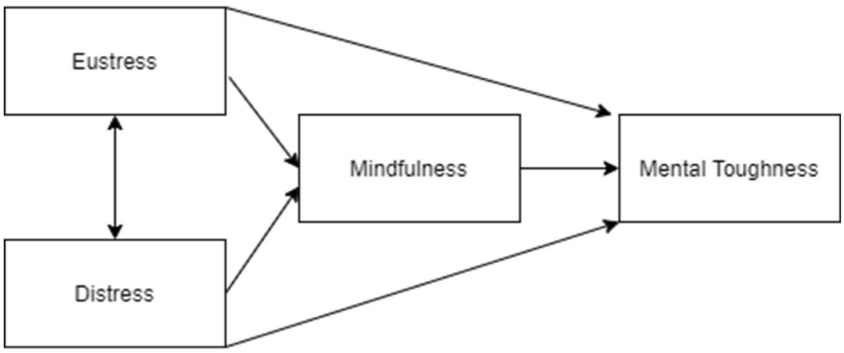
2.1 | Participants

Convenience sampling was used to recruit the participants from Turkey. The study group comprised 421 adolescents. By identifying outliers, we removed the data of seven participants from the dataset. Finally, 414 participants provided complete data and were included in the analysis. Thirty participants were female (n = 123) and 70% were male (n = 291). The age range was 10 and 19 (M = 14.45, SD = 2.20). 7% of the participants had low socioeconomic status, 65% had moderate, and 28% had high socioeconomic status. Among this sample, 16% reported that their village was urban. In addition, 50% of the participants stated that they lived in the town, and 34% lived in the province.

2.2 | Measures

Distress–Eustress Scale in Adolescents: Eustress–distress was measured by the Turkish version (Akgün et al., 2021) of The Adolescent Distress–Eustress Scale (Branson, Dry, et al., 2019). This measure consists of 10 items assessing two dimensions: distress and eustress (positive). All items were rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (much). The minimum score of 0 and the maximum score of 20 can be obtained from the sub-dimensions of the scale.

FIGURE 1 Hypothetical model.



High scores on the distress dimension indicate that stress is perceived as a concept that causes tension and distress; high scores on the eustress dimension indicate that stress is perceived as constructive and encouraging. Cronbach's α was 0.81 for the distress subscale and 0.84 for the eustress subscale in Turkish adolescents.

Mental Toughness Scale for Adolescents-Short Form: MT was measured by the Turkish version (Soylu et al., 2019) of The MT Scale for Adolescents (McGeown et al., 2018). This measure consisted of six items that assessed MT. All items were rated on a 4-point Likert scale ranging from 1 (absolutely agree) to 4 (strongly disagree). The minimum score was 6 and the maximum score was 24. Higher scores indicate a higher level of MT. This measure has demonstrated that Cronbach's α of was 0.72 in samples of Turkish adolescents.

Mindfulness Scale: The Turkish version (Yavuz et al., 2019) of The Mindfulness Scale for Adolescents (Brown & Ryan, 2003) measured mindfulness. This measure consists of 15 items assessing mindfulness. All items were rated on a 6-point Likert scale ranging from 1 (almost always) to 6 (rarely). The minimum score was 15, and the maximum score was 90. Higher scores indicate a higher level of mindfulness. This measure demonstrated that Cronbach's α was 0.80 in samples of Turkish adolescents.

2.3 | Procedure

The author's University Committee approved the study protocol for Ethical Research. Data were collected by obtaining permission from the application schools. All participants were informed of the study's purpose and procedures and consented to participate. Between March and June 2023, the researcher collected data from Turkey using a self-report survey delivered in Turkish. To protect participants' privacy, no identifiable personal information was collected, and all answers were kept confidential.

2.4 | Statistical analyses

Analyses were carried out following several steps. First, descriptive statistics were calculated for all measurements. We checked the box plot output to test for outliers in the variables. When we examined the box plots, we identified seven outliers and removed them from the data set. Second, normal distribution tests showed that the skewness and kurtosis of the eustress, distress, mindfulness, and MT scores were within acceptable ranges. After preliminary analyses, correlations between variables were estimated using Pearson correlation and network analysis. A network model was calculated to show the structure of interactions between eustress, distress, mindfulness, and MT. SPSS and JASP (Goss-Sampson, 2022) were used for the analyses. Helping to conceptualize behaviour as a complex interaction of various components, this method provides essential information about the relationships between various variables. Psychological networks are nodes connected by edges representing statistical relationships between variables (Epskamp et al., 2018). In network analysis, a change in a central node is expected to lead to changes in other nodes in the network. This can provide insight into causal relationships between nodes. Nodes associated with MT may point to possible variables that can causally explain MT. The strength, betweenness, and closeness of the relationships between variables were calculated with JASP. According to network analysis, first, we created the mediation model with the observed variables of eustress, distress, mindfulness, and MT. After, a mediation model was conducted using the JASP programme. To test the significance of indirect effects, 5000 bootstrap samples were used to create a 95% confidence interval. Models are significant if the 95% CI does not include zero.

3 | FINDINGS

3.1 | Preliminary analyses

In the present study, preliminary analyses calculated mean, standard deviation, skewness, kurtosis, minimum, and maximum others for eustress, distress, mindfulness, and MT (see Table 1). The skewness (ranging from −0.54 to 0.07) and kurtosis (ranging from −0.50 to 0.10) values show that the data is normally distributed (Kline, 2011).

3.2 | Correlational and network analysis

Pearson's correlation and correlation estimation mediational network analysis were performed for the relationships between all

TABLE 1 Preliminary analyses.

	Mean	SD	Skewness	Kurtosis	Minimum	Maximum
Eustress	9.10	4.67	0.08	−0.50	0	20
Distress	9.71	4.50	−0.54	−0.34	0	20
Mindfulness	55.96	10.91	0.07	−0.32	29	84
Mental toughness	16.27	3.04	−0.14	0.10	8	24

Note: $N = 414$.

variables (see Table 2 and Figure 2). All correlations were significant. The highest correlation was found between MT and eustress ($r = 0.41$, $p < 0.001$). Also, mindfulness, MT, and awareness had a positive relationship ($r = -0.24$, $p < 0.001$). Mental toughness has also been found to be negatively related to distress ($r = 0.26$, $p < 0.001$). The results showed that distress was negatively related to all variables, and all other variables had a positive relationship. All correlations are presented in Table 2.

Network analysis provides visual information about variables' structural properties. Each variable is defined as a node, and the relationships between nodes are 'edges'. Green colours indicate positive relationships and red colours indicate negative relationships. Moreover, thin or thick edges provide information about the strength of the relationship. Figure 2 shows the estimated network of MT.

The estimated network was interconnected, with strong positive edges between MT, eustress, and mindfulness (see Figure 2). Furthermore, MT was negatively connected to distress ($r = -0.29$, $p < 0.05$). Protective factors such as mindfulness ($r = 0.26$, $p < 0.05$) and eustress ($r = 0.41$, $p < 0.05$) were more closely and strongly associated with MT. In contrast, distress associated with psychopathology had a negative relationship with eustress ($r = -0.24$, $p < 0.05$) and mindfulness ($r = -0.19$, $p < 0.05$). As expected, in this network, a positive relationship was observed between variables associated with positive health outcomes, while a negative relationship was observed between variables associated with adverse health outcomes. Figure 2 shows the inference measures of the estimated network. Network analysis revealed a strong link between MT and eustress; that is, in other words, mentally tough individuals evaluate stress positively. This finding shows that appraisals of stressful situations are associated with MT, a protective factor.

Centrality measures for the correlation network were examined. Three of the centrality measures depend on the shortest paths in the network, and an edge is missing if there is no correlation between variables. The centrality index values for each variable are scaled, and the centrality indexes are shown in Figure 3.

According to this, MT is the most central variable according to the four indices. Regarding strength, node MT is followed by node eustress, distress, and mindfulness. For closeness, eustress, and distress ranked the highest after MT, meaning that they were closest to all other nodes in the network. For the betweenness indices, eustress, distress, and mindfulness are similar, meaning that their closeness to other nodes in the network is similar (Figure 3).

TABLE 2 Correlational analysis.

Variable	1	2	3	4
1. Eustress	—			
2. Distress	−0.24**	—		
3. Mindfulness	0.15*	−0.19**	—	
4. Mental toughness	0.41**	−0.29**	0.26**	—

*$p < 0.01$; **$p < 0.001$.

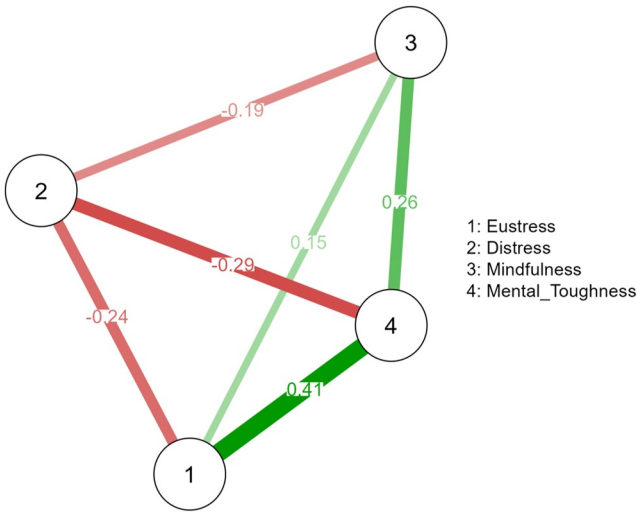


FIGURE 2 Network analysis.

3.3 | Mediation model

First, we checked the role of mindfulness as a mediator between eustress, distress, and MT (see Table 3).

The analysis results showed that all effects are significant (Table 3). Accordingly, eustress positively effects MT ($\beta = 0.22$, $p < 0.001$), and distress negatively effects MT ($\beta = -0.12$, $p < 0.001$). Regarding indirect effects, eustress positively effects MT ($\beta = 0.01$, $p < 0.04$) through mindfulness. In contrast, distress negatively effects MT through mindfulness ($\beta = -0.02$, $p < 0.01$). In terms of total effect, eustress positively effects MT ($\beta = 0.24$, $p < 0.001$) and distress negatively effects MT ($\beta = -0.14$, $p < 0.001$). The mediating role of mindfulness between eustress, distress, and MT was significant ($\beta = 0.01$, SE = 0.01, 95%

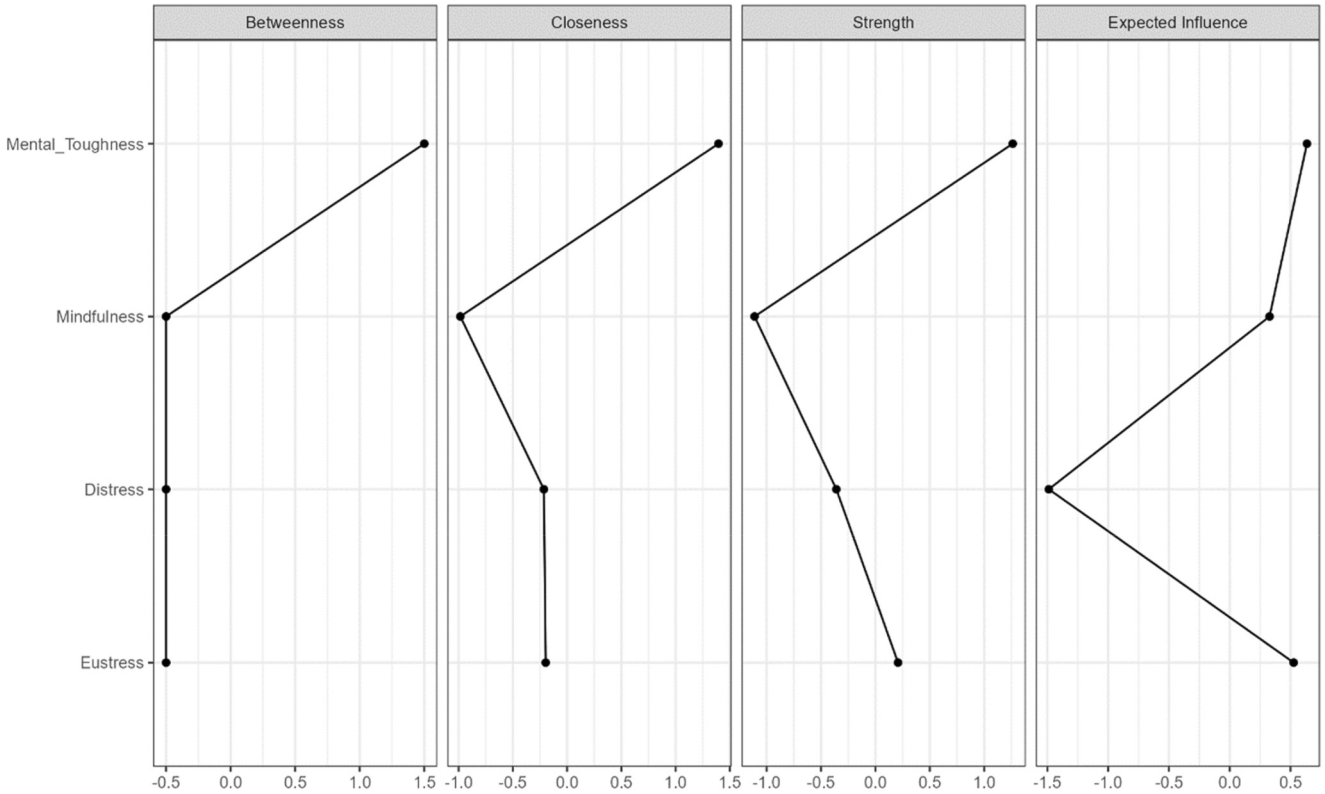


FIGURE 3 Centrality indices.

TABLE 3 Effects.

Effects	Paths	Estimate	SE	*z*-value	*p*	95% CI	
						Lower	Upper
Direct effects	Eustress → MT	0.22	0.03	7.76	<0.001	0.17	0.28
	Distress → MT	−0.12	0.03	−3.90	<0.001	−0.18	−0.06
Indirect effects	Eustress → mindfulness → MT	0.01	0.01	2.00	0.04	0.01	0.03
	Distress → mindfulness → MT	−0.02	0.01	−2.54	0.01	−0.03	−0.00
Total effects	Eustress → MT	0.24	0.03	8.11	<0.001	0.18	0.30
	Distress → MT	−0.14	0.03	−4.52	<0.001	−0.20	−0.08

Note: Delta method standard errors, normal theory confidence intervals, ML estimator.
Abbreviation: MT, mental toughness.

CI = [0.01, 0.03]; β = 0.02, SE = 0.01, 95% CI = [−0.03, −0.00]). The findings showed that the total effect of eustress on MT was statistically significant (β = 0.24, SE = 0.03, 95% CI = [0.18, 0.30]). Also, the total effect of distress on MT was statistically significant (β = −0.14, SE = 0.03, 95% CI = [−0.20, −0.08]). Overall, the model was found to have a total variance of 23.90%. The present results suggest that stress types directly and indirectly effect MT significantly through mindfulness. The findings suggest a partial mediating role of mindfulness. The mediation model with a combination of variables is shown in Figure 4.

4 | DISCUSSION

Our study, which is the first to examine the network structure of MT in adolescence with various variables, holds significant implications for the field of adolescent mental health and psychology. We aim to provide a deeper understanding of the links between MT and positive and negative stress and mindfulness as a protective factor. The first main objective of this study was to analyse the network structure of MT, eustress, distress, and mindfulness in a sample of adolescents. The network analysis results may provide different perspectives and

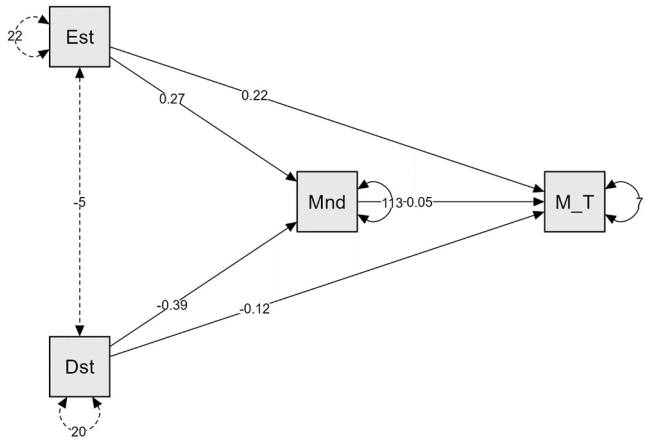


FIGURE 4 Mediation model. Dst, distress; Est, eustress; Mnd, mindfulness; M_T, mental toughness (MT).

approaches to enhance MT. Also, this study examined whether mindfulness mediates the relationship between eustress, distress, and MT. As expected, the network analysis showed a significant relationship among all variables. The strength in the network showed that mental resilience is the most critical node. The findings from the present network indicate the potential importance of mental resilience as an outcome node. Moreover, mediation analyses provided a new perspective on these connections and showed that mindfulness was partially mediated in this relationship.

Our network analysis between MT and eustress, distress, and mindfulness revealed practical implications for educators and mental health professionals. The most central nodes in this network were between MT and eustress and distress. The network analysis revealed the node's MT and eustress as the most central variable in the network. Other important strong edges identified in this study were the connections between distress and MT and between MT and mindfulness. Both connections are essential criteria for MT. Node distress was identified as one of the most central variables in the MT network of adolescents, consistent with previous studies. As such, high MT may be a critical intervention target for educators and mental health professionals treating adolescents who experience high stress. For example, mindfulness might be hypothesized to mediate the relationship between the edges linking eustress, distress, and MT. Moreover, strength indicates more connections and relationships between the network nodes. Therefore, MT is more important than other nodes. This means that it provides more connections and correlations between the nodes in the network, and MT is more interactive critically. In addition, this study showed that MT was positively related to eustress and negatively related to distress. Mental toughness is centred in the network, confirming the negative relationship between MT and perceived stress in one of the studies (Papageorgiou, Benini, et al., 2019; Papageorgiou, Gianniou et al., 2019). Similarly, mindfulness was negatively associated with distress and positively associated with eustress and MT. The findings showed that variables associated with positive mental health (e.g., MT, mindfulness, eustress) were negatively associated with variables indicating mental health problems (e.g., distress). To date, there are no studies in which MT in adolescents has been network analysed with protective factors and concepts associated with psychopathology. This makes it difficult to compare the results. Distress evaluates situations as threatening, while eustress evaluates situations as challenging but not threatening (Pluut et al., 2022). Whether stressors result in eustress or distress depends on the individual's interpretation (Le Fevre et al., 2003). A negative relationship has been observed between MT, stress, and mental health problems (Gerber, Kalak, et al., 2013; Haghighi & Gerber, 2019). Compared to participants with low MT, participants with higher MT reported significantly fewer mental health problems when exposed to high stress. In contrast, when stress levels were low, MT was not associated with mental health complaints (Gerber et al., 2018). Overall, studies point to the protective role of MT for mental health (Gerber et al., 2012) and highlight the negative mental health implications of viewing stress from a negative perspective (Ramshaw & St Clair-Thompson, 2021). The network analysis showed that participants who perceived stress positively had higher MT, while participants who perceived stress negatively decreased their MT. We found that our findings align with the research results, which show that how the stressor is interpreted is related to MT.

We also found a solid and positive relationship between higher mindfulness, eustress, and MT. However, we found that mindfulness was negatively associated with distress. Mindfulness is associated with decreased stress and higher MT (Ciesla et al., 2012; Erbe & Lohrmann, 2015; Walker, 2016; Wu et al., 2021). Mindfulness can reduce automatic and inattentive responses and emotional triggers (Mantzios & Wilson, 2015). This may increase the ability to respond flexibly to stress (Ciesla et al., 2012), leading to a positive relationship between eustress and mindfulness. In addition, Walker (2016) found that individuals with high levels of mindfulness had higher MT than those with low levels of mindfulness. These findings confirm the literature on the relationships between mindfulness and eustress, distress, and MT. The results of our network analysis also showed that a network with strong associations with distress and eustress characterizes MT. While these associations show that stress assessment is important for MT, they do not clarify the causal relationships between the variables. It is assumed that elements in the network influence each other. In this case, it is thought that higher MT would be associated with changes in eustress, distress, and mindfulness.

The mediator analysis results revealed that eustress and distress predict MT through mindfulness. Specifically, high levels of distress may be associated with low levels of mindfulness, which may lead to low levels of MT. High levels of eustress may be associated with high levels of mindfulness, leading to high MT. The study's finding is that eustress and distress, directly and indirectly, predict MT via mindfulness. The association between mindfulness and MT was mediated by eustress and distress. There is a lack of research in the literature examining the potential mediating role of mindfulness in the relationship between eustress, distress, and MT. On the other hand, few study findings are addressing the relationships between variables. Adolescence is defined as a transition period that includes significant

physical, social, emotional, and cognitive changes and various stressors in terms of mental health (Dahl & Gunnar, 2009), and this period is important for the development of MT (Connaughton et al., 2008). It is known that MT in this period reduces the effects of stress and causes the individual to maintain balance and exhibit active coping behaviours (Crust & Keegan, 2010). Indeed, the interaction between stress and MT explained 2% of the variance among adolescents and 10% among young adults (Gerber et al., 2012). In adolescents, MT functions as a source of stress resilience, and higher levels of MT predict depressive symptoms and life satisfaction over time (Gerber, Kalak, et al., 2013). In this period, stress levels are seen to decrease as MT improves (Zalewska et al., 2019), and mentally tough individuals are resilient to stress (Crust & Clough, 2005). Psychological stress during childhood and adolescence increases the risk of lifelong health problems (Chiang et al., 2022), and mental resilience is a practical starting point for preventive measures in the non-clinical adolescent population (Gerber et al., 2012). Research has shown that improving mindfulness enhances mental resilience, while mindfulness activities reduce perceived stress (Ajilchi et al., 2019). It is known that adolescents in the high mindfulness group have higher levels of MT, and mindfulness is positively related to all aspects of MT (Walker, 2016). The findings obtained from this study are like those of the literature, and mindfulness potentially influences the impact of stress on mental resilience. These findings regarding psychological stress, which has become an essential problem during adolescence, provide encouraging evidence for the effectiveness of mindfulness in reducing adolescents' psychological stress (Liu et al., 2023).

According to these findings, MT decreases as perceived stress is high (Benjamin & John, 2021; Ergin et al., 2023; Papageorgiou, Benini, et al., 2019; Papageorgiou, Gianniou et al., 2019), and higher mindfulness is positively associated with MT (Jones & Parker, 2018; Wu et al., 2021). It has also been observed that mindfulness is essential in higher MT (Doğanay & Türkmen, 2022). Distress is typically associated with unpleasant subjective stress responses such as anxiety and depression (Matthews, 2016), while eustress is generally associated with better well-being, health, or greater longevity (Bienertova-Vasku et al., 2020). Instead of trying to suppress or avoid the negative emotions that arise in distress because of assessing the stressful situation, mindfulness can help one cope with negative emotions (Mantzios & Wilson, 2015). Eustress, which refers to the association of the situation with positive emotions and health benefits because of the evaluation of the stressful situation (Li et al., 2016), may lead to the preference for effective coping methods (Gibbons et al., 2008). In this case, more problem-focused coping may help with high MT (Kaiseler et al., 2009), which is associated with less emotion-focused and avoidance coping. Moreover, perceived stress may function as both distress and eustress because mindfulness has been indirectly associated with MT through perceived stress (Chen et al., 2023). The findings supporting the mediating role of mindfulness between eustress and distress and MT align with the literature. Studies have shown that mindfulness-based interventions improve adolescents' coping skills with stress (Fulambarkar et al., 2023), and higher coping competence is an essential predictor of MT (Alonso-Tapia et al., 2019).

Mental toughness has been associated with reduced perceived stress (Gerber et al., 2015; Szabó et al., 2022). Mindfulness has also been found to be negatively related to perceived stress (Ajilchi et al., 2019; Biegel et al., 2009), and research has shown that mindfulness is positively related to MT (Walker, 2016; Wu et al., 2021). Therefore, these findings are consistent with previous research results and provide a holistic perspective on the relationships between variables. As the results reveal, individuals who tend to evaluate stress negatively have a lower level of awareness. This situation negatively effects their durability. Eustress and distress, which express the individual's evaluations of stressful situations, effect the level of mindfulness and negatively effect MT. This is considered a significant finding considering the relationship between MT and negative health outcomes. Because the developmental transitions that occur in adolescence are essential for the onset or stabilization of psychopathology, MT is an exciting topic for health professionals working with the adolescent population (Gerber, Kalak, et al., 2013). This is because evidence suggests that adolescents with low MT report higher rates of mental health problems in the face of stress (Gerber et al., 2018). In terms of supporting protective factors that promote adaptation, MT can address individuals in challenging situations (Gerber et al., 2012).

5 | LIMITATIONS AND SUGGESTIONS

The present study is not without limitations. The data collected from participants are based on self-report. The second limitation is that the study is cross-sectional. The study's cross-sectional nature is unsuitable for examining individual interactions between variables. Moreover, network analyses prevented a comprehensive discussion due to the paucity of previous literature. The present study may provide a preliminary basis for the potential role of MT in future studies. The third limitation is that the analyses are limited to the structure measured by the measurement tools used.

This study provides recommendations for mental health workers and researchers. Mental health studies aim to develop strategies to prevent adverse mental health outcomes as well as to develop interventions. The findings obtained from this study show that interventions targeting the regulation of cognitive structures related to stressful situations can be effective in higher MT. In this context, studies aiming to strengthen adolescents' awareness are thought also to influence higher MT. Future research should address stress assessment processes as critical in planning preventive interventions. The findings of this study showed that MT, one of the most central nodes in the predicted psychological network, was associated with positive and negative stress as predicted. Mental toughness, which plays the most critical role in the current research network, may have a central role in positive mental health outcomes. The fact that the most prominent node in the network is MT provides insight for future researchers. Mental toughness is central to many variables in this research and reveals that MT may have an essential mediating role in positive psychology. Thus, the present network findings go beyond

traditional correlation findings and expand our understanding. Researchers could also focus on the role of MT in time-dependent change. When examining MT, which is related to cognitive appraisal processes regarding the intensity and controllability of stress (Kaiseler et al., 2009), individuals' perspectives on stressful situations and the biological, psychological, and social factors effecting this perspective should be considered. This study tested the mediating role of mindfulness between stress and MT. Although the network analysis and the tested model showed that awareness significantly contributed, this contribution was low. Future research should address different psychosocial variables (e.g., self-regulation, coping styles, self-compassion, social support, etc.) to explain the relationships between variables. In addition, it would be hugely important to collect longitudinal information through new methodologies. Alternatively, experimental or longitudinal designs may be necessary for future researchers to understand the causal relationship between MT, eustress, distress, and mindfulness. Additionally, this study was conducted with adolescents. Repeating the study with different age groups and populations may be recommended to generalize the findings to other developmental periods. Due to the study's cross-sectional nature, individual experiences with qualitative or mixed methods could provide a more comprehensive understanding.

Adolescence is a critical period in terms of the emergence of mental health problems. During this period, school psychological counselling services come to the forefront of preventing mental health problems and empowering adolescents regarding protective resources. Based on our findings, we should design awareness-based individual and group mental health services to promote MT in schools. Our results indicate that the way in which the stressor is interpreted is important in terms of MT and awareness. Intervention programs that include optimism and hope, which express positive interpretations, may be recommended for design and implementation in protective and preventive mental health studies. In addition, to build mentally tough communities, these concepts should be included in implicit curriculums and supported by community mental health interventions.

6 | CONCLUSIONS

The fact that stress is a widespread mental health problem and that this problem creates significant threats to individuals' mental health makes it necessary to investigate protective and preventive factors. Mental toughness is a complex construct comprising commitment, control, challenge, and confidence dimensions (Clough et al., 2002). New statistical models such as network analysis help us better understand and analyse such constructs. Therefore, it is important to reveal the factors associated with MT and to causally address the relationships between them in preventive and protective services. This study's results provide evidence for the relationship between mindfulness, eustress distress, and MT. The mediation model comprehensively explains how eustress, distress, and MT are related. It has enhanced our understanding of mindfulness and mediates the impact of eustress and distress on MT. The findings of this study provide practical contributions to the content of the service to be provided in psychological help processes to improve MT. In addition, essential contributions are offered for protective and preventive studies that can prevent individuals in adolescence, which is an essential stage of identity development, from experiencing psychopathological problems in the face of intense stressors.

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The author declared no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study was approved by the Research Ethics Committee of Recep Tayyip Erdogan University (Ethics Approval Numbers: 2023/036, 25 January 2023).

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

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