



Intolerance of uncertainty, rumination, post-traumatic stress symptoms and aggression during COVID-19: a serial mediation model

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic can be identified as a source of traumatic stress. Previous studies have shown that post-traumatic stress and intolerance of uncertainty are associated with aggressive behaviour.

Objective: In the present study, we aimed to test a serial mediation model, considering rumination and post-traumatic stress symptoms (PTSS) as mediators that link intolerance of uncertainty and aggression, while controlling the confounding effect of crisis-induced health and socioeconomic stressors during the COVID-19 pandemic.

Method: A total of 714 participants [533 (74.6%) females, 176 (24.7%) males, aged 18–64 years ($M_{age} = 25.16$, $SD_{age} = 9.34$)] completed the following self-reported scales: Aggression Scale, COVID-19 stressors checklist, Short Version of the Intolerance of Uncertainty Scale, Impact of Event Scale with Modifications for COVID-19, and Ruminative Thought Style Questionnaire.

Results: The results revealed that there was an association between intolerance of uncertainty and aggressive behaviours. Moreover, the results of serial mediation analysis showed that intolerance of uncertainty predicts aggressive behaviours via rumination and PTSS. Besides, socioeconomic stressors are significantly associated with the level of PTSS and aggression, while health stressors are not significantly associated with the level of PTSS and aggression.

Conclusions: The findings provide several contributions to understand the link between intolerance of uncertainty and aggressive behaviours during the COVID-19 pandemic, and confirm the importance of early psychological intervention, especially for those who are more likely to ruminate and suffer from PTSS, to prevent aggression and violence in the long run. In addition to health-related regulations, it is important to take the social and economic aspects of the crisis into account and develop intervention strategies accordingly. Nevertheless, the limitations of cross-sectional mediation analysis in explaining causal relationships should be kept in mind, and future studies should extend these findings using longitudinal data.

Intolerancia a la incertidumbre, rumiación, síntomas de estrés postraumático y agresión durante el COVID-19: Un modelo de mediación en serie

Antecedentes: La pandemia por COVID-19 se puede identificar como una fuente de estrés traumático, y estudios previos mostraron que el estrés postraumático y la intolerancia a la incertidumbre están asociados con el comportamiento agresivo. **Objetivo:** En el presente estudio, nuestro objetivo fue probar un modelo de mediación en serie, considerando la rumiación y los síntomas de estrés postraumático (SEPT) como mediadores que vinculan la intolerancia a la incertidumbre y la agresión, controlando el efecto de confusión de los factores estresantes socioeconómicos y de salud inducidos por crisis durante la pandemia de COVID-19.

Método: Un total de 714 participantes (533 [74,6%] mujeres, 176 [24,7%] hombres de entre 18 y 64 años ($M_{edad} = 25.16$, $DE_{edad} = 9.34$) completaron las siguientes escalas de auto-reporte: Escala de agresión, Lista de Chequeo de Factores Estresantes por COVID-19, Versión Corta de la Escala de Intolerancia a la incertidumbre, Escala de Impacto de Eventos con modificaciones para COVID-19 y Cuestionario de Estilo de Pensamiento Rumiante.

Resultados: Los resultados revelaron una asociación entre la intolerancia a la incertidumbre y las conductas agresivas. Además, el resultado del análisis de mediación en serie mostró que la intolerancia a la incertidumbre predice comportamientos agresivos a través de la rumiación y los SEPT. Además, los factores de estrés socioeconómico están significativamente asociados con el nivel de SEPT y la agresión, mientras que los estresores de salud no están significativamente asociados con el nivel de SEPT y la agresión.

Conclusiones: Los hallazgos brindan varias contribuciones para comprender el vínculo entre la intolerancia a la incertidumbre y los comportamientos agresivos durante la pandemia de COVID-19 y la importancia de la intervención psicológica temprana, especialmente para aquellos que tienen más probabilidades de presentar rumiación y sufrir SEPT para prevenir la

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PALABRAS CLAVE

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关键词

反刍; 无法容忍对不确定性; 攻击; 创伤后应激症状; COVID-19

HIGHLIGHTS

- Intolerance of uncertainty is a predisposing tendency that predicts rumination and post-traumatic stress symptoms, which, in turn, serves to increase aggressive behaviours during the COVID-19 pandemic.

agresión y la violencia a largo plazo. Además de las regulaciones relacionadas con la salud, es importante tener en cuenta los aspectos sociales y económicos de las crisis, y desarrollar en concordancia estrategias de intervención. No obstante, deben tenerse en cuenta las limitaciones del análisis de mediación transversal para explicar las relaciones causales y los estudios futuros deben ampliar los hallazgos mediante el uso de datos longitudinales

COVID-19 期间无法忍受不确定性, 反刍, 创伤后应激症状和攻击性: 一个链式中介模型

背景: COVID-19 疫情可以被确定为创伤性应激的一个来源, 之前研究表明, 创伤后应激和无法忍受不确定性与攻击行为有关。

目的: 在本研究中, 我们旨在考查一个将反刍和创伤后应激症状 (PTSS) 作为把无法忍受不确定性和攻击性联系起来的中介因子, 同时控制 COVID-19 疫情期间由危机引起的健康和社会经济应激源在治疗期间的混杂效应的链式中介模型。

方法: 共有 714 名参与者 (533 [74.6%] 名女性, 176 名 [24.7%] 男性, 年龄在 18 至 64 岁之间 (平均年龄 = 25.16, 年龄标准差 = 9.34) 完成了以下自我报告量表: 攻击性量表, COVID-19 应激源检查表, 简短版无法容忍不确定性量表, 针对 COVID-19 修订的事件影响量表和反刍思维方式问卷。

结果: 结果表明, 无法容忍不确定性与攻击性行为之间存在关联。此外, 链式中介分析的结果表明, 无法容忍不确定性通过反刍和 PTSS 预测攻击性行为。此外, 社会经济应激源与 PTSS 和攻击性水平显著相关, 而健康应激源与 PTSS 和攻击性水平无显著相关。

结论: 研究结果为理解 COVID-19 疫情期间无法容忍不确定性和攻击行为之间的联系与早期心理干预的重要性做出了一定贡献, 尤其对于那些更有可能反刍和有 PTSS 的人, 以预防长期的攻击和暴力。除了健康相关的法规外, 重要的是要考虑危机的社会和经济方面并相应制定干预策略。然而, 应牢记横断面中介分析在解释因果关系方面的局限性, 未来的研究应通过使用纵向数据扩展研究结果。

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a source of traumatic stress (Kira et al., 2020) since it impacts educational, economic, and health systems globally. Implementations such as quarantine and social distancing may cause people to feel alone, left out, and abandoned (Hoffart, Johnson, & Ebrahimi, 2020), and to develop post-traumatic stress symptoms (PTSS) (e.g. Ikizer, Karanci, Gul, & Dilekler, 2021; Rossi et al., 2021). The conditions of the COVID-19 pandemic have led to a deep sense of uncertainty regarding people's safety, view of the world, and financial situation, which may be difficult to bear for some individuals (Satici, Saricali, Satici, & Griffiths, 2020). Freeston, Tiplady, Mawn, Bottesi, and Thwaites (2020) stated that situational uncertainty, especially in times of crisis, evoke negative affect; including frustration, feelings of unfairness and helplessness, anger, and rage, which may amplify the psychological distress of the individuals. In an uncertain pandemic period, individuals may feel out of control of their own faith and future (Sigurvinsdottir, Thorisdottir, & Gylfason, 2020). Individuals who cannot tolerate uncertainty are at high risk of being affected by the threats and conditions related to a pandemic because it contains various uncertainties (Taylor et al., 2020).

Intolerance of uncertainty (IU) is defined as 'an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty' (Carleton,

2016, p. 31). Individuals with a high level of intolerance of uncertainty are more likely to have a disrupted cognition regarding perceived threat and to be unable to inhibit their attention even in the absence of actual threat (Morris & McSorley, 2019). Although IU has been proposed as a cognitive risk factor for generalized anxiety disorder, it is increasingly acknowledged as a transdiagnostic concept (McEvoy, Hyett, Shihata, Price, & Strachan, 2019). Failing to cope with uncertainty, individuals become more vulnerable to experience stress through life events and are at high risk of developing PTSS after various negative life events (Boelen, 2019; Oglesby, Boffa, Short, Raines, & Schmidt, 2016). Studies have also shown that IU is associated with insomnia (Voitsidis et al., 2020), less positivity (Bakioğlu, Korkmaz, & Ercan, 2020), fear of COVID-19 (Deniz, 2021), health anxiety (Tull et al., 2020), increased fear of the coronavirus (Mertens, Gerritsen, Duijndam, Saleminck, & Engelhard, 2020), depression, and emotional eating (Pak, Süsen, Nazlıgül, & Griffiths, 2021), and can predict anxiety and depressive symptoms (e.g. del Valle et al., 2020; Glowacz & Schmits, 2020) during the COVID-19 pandemic.

According to Freeston et al. (2020), IU is a dispositional tendency that may lead individuals to experience aversion and perceive greater threat even when the adversity of an encountered situation is, as yet, unknown. In other words, IU is an individual difference variable that first leads people to experience uncertain situations as aversive, then leads them to

engage in dysfunctional uncertainty-reducing behaviours such as spending marked time and effort in being prepared for the possible negative outcomes of the situation and repeatedly seeking reassurance, which further amplifies the perceived severity of threat in the situation. The negative beliefs and emotions about uncertainty may disrupt functional cognitive processes and cause inefficient coping strategies such as rumination (Yook, Kim, Suh, & Lee, 2010). People who are intolerant to uncertainty may highly worry and repetitively think over a situation to reduce the uncertainty related to it. Rumination is conceptualized as a response style characterized by repetitive and passive thinking over one's own distress caused by a stressful situation (Nolen-Hoeksema, 2000). According to Dugas, Gagnon, Ladouceur, and Freeston (1998), IU may cause exaggerated focus on the details of a problematic situation and worrying about the future because the individuals may believe that these cognitive attempts bring a sense of control in uncertainty. de Jong-Meyer, Beck, and Riede (2009) proposed that people with high IU may have positive expectations about rumination to reduce uncertainty, which leads them think more repetitively about uncertain situations; and their study supported that IU and beliefs on worrying are highly related to ruminative thinking. On the other hand, rumination makes people who are intolerant to uncertainty highly vulnerable to negative affect, instead of reducing uncertainty. In fact, focusing on the self and negative emotions and repetitively thinking about them may lead the individuals with high IU to develop more psychological symptoms (Yook et al., 2010). Similarly, Taha, Matheson, Cronin, and Anisman (2014) conducted a study on the mental health outcomes in the H1N1 pandemic and found that the relationship between IU and infection anxiety was mediated by emotional-focused coping, such as rumination. Moreover, research indicates that rumination may also create even more uncertain situations for individuals. Ward, Lyubomirsky, and Nolen-Hoeksema (2003) reported that people who have a tendency to ruminate, compared to non-ruminators, show more negative affect and are more reluctant to engage in problem-solving behaviours as a reaction to a potentially aversive situation, which actually increases uncertainty in the situation that they are already in.

A significant body of research has found supporting evidence for the association between rumination and post-traumatic stress disorder (PTSD) (e.g. Bravo et al., 2019; Brown, Hetzel-Riggin, Mitchell, & Bruce, 2018). Longitudinal studies showed that rumination measured immediately after the trauma predicts the later PTSD, even controlling for initial symptom levels of PTSD (Kleim, Ehlers, & Glucksman, 2007; Michael, Halligan, Clark, & Ehlers, 2007). Moreover, experimental studies show that the induction of rumination, compared with

control conditions, leads to more development and maintenance of negative mood and PTSD symptoms after a traumatic video or a narrative of a traumatic real-life event (Ehring, Fuchs, & Klasener, 2009; Zetsche, Ehring, & Ehlers, 2009). A ruminative thinking style may cause the individual to pay more attention to stressors and increase their salience and perceived importance (Brinker & Dozois, 2009). Spinhoven, Penninx, Krempeniou, van Hemert, and Elzinga (2015) found that rumination leads people to appraise a traumatic experience as more significant for their lives, and this appraisal increases the risk of PTSD. Another study on trauma-exposed individuals indicated that rumination enhances the severity of PTSD by increasing the perceived stress (Hu et al., 2014). Rumination is also considered a dysfunctional avoidant strategy because repetitively thinking about and focusing on the superficial aspects of a traumatic event obstruct the necessary emotional processes to cope with the trauma (Bishop, Ameral, & Palm Reed, 2018; Michael et al., 2007). Ikizer et al. (2021) found that PTSS and post-traumatic depreciation are predicted by intrusive rumination in the context of COVID-19.

In addition to psychological difficulties such as anxiety, depression, and PTSD, there is a risk of escalation in aggressive behaviours in the time of COVID-19. Various studies on interpersonal violence, an extreme form of aggression with an intention to harm others, in the COVID-19 pandemic have shown that there is an increase in the prevalence rates of domestic violence against women and children (e.g. Boxall, Morgan, & Brown, 2020; Humphreys, Myint, & Zeanah, 2020). Any forms of aggression may also further be exacerbated, since the individuals' capacity to manage stress would deteriorate in the conditions brought by COVID-19. Sharma and Borah (2020) stated that a lack of social support and economic issues, such as being unemployed, loss of income, or fear of losing one's job, arising during the COVID-19 pandemic are among the main contributors to interpersonal violence. Moreover, the constrained conditions due to economic concerns, fear of infection, isolation, and social distancing may prevent the victims leaving the aggressive environment (Cluver et al., 2020).

IU may increase the risk of engaging in aggressive behaviours in COVID-19 pandemic conditions through increased rumination and PTSS. First, individuals who are intolerant of uncertainty may be at high risk of aggression because the uncertainty can be very stressful and frustrating for them. Fracalanza, Koerner, Deschenes, and Dugas (2014) supported the idea that the belief that uncertainty is unfair and ruins everything predicted an individual's hostility and outward expression of anger. Moreover, Gorka, Phan, Hosseini, Chen, and McCloskey (2018) reported that higher levels of IU predicted a greater lifetime history of aggressive behaviours. Sadeh and Bredemeier (2019) proposed that people who are intolerant to uncertainty

tend to engage in risky and impulsive behaviours such as aggression because of the motivation to eliminate the distress evoked by uncertainty. Secondly, trying to cope with uncertainty of the pandemic conditions, individuals who have a tendency for rumination may also be at risk of showing aggression. Although most of the studies focused on the effect of anger rumination on aggression (e.g. Babcock & Potthoff, 2020; Turner & White, 2015), research shows that self-focused rumination may also lead to externalizing psychopathology (du Pont, Rhee, Corley, Hewitt, & Friedman, 2018; Pedersen et al., 2011). Finally, traumatic stress can lead to heightened aggression. There is well-documented evidence on the association between traumatic stress and aggression, especially in studies on veterans and war survivors (Holliday et al., 2019; MacManus et al., 2013). Developmental studies have also suggested that traumatic experiences may increase aggression by causing hostile biases in information processing (Chen, Coccaro, & Jacobson, 2012). Some researchers suggested that not only exposure to traumatic events but also some specific symptoms of PTSD may also trigger aggression (e.g. Dierkhising et al., 2013). In other words, the association between adversities or traumatic experiences and aggression may be mediated by the severity or form of PTSD symptoms (Webb & Johnson, 2019).

1.1. The current study

Crisis-induced stressors may have both a cumulative effect as well as a domain-specific differential effect on the psychological well-being of individuals. In our study, we aim to understand how different forms of COVID-19 pandemic stress factors (health and socio-economic) impact PTSS and aggression.

It is known that not only event-related stressors but also the individual differences in underlying psychological predispositions may affect how well individuals will cope or suffer in times of crises and traumatic exposures. The findings of the aforementioned studies indicated that IU, as a dispositional tendency, impairs the psychological functioning of the individual and predicts PTSS (Boelen, 2019; Oglesby et al., 2016), and the relationship between IU and PTSS is mediated by rumination (Taha et al., 2014). Longitudinal and experimental studies provided

supporting evidence on the role of rumination in the development of PTSD symptoms, even after controlling for the initial level of stress symptoms (e.g. Ehring et al., 2009; Kleim et al., 2007). Previous studies also supported that aggressive behaviours are predicted by IU (Gorka et al., 2018) and traumatic stress (Holliday et al., 2019). Although various studies have explored the independent contributions of IU, rumination, and traumatic stress on aggression, none of them has investigated all of these variables in one model. In this study, we aimed to test a serial mediation model, considering rumination and PTSS as mediators that link IU and aggression while controlling for the confounding effect of crisis-induced health and socioeconomic stressors during the COVID-19 pandemic. Figure 1 summarizes the hypothesized model.

The specific hypotheses of this study were as follows:

Hypothesis 1. The crisis-induced socioeconomic stressors are associated with the level of PTSS and aggression.

Hypothesis 2. There is a serial multiple mediation effect of IU on aggression, through rumination, then through PTSS.

2. Method

2.1. Participants

After ethical approval had been received from the university committee, data were collected online using a convenience sampling method. The participants were 714 Turkish-speaking individuals from Turkey and the Turkish Republic of Northern Cyprus; 533 were females (74.6%), 176 were males (24.7%), and five identified themselves as other (0.7%). They were aged between 18 and 64 years ($M = 25.16$, $SD = 9.34$).

2.2. Measures

2.2.1. Aggression

The Aggression-ES Scale was developed to assess participants' immediate aggressive behaviour, rather than their trait aggressiveness, by experience sampling

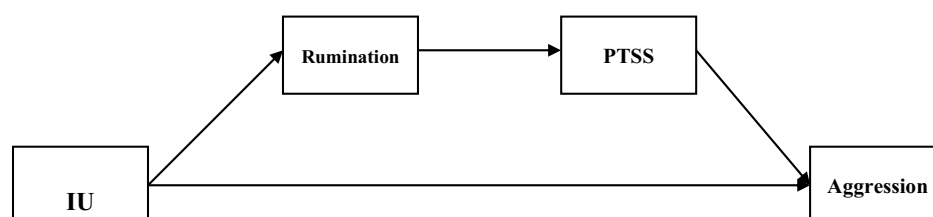


Figure 1. Illustration of the hypothetical serial mediation model. IU, intolerance of uncertainty; PTSS, post-traumatic stress symptoms.

methodologies (Borah, Murray, Eisner, & Jugl, 2018). Omega reliability for the Aggression-ES Scale was reported to be 0.66 at the within-person level and 0.85 at the between-person level (Murray, Eisner, Ribeaud, & Booth, 2020). The Aggression-ES Scale was translated into Turkish and modified in accordance with the purpose of the present study, in which the participants were asked about the frequency of aggressive behaviours in the past 2 weeks using a five-point Likert scale from 1 (never) to 5 (always). The scale consists of 12 items (e.g. 'Shouted at someone', 'Physically attacked someone'). In this study, Cronbach's alpha coefficient was calculated as 0.85.

2.2.2. COVID-19 stressors

A self-developed seven-item checklist was created to evaluate the COVID-19-related economic, social, and health factors. Participants were asked to answer (0 = 'No'; 1 = 'Yes') the items, and the sum of scores was calculated, with higher scores representing exposure to more COVID-19-related problems. To assess the dimensionality of the scale, we conducted an exploratory factor analysis using principal factor analysis (PFA) with the Promax rotation. The results of the analysis showed that a two-factor structure consisting of seven items explained 42.16% of the variance. The first dimension (three items, accounting for 22.830% of the total variance) included items on health-related conditions. This dimension was named the 'health factor'. The second dimension (four items, accounting for 19.966% of the total variance) comprised socioeconomic-related items. Thus, we labelled this factor the social-economic factor. The detailed values and notes are shown in Table 1.

2.2.3. Intolerance of uncertainty

The Intolerance of Uncertainty Scale (IUS-12), consisting of 12 items, was used to assess participants' anxiety levels in uncertain or ambiguous situations (Carleton, Norton, & Asmundson, 2007). The Cronbach's alpha internal consistency reliability coefficient is 0.88 for the overall scale. The Turkish version of IUS-12 was previously validated in

a Turkish sample (Sarıçam, Erguvan, Akın, & Akça, 2014). In the present study, Cronbach's alpha coefficient for the scale was 0.88.

2.2.4. Post-traumatic stress symptoms (PTSS)

The Impact of Event Scale with Modifications for COVID-19 (IES-COVID-19) was used to assess participants' traumatic stress symptoms during the COVID-19 pandemic (Vanaken, Scheveneels, Belmans, & Hermans, 2020). The IES-COVID-19 was developed based on the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979), which is used to evaluate the frequency of intrusive thoughts and avoiding triggers after various traumatic experiences. Expressions in the original version of the scale that refer to the past, such as 'Any reminder brought back feelings about it', have been converted to expressions more applicable to the ongoing impact of COVID-19, such as 'Every thought about it brought back the feelings about it', and the instruction of the scale was also modified as 'statements regarding the situation related to the coronavirus (COVID-19)'. The IES-COVID-19 has been shown to have good validity and reliability ($\alpha = 0.75$). Cronbach's alpha reliability for the IES-COVID-19 in the current study was 0.84.

2.2.5. Rumination

The Ruminative Thought Style Questionnaire (RTSQ) is a 20 item-measure which was developed by Brinker and Dozois (2009) to evaluate the general tendency for rumination. It has also been used to assess trait rumination (e.g. Brinker, Chin, & Wilkinson, 2014; Odou & Brinker, 2014) in some studies. The Turkish form of the RTSQ (Karatepe, Yavuz, & Turkcan, 2013) has good reliability ($\alpha = 0.91$). In the present study, total scores on the RTSQ demonstrated excellent internal consistency ($\alpha = 0.95$).

2.3. Data analysis

Descriptive statistics and correlation coefficients were computed for the study variables. We examined the

Table 1. Factor loadings, internal consistency values, and item frequencies of cumulative factors on the COVID-19 stressors checklist.

Item	Health stressors	Socioeconomic stressors	Answered yes	
			<i>n</i>	%
1. Have you been diagnosed or followed up with the suspicion of the COVID-19 virus?	0.658	-0.032	74	10.4
2. Has someone close to you been diagnosed with the COVID-19 virus?	0.746	0.057	286	40.1
3. Has someone close to you died because of the COVID-19 virus?	0.635	0.157	49	6.9
4. Did you have any serious financial difficulties which affect your family functioning in the COVID-19 pandemic?	0.058	0.745	308	43.1
5. Has anyone in your family lost his/her job during the COVID-19 pandemic?	-0.025	0.714	115	16.1
6. Did you have to work under unhealthy conditions without any precautions during the COVID-19 pandemic?	0.044	0.343	78	10.9
7. Have you ever been unable to get social support from people around you when you needed it in the COVID-19 pandemic?	0.094	0.606	238	33.3
Eigenvalues	1.837	1.270		
Cronbach's alpha	0.63	0.71	<i>N</i> = 714	

mediator roles of rumination and PTSS in the relationship between IU and aggression using a serial mediation model. The serial mediation model was tested using the PROCESS macro for SPSS (Model 6) (Hayes, 2013). All indirect effects were tested by bootstrap analyses with 5000 resamples, in which 95% bias-corrected and accelerated confidence intervals (CIs) were estimated. The indirect effect is assumed to be significant if the confidence interval does not include zero (Preacher & Hayes, 2008).

3. Results

3.1. Preliminary analyses

Table 2 displays the means, standard deviations, and correlation coefficients of the study variables. All variables were reasonably normally distributed (maximum skewness = 0.48, maximum kurtosis = -0.86) [between -2 and +2 (George & Mallery, 2010)]. Correlation analysis indicated that IU was positively associated with all variables. Similarly, rumination, PTSS, and aggression were found to have statistically significant relationships with one another. Social-economic stressors were significantly related to IU, rumination, PTSS, and aggression, while there was no association between health stressors and other variables in the study.

3.2. Serial mediation model

The serial multiple mediation model includes three indirect effects (Indirect 1: $X \rightarrow M_1 \rightarrow Y$; Indirect 2: $X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$; Indirect 3: $X \rightarrow M_2 \rightarrow Y$). We treated IU as the independent variable (X), rumination as the first mediator (M_1), PTSS as the second mediator (M_2), and aggression as the dependent variable (Y). Figure 2 demonstrates the findings of the tested model of the mediation roles of rumination and PTSS in the link between IU and aggression while controlling for socioeconomic stressors of COVID-19.

As indicated in Table 3, the results showed that IU significantly predicted rumination ($B = 1.668$, $SE = 0.08$, $t = 19.43$, $p < 0.001$) and PTSS ($B = 0.225$, $SE = 0.03$, $t = 6.038$, $p < 0.001$). As a predictor, rumination was found to have a positive effect on PTSS ($B = 0.067$, $SE = 0.01$, $t = 5.112$, $p < 0.001$). Both rumination and PTSS had a significant impact on aggression ($B = 0.943$, $SE = 0.01$, $t = 7.117$, $p < 0.001$ for rumination; $B = 0.122$, $SE = 0.04$, $t = 3.299$, $p < 0.001$ for PTSS). Moreover, the direct effect of IU on aggression was not significant ($B = 0.015$, $SE = 0.04$, $t = 0.405$, $p = 0.662$). Finally, the total effect of IU on aggression was significant ($B = 0.214$, $SE = 0.03$, $t = 6.863$, $p < 0.001$).

The total indirect effect was significant ($B = 0.198$, $SE = 0.02$) and the bias-corrected bootstrap confidence interval based on 5000 samples did not contain zero

Table 2. Means (M), standard deviations (SD), and correlations among the study variables ($N = 714$).

Variable	M	SD	1	2	3	4	5	6
1. IU	38.72	9.05	-	0.593**	0.388**	0.260**	0.041	0.123*
2. Rumination	89.16	25.79	-	-	0.381**	0.387**	-0.001	0.146**
3. PTSS	15.40	4.57	-	-	-	0.275**	-0.030	0.169**
4. Aggression	21.48	7.90	-	-	-	-	0.033	0.231**
5. Health	5.40	0.77	-	-	-	-	-	0.076*
6. Social-economic	8.71	1.26	-	-	-	-	-	-

IU, intolerance of uncertainty; PTSS, post-traumatic stress symptoms; Health, health factors of COVID-19; social-economic, social and economic factors of COVID-19.

* $p < 0.01$, ** $p < 0.001$.

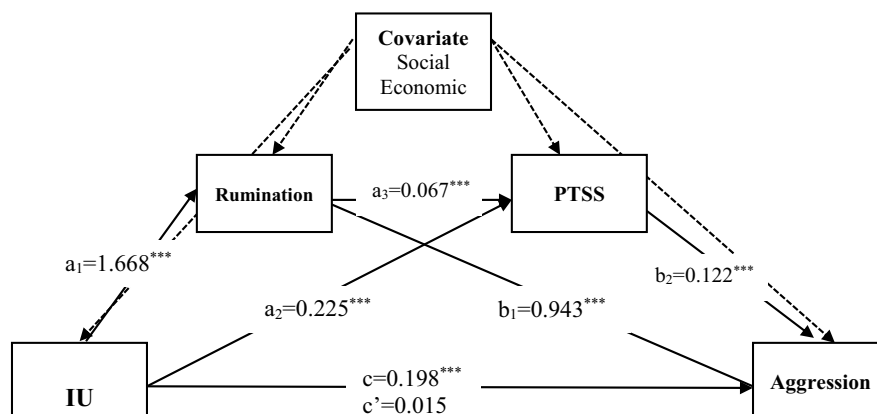


Figure 2. Illustration of the indirect effects of serial mediation model with unstandardized coefficients. IU, intolerance of uncertainty; a_1 , direct effect of intolerance of uncertainty on rumination; a_2 , direct effect of intolerance of uncertainty on post-traumatic stress symptoms (PTSS); a_3 , direct effect of rumination on PTSS; b_1 , direct effect of rumination on aggression; b_2 , direct effect of PTSS on aggression; c , total indirect effect of intolerance of uncertainty on aggression, c' , direct effect of intolerance of uncertainty on aggression. *** $p < 0.001$.

Table 3. Intolerance of uncertainty (IU), rumination, post-traumatic stress symptoms (PTSS), and aggression: testing a serial mediation model.

Model pathway	Estimate	SE	<i>t</i>	<i>p</i>	95% CI	
					LL	UL
IU → Rumination	1.668	0.08	19.483	< 0.001***	1.500	1.836
IU → PTSS	0.225	0.03	6.038	< 0.001***	0.152	0.299
Rumination → PTSS	0.067	0.01	5.112	< 0.001***	0.417	0.936
Rumination → Aggression	0.943	0.01	7.117	< 0.001***	0.683	0.120
PTSS → Aggression	0.122	0.04	3.299	< 0.001***	0.493	0.194
Total model effect	0.214	0.03	6.863	< 0.001***	0.152	0.274
Direct effect	0.015	0.04	0.405	0.686	−0.580	0.089
Total indirect effect	0.198	0.02			0.154	0.247
IU → Rumination → Aggression	0.157	0.02			0.113	0.206
IU → PTSS → Aggression	0.027	0.01			0.009	0.049
IU → Rumination → PTSS → Aggression	0.014	0.01			0.005	0.025

CI, confidence interval; LL, lower limit; UL, upper limit.

****p* < 0.001. Bootstrap sample size = 5000.

[lower limit (LL) CI: 0.154, upper limit (UL) CI: 0.247]. The indirect effect of perceived IU on PTSS through rumination ($X \rightarrow M_1 \rightarrow Y$) was also significant ($B = 0.157$, $SE = 0.02$) and the bias-corrected bootstrap confidence interval based on 5000 samples did not contain zero (LL CI: 0.113, UL CI: 0.206), indicating that mediation probably occurs. Furthermore, the second indirect effect of IU on aggression through PTSS ($X \rightarrow M_2 \rightarrow Y$) was significant ($B = 0.027$, $SE = 0.01$) and the bootstrap confidence interval based on 5000 samples did not contain zero (LL CI: 0.009, UL CI: 0.049).

As a result of the serial mediating effect, ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$) was significant ($B = 0.014$, $SE = 0.01$) and the bootstrap confidence interval did not contain zero (LL CI: 0.005, UL CI: 0.025), which was considered to be statistically significant. Consequently, findings from the analysis show that the serial mediation effects of rumination and PTSS were supported in the relationship between IU and aggression. The results of the serial mediation models are provided in Table 3.

4. Discussion

In the present study, we aimed to understand the impact of crisis-induced health and socioeconomic stressors on the psychological well-being of individuals, as well as to discover the underlying psychological mechanism between IU, rumination, PTSS, and aggression, while controlling for the confounding effect of the stressors.

First of all, we aimed to investigate the differential effect of health stressors as well as socioeconomic stressors on the psychological well-being of the individuals. Previous studies documented that the stressors in times of global health crises are not limited to health-related concerns but, rather, there are multi-dimensional aspects of the potential stressors, such as social isolation (Hoffart et al., 2020; McKibbin & Fernando, 2020) and financial hardships (Nicola

et al., 2020), and these crisis-induced social and economic stressors also have a negative impact on the psychological well-being of individuals (Jalloh et al., 2018; Sprang & Silman, 2013) and lead to an increase in the level of aggression and interpersonal violence (Lazaratou, Kalogerakis, Economou, & Xenitidis, 2017). Recent studies on the psychological consequences of the socioeconomic aspect of the COVID-19 pandemic also supported the contribution of these stressors to traumatic stress and interpersonal aggression (Cluver et al., 2020). Our findings are consistent with the previous literature: socioeconomic stressors are significantly associated with the level of PTSS and aggression, while health stressors are not significantly associated with the level of PTSS and aggression.

Secondly, and more importantly, we assessed a serial mediation model of the relationship between IU, rumination, PTSS, and aggressive behaviours, while controlling for the effect of stressors, by testing a serial multiple mediation model using bootstrapping methods. Carleton (2016) stated that IU may be associated with maladaptive externalizing behaviours as well as internalizing psychopathology. However, the mechanism behind the relationship between IU and aggression is still unclear. Although there is no clear evidence regarding the mediator role of rumination between IU and aggressive behaviour in the literature, previous research also showed that IU may lead to aggressive behaviour (Gorka et al., 2018) since individuals with a high level of IU are more likely to perceive the situation as unfair and feel frustrated by the interruptions regarding their goals and expectations (Fracalanza et al., 2014). They may believe that their worries and sense of uncertainty will be reduced, and they will be able to eliminate future mistakes, with rumination (de Jong-Meyer et al., 2009). However, increased levels of rumination and constantly focusing on the self and negative emotions is a form of maladaptive functioning and further amplifies psychological symptoms (Huang, Yu, Carleton, & Beshai, 2019; Liao & Wei, 2011; Yook et al., 2010). There is also supporting evidence on the mediation role of

rumination between IU and anxiety (Taha et al., 2014) as well as mental well-being (Satici et al., 2020) in global health crises. Moreover, longitudinal studies have shown that rumination is a significant predictor of the prevalence and severity of PTSD for trauma-exposed individuals (Zhou, Wu, Fu, & An, 2016), and traumatic stress can lead to anger management problems (MacManus et al., 2013), heightened aggression (Dierkhising et al., 2013; Webb & Johnson, 2019), and interpersonal violence (Gillikin et al., 2016). The results of the serial mediation model showed that rumination and PTSS have serial mediator roles in the association between IU and aggression. Thus, in the context of the current study, IU, as a predisposing tendency, predicts rumination and PTSS, which, in turn, serve to increase aggressive behaviours during the COVID-19 pandemic.

This study has several limitations that need to be considered alongside the results. The primary limitation of this work is that the cross-sectional nature of the data does not allow us to draw inferences about the causal associations among variables. Although previous studies suggested a path from IU to rumination (e.g. Liao & Wei, 2011; Taha et al., 2014), from rumination to trauma symptoms (e.g. Kleim et al., 2007), and from trauma symptoms to aggression (e.g. Dierkhising et al., 2013), as in the present study, it is hard to make a conclusive prediction about the causal sequence between the variables from a cross-sectional design since the reverse sequence between some of the variables may also occur. Future studies should extend these findings using longitudinal data or experimental methods to interpret the causal relationships between IU, rumination, trauma symptoms, and aggression. In addition, for the assessment of aggressive behaviours, we translated and modified the instruction of the Aggression-ES Scale (Borah et al., 2018), which was originally designed as an experience sampling tool, and used it as a self-report aggressive behaviour assessment instrument for the last 2 weeks, since there is no other self-report measurement tool for assessing recent aggressive behaviours in Turkish. Lastly, IES-COVID-19 (Vanaken et al., 2020) could be further developed by obtaining additional information on the traumatic stressors experienced by the participants, since a pandemic is a period of multiple stressors and potentially traumatizing situations, rather than a single incidence. For future studies, focusing on specific populations with an identified traumatic experience and understanding how it impacts at-risk populations, such as healthcare professionals or those who have been infected and/or hospitalized, could further enhance our understanding of the relationship between the variables.





Despite these limitations, to the best of our knowledge, these findings provide several contributions towards understanding the link between IU and aggressive behaviours during the COVID-19

pandemic, and confirm the importance of early psychological intervention, especially for those who are more likely to ruminate and suffer from traumatic stress symptoms, to avoid aggression and violence in the long run. Besides, in addition to health-related regulations, it is important to take the social and economic aspects of the crisis into account and to develop intervention strategies accordingly to improve the psychological well-being of individuals.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Data availability statement

The data described in this article are openly available in the Open Science Framework at <https://doi.org/10.17605/OSF.IO/TPA6U>.

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This article has earned the Center for Open Science badge for Open Data. The data are openly accessible at <https://doi.org/10.17605/OSF.IO/TPA6U>.

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