The Impact of Information About COVID-19 on the Endocrine Stress System and Cognitive Distortions

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ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic is one of the major health concerns worldwide affecting not only human physical health but also contributing to the development of many mental disorders including impairment of the cognitive function. It is highly conceivable that elevation of the stress hormones, i.e., glucocorticoids and catecholamines, due to the infection, as well as the presence of psychosocial stressors, such as COVID-19 information, play a critical role in the development of these disorders. In the present study, the potential impact of exposure to COVID-19 information on the cognitive distortion and stress levels was analyzed in a population of 32 first-year medical sciences students using the stress assessment questionnaire (SAQ) and the posttraumatic cognitions inventory (PTCI) surveys. Both surveys demonstrated no acute change in the stress and post-traumatic cognition levels between medical sciences students who were either exposed or not to information about COVID-19. Interestingly, analysis of the stress and cognition points across the first and second measurements of the SAQ categories revealed a significant change in the control group but not in the experimental group. In addition, there was no significant difference among groups when considering the time*group factor. To conclude, we found that exposure to information about COVID-19 did not contribute acutely to cognitive distortion and stress levels among participating students. The previous exposure to COVID-19-related information from media and living during the COVID-19 pandemic era might have enhanced the awareness of the students to the situation.

Introduction

Life across the globe has been dramatically altered by the coronavirus disease 2019 (COVID-19) pandemic, posing numerous mutual risks to public physical and mental health [1]. An adequate and balanced response to stress is detrimental to human health as excessive or chronic activation of the hypothalamus-pituitary-adrenal axis and the sympathoadrenal system, also known as the endocrine stress system, is associated with the pathogenesis of various human diseases and psychological disorders, including metabolic syndrome, anxiety, or post-traumatic stress disorder (PTSD) [2–5]. Recent studies have demonstrated that patients with severe COVID-19 have a pronounced elevation in the plasma stress hormones [6]. Interestingly, an elevation of adrenal glucocorticoids in the plasma might persist long after the initial infection with coro-

navirus, as shown in the case of survivors of the SARS-CoV-1 pandemic [7]. In addition to the actual coronavirus infection and treatment affecting the endocrine stress axis, psychological stress occurs due to pandemic restrictions and fear of infection, as has been observed particularly among health care workers [2, 8]. The complexity and low predictability of COVID-19 not only threaten the physical health of people but also affect their mental health, especially in terms of emotions and cognition [9]. There is an abundance of research demonstrating the deleterious effects of stress and anxiety on cognitive functioning [10–14]. Therefore, it is highly probable that the recent increases in stress and anxiety due to COVID-19 are likely to affect cognitive functioning [15] possibly through mechanisms involving mind wandering [10]. Particularly, because repeated exposure to social media/news relating to COVID-19 might be an important source of anxiety and stress symptoms [16]. Moreover, reports of infectious diseases often use risk-elevating information, which can amplify the perception of risk, stress, anxiety, and impaired functioning [17, 18].

While healthcare workers battle the coronavirus, social and behavioral science insights can help align human behavior with public health professionals' recommendations and promote pandemic preparedness [19]. These recommendations from health experts and the promotion of pandemic response were disseminated through the media [20–22]. Evans and Hargittai have highlighted that news media are influential and not only function as a source of information, but also shape public perceptions [23]. It has been supposed, in the early stages of the pandemic, that news media may function as a comfort, reducing uncertainty about COVID-19 and the consequences of the pandemic. Thus, it was easy to suppose also that the more people know about what is happening around them, the safer they may feel. However, during periods of uncertainty about what could occur in the future, for example, rising infections and deaths, lack of vaccine, losing jobs, evidence from the literature showed that increasing media exposure, on one hand, amplify risk perception [17, 24], and on the other hand, amplify population distress [16, 18, 25]. Since the first lockdown, which started in many countries worldwide in March 2020, the empirical evidence has highlighted that repeated exposure to social media/news relating to COVID-19 is acting as increase in anxiety and psychological distress [16, 26–28].

During the COVID-19 outbreak, media attention typically included a variety of stress-inducing elements, such as rumors, false representation, and fear messages, particularly image graphic pictures (e. g., diagnosed patients on ventilators), all of which put the public under a great deal of psychological stress [29]. Therefore, we assumed that being exposed to COVID-19-related information might induce cognitive distortion and enhance stress levels.

To our knowledge, only a few studies have been conducted on this issue worldwide and those that included the population of Kosovo, supported the relation between the COVID-19 pandemic and incidence of cognitive distortion (e. g., anxiety and depressive symptoms) among healthcare professionals [30] and students [31]. However, to the best of our knowledge, no study has investigated the effects of media/news exposure about COVID-19 on cognitive distortion and anxiety in Kosovo.

Subjects and Methods

Subjects

In total, thirty-two first-year female medical sciences students (speech therapy and nursing) attending the Heimerer College in Prishtina, Kosovo were recruited to the study. The women were aged 18–21 years, of single marital status, and of Albanian nationality. None of them had ever given birth, had not been imprisoned, and had not been divorced.

General study design

This is a cross-sectional study based on data acquired from self-completed questionnaires assessing cognitive distortion and stress levels among students who were either exposed (experimental group) or not (control group) to specific interventions related to COVID-19.

Within a week after completing initial questionnaires on cognitive distortion and the level of stress, participants were randomly assigned to two parallel groups based on their birth months. The experimental group of 16 students was given a lecture by a clinical psychologist on the risk and consequences of COVID-19, whereas the control group did not receive any intervention. Both groups were required to re-complete the same questionnaires afterwards. The lecture consisted of global data obtained from WHO on the number of infected and deaths as a result of COVID-19 hitherto, on health consequences including the effects of COVID-19 on mental health as well as national statistics data obtained from the National Institute of Public Health of Kosovo (NIPH) regarding the spread curve of the virus during 2020 within the last months. The whole session lasted 50 minutes (20 min of lectures and 30 min of completing the questionnaires). The procedures of this study complied fully with the provisions of the Helsinki Declaration regarding research on human participants. All participants provided informed consent before enrolment. Participation in the study was on a voluntary basis.

Questionnaire characteristics

Data were collected through a structured, anonymous, self-directed questionnaire, including socio-demographic characteristics (age, marital status, and living setting), and past exposure to different traumas. The Stress Assessment Questionnaire (SAQ) [32], and the Post Traumatic Cognitions Inventory (PTCI) were used to assess the stress level and the posttraumatic cognitions [33].

SAQ is a 7-item self-report measure for stress. SAQ is a subscale from the Depression Anxiety Stress Scales (DASS). The stress scale is sensitive to levels of chronic nonspecific arousal. It assesses difficulty in relaxing, nervous arousal, being easily upset/agitated, irritable/over-reactive, and impatient. Each item is scored on a 4-point Likert scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Total scores are calculated by summing the items and giving a score range of 0–42 [32]. The DASS shows good convergent and discriminant validity, and high internal consistency and reliability with Cronbach's alpha, reported at 0.94 for Depression, 0.87 for Anxiety, and 0.91 for Stress [34].

The PTCI is a 36-item self-report measure with three subscales that assess cognitions (i. e., beliefs about self and others) that can form as a result of experiencing trauma. The measure consists of three subscales: negative cognitions about self (PTCI-Self, 21 items), negative cognitions about the world (PTCI-World, 7 items), and self-blame (PTCI-Blame, 5 items). Likert scale ranging from 1 (totally disagree) to 7 (totally agree). The PTCI-Self measured the extent to which individuals had a negative view of him/herself and symptoms and thoughts of helplessness and alienation. The PTCI-World measured the degree to which individuals lack trust in others and believe the world to be unsafe. The PTCI-Blame scale measured the extent to which individuals attribute the occurrence of the event to something he/she did or did not do. The three PTCI subscales and total score have demonstrated excellent internal consistency as follows: total score ($\alpha = 0.97$); Negative Cognitions About Self ($\alpha = 0.97$); Negative Cognitions About the World ($\alpha = 0.88$); Self Blame ($\alpha = 0.86$) as well as good test retest reliability ranging from 0.74–0.89. In addition, the PTCI has demonstrated excellent convergent validity and discriminant validity [33].

Statistical analyses

The Statistical Package for the Social Sciences software (SPSS version 21.0) was used for data analysis [35]. Frequencies (*n*) and percentages (%) were used to summarize categorical variables, and continuous variables are summarized with mean ± standard deviation (SD). The chi-square (χ^2) test and contingency tables were used to compare the frequency of categorical variables. The Student *t*-test (for two groups), and the repeated measures ANOVA test were used to analyze continuous variables. For all statistical tests, a p-value of < 0.05 was considered statistically significant.

Results

There was no statistically significant difference between the experimental group (n = 16) and the control group (n = 16) on mean age, living setting, witnessing a traumatic situation, suffering from a severe disease, and the loss of loved ones (p > 0.05) (► **Table 1**).

As shown in ► **Table 2**, there were no statistically significant differences in the mean points of the SAQ and the PTCI among groups (p > 0.05). The first and second measurements showed no change in the stress and cognition points of the participants (p > 0.05) (► **Table 3**). The chi-square test comparison of the first and second measurements of groups of the Stress Assessment Questionnaire (SAQ) categories showed no statistical difference between the experimental group and a statistically difference within the control group (► **Table 4**). Analyzed with repeated measures ANOVA test there was no statistically significant difference among groups when considering the time * group factor (F = 0.147, p = 0.704, η²p = 0.005).

Discussion

In the present study, we examined the impact of being exposed to information about COVID-19 on stress and cognitive distortions levels among medical sciences students using two questionnaires, the SAQ and the PTCI. Our results demonstrated that exposure to a lecture about COVID-19 and a 20-minute video about the dramatic events of the patients infected with SARS-CoV-2 did not significantly impact stress and cognitive distortion levels as shown by no significant changes in the mean points of the SAQ and the PTCI among participants of the study (p > 0.05). These findings are unexpected and contradictory according to the previous results, which have been found in the literature [16, 27, 28]. These studies showed that exposure to news and information about COVID-19 is a source of psychological distress [20, 36], especially when the content is negative [37], and when the news provides misinformation [21]. We would have expected a higher stress and anxiety level among the experimental group compared to the control group because of their exposure to media. Hence, being exposed to information about COVID-19 would have explained, to a certain part, an increase in their stress and anxiety. Moreover, these cognitive distortions would have been enhanced by tragic images they would have watched in the video and listened to during the lecture. However, no significant differences came out between the two groups of participants on the SAQ and PTCI measures. Thus, we supposed the impact of media exposure could be decreased according to the news-consuming process about COVID-19. Empirical evidence has found the impact of media on anxiety and psychological distress differs depending on how the information is consumed. The mode of information consumption can be either active or passive [38]. Interestingly, Ryerson [39] included a combination of items that assessed both the active and passive process of consuming media.

► **Table 1** Sociodemographic and stress related factors by groups.

	Experimental Group	Control Group	p
	n = 16	n = 16	
Age (years)	19.9 ± 0.8	20.4 ± 0.6	0.079
Living setting			
Rural	4 (12.5)	2 (6.3)	0.651
Urban	12 (37.5)	14 (43.8)	
Witnessing traumatic situations			
Yes	4 (12.5)	4 (12.5)	0.117
No	12 (37.5)	12 (37.5)	
Having Financial difficulties			
Yes	2 (6.3)	2 (6.3)	0.087
No	14 (43.8)	14 (43.8)	
Exposed to natural disaster			
Yes	1 (3.1)	2 (6.3)	0.382
No	15 (46.9)	14 (43.8)	
Have had an accident of injury			
Yes	3 (9.4)	4 (12.5)	0.732
No	13 (40.6)	12 (37.5)	
Being exposed to crime or abuse			
Yes	0 (0.0)	1 (3.1)	0.625
No	16 (50.0)	15 (46.9)	
Suffering from severe disease			
Yes	1 (3.1)	3 (9.4)	0.732

▶ **Table 2** The Stress Assessment Questionnaire (SAQ) and the posttraumatic cognitions inventory (PTCI) results for both groups a priori.

	Group	n	Mean	Std. Deviation	
SAQ total points	Experimental	16	18.37	7.7	t = 1.197, p = 0.241
	Control	16	15.12	7.66	
PTCI-Self	Experimental	16	2.95	0.79	t = 1.724, p = 0.095
	Control	16	2.42	0.93	
PTCI-World	Experimental	16	4.14	0.66	t = 1.938, p = 0.062
	Control	16	3.58	0.95	
PTCI-Blame	Experimental	16	2.71	0.96	t = 1.803, p = 0.081
	Control	16	2.06	1.07	
PCTI total points	Experimental	16	104.56	22.98	t = 1.933, p = 0.063
	Control	16	86.31	29.97	

▶ **Table 3** The comparison of the Stress Assessment Questionnaire (SAQ) and the posttraumatic cognitions inventory (PTCI) results by groups.

Group		Mean	Std. Deviation	t	p
Experimental	First measurement SAQ total points	18.37	7.7	0.859	0.404
	Second measurement SAQ total points	16.87	8.1		
	First measurement PTCI-Self	2.95	0.79	1.917	0.074
	Second measurement PTCI-Self	2.74	0.93		
	First measurement PTCI-World	4.14	0.66	1.647	0.12
	Second measurement PTCI-World	3.92	0.64		
	First measurement PTCI-Blame	2.71	0.96	−0.889	0.388
	Second measurement PTCI-Blame	2.87	0.93		
	First measurement PCTI total points	104.56	22.99	1.396	0.183
	Second measurement PCTI total points	99.31	26.82		
Control	First measurement SAQ total points	15.12	7.66	0.426	0.676
	Second measurement SAQ total points	14.5	8.02		
	First measurement PTCI-Self	2.42	0.93	−0.14	0.891
	Second measurement PTCI-Self	2.45	0.82		
	First measurement PTCI-World	3.58	0.95	0.739	0.471
	Second measurement PTCI-World	3.48	0.84		
	First measurement PTCI-Blame	2.06	1.07	−1.615	0.127
	Second measurement PTCI-Blame	2.46	0.94		
	First measurement PCTI total points	86.31	29.97	−0.346	0.734
	Second measurement PCTI total points	88.12	26.53		

In this study, Ryerson used only one of the three factors of Coronavirus Experiences Questionnaires [40]: The News factors where the scale includes three items that assess exposure to media about COVID-19 (i. e., "I watch a lot of news about COVID-19", "I purposefully try not to watch the news on COVID-19", and "I spend a huge percentage of my time finding updates online or on TV about COVID-19"). Ryerson found that psychological health was not related to active or passive media exposure. Moreover, Yang et al. [41] identified the lower frequency of passively being exposed to pandemic media as a characteristic that is associated with lower anxiety [42, 43].

Furthermore, the results did not show changes in stress and cognition points in participants across the first and the second measurement (means = 16.75–95.44 and 15.69–93.72 for SAQ and PTCI on the first and the second measurement, respectively). This result is in line with the interaction between time and group, which did not show significance. In accordance with previous research, these findings suppose that the impact of media exposure on anxiety and

► **Table 4** The chi-square test comparison of first and second evaluation by groups of the Stress Assessment Questionnaire (SAQ) based on categories.

Group	After	Normal n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	p
	Before					
Experimental	Normal	4 (25)	0 (0)	0 (0)	1 (6.3)	0.055
	Mild	0 (0)	1 (6.3)	0 (0)	0 (0)	
	Moderate	1 (6.3)	1 (6.3)	3 (18.8)	2 (12.5)	
	Severe	0 (0)	1 (6.3)	2 (12.5)	0 (0)	
Control	Normal	6 (37.5)	1 (6.3)	1 (6.3)	0 (0)	0.049
	Mild	1 (6.3)	3 (18.8)	0 (0)	0 (0)	
	Moderate	0 (0)	1 (6.3)	1 (6.3)	0 (0)	
	Severe	0 (0)	0 (0)	1 (6.3)	1 (6.3)	

cognitive distortion can be influenced by the sanitary context, specifically the fluctuations in COVID-19-related news [44]. Interestingly, Chisty et al. [45] found that people's perception of COVID-19 can be inconsistent with the fluctuating condition of the pandemic. Their findings highlighted that the information sought about any risk could amplify or reduce the level of perceived risk. Furthermore, previous studies that investigated the impact of media consumption during the COVID-19 pandemic collected their data during the first lockdown and the early post-lockdown period. Then, during this uncertain period, populations were not aware of future perspectives (e. g., vaccine elaboration) to face this pandemic. These uncertainties and the media exposure of COVID-19 have, in a way, shaped populations' risk perceptions. This risk perception did participate in the decline of mental health worldwide. In contrast, the present study assessed the impact of media exposure on mental health (i. e., stress and cognitive distortion) long after (in January 2021) these lockdown periods were over, and the peak of infection and death rates were high. Even if some measures stayed active (curfews, masks, social distance), we suppose that risk perception, psychological distress, and cognitive distortions should have been much lower during the experiment testing time. We suppose that this new return to some sort of freedom (in contrast with lockdowns), may contribute to a certain form of resilience in facing the stressors (i. e., stress, cognitive distortion, risk perception) associated with COVID-19.

Interestingly, when we assessed with the chi-square test, the results did not show a statistically significant difference in the participants' distribution within categories of stress levels before and after exposure to the COVID-19 stressful information (p > 0.05). This finding does not corroborate the previous evidence, which found that direct and indirect media exposure to COVID-19 has an impact on and increases the levels of mental health problems [46]. Regarding this result, it is possible that being exposed to media for months (i. e., from the first peak of the pandemic and the lockdown, the 12th of March 2020 in Kosovo and January 2021) made the partic-

ipants efficiently aware of the pandemic situation. We suppose this awareness about COVID-19 (e. g., how the virus can spread, and which behaviors should be adopted to avoid the spread: handwashing, opening the windows every N-hours, wearing masks, keeping distance from other people) provided participants the opportunity to adopt coping mechanisms, such as cognitive coping behaviors [46, 47]. This coping strategy highlighted that taking preventive actions and learning about COVID-19 can accurately decrease the levels of cognitive distortion and anxiety [46]. Thus, it is possible that participants were protected from an acute mood change by the use of coping mechanisms before being tested in our experimental condition.

Then, the chi-square results showed a slightly significant difference in the distribution of frequencies in the control group among categories of stress levels at the first and the second measurement. This finding showed the frequency of participants from the control group was higher in the normal stress category (37.5 % of participants) than in other categories of stress levels. In line with previous results in the present study, this finding confirms our explanations about the non-significant results in the experimental groups. Indeed, it is probable that the coping behaviors (e. g., emotional support from others, acceptance, positive reframing, and religious coping) [48], in the control group, may have already been implemented by this group, prior to the experiment. As it has been demonstrated in research on trauma and in post-disaster mental health, that negative psychological effects are not always present, and that traumatic events can occasionally lead to positive emotional states and growth [49]. Thus, it has been studied that through the constructs of resilience, post-traumatic growth (PTG) and, coping strategies, the human being has also a faculty to cope with horrific situations and to recover, more or less quickly, from trauma such as terrorism, natural disaster and even pandemics [50–53]. As a result, it is probable these strategies may have partially relieved stress and maintained active coping resources in our sample of participants during the pandemic period.

Conclusion

Since the outbreak of COVID-19, the literature has primarily focused on the negative impact of media exposure (i. e., stress level, anxiety, cognitive distortion, PTSD). However, depending on some parameters that we highlighted (e. g., passive/active mode consumption, fluctuations in COVID-19-related news) our results showed different outcomes from the media exposure to COVID-19 literature. These results can be aligned with research on resilience, coping methods, and post-traumatic growth that has shown a positive outcome from catastrophic tragedies and frightening experiences is entirely possible after being exposed to unpleasant events. As a result, the media's future work should balance more their information between current facts and psychological aids. This would be essential to better inform the population about psychological support that can help people to implement coping strategies quickly after certain psychological emergencies (e. g., follow-up of Ukrainian refugees' psychological state) in order to avoid, or at the very least, lessen the evolution, sometimes insidious, of cognitive distortion, anxiety, or even PTSD.

Author Statement

ML: Conceptualization, Software, Writing – Original Draft Preparation, Writing – Review & Editing; BT: Methodology, Software, Formal Analysis, Data Curation, Writing – Original Draft Preparation; AH: Validation, Writing – Original Draft Preparation, Supervision; NS: Validation, Writing – Original Draft Preparation, Writing – Review & Editing; RM: Investigation, Resources, Writing – Original Draft Preparation, Visualization, Project Administration; LP: Investigation, Resources, Writing – Original Draft Preparation. All authors have read and approved the final manuscript; PS: Validation, Writing – Original Draft Preparation, Writing – Review & Editing; CS: Validation, Writing – Original Draft Preparation, Writing – Review & Editing; AI: Investigation, Resources, Writing – Original Draft Preparation.

Ethics Approval and Consent to Participate

The studies involving human participants were reviewed and approved by the Heimerer College. The participants provided their written informed consent to participate in this study. The procedure of this study complied fully with the provision of the Helsinki Declaration regarding research on human participants

Human and Animals Rights

All the human procedures used were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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