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The Effect of COVID-19 Pandemic on Psychosomatic Complaints and Investigation of The Mediating Role of Intolerance to Uncertainty, Biological Rhythm Changes and Perceived COVID-19 Threat in this Relationship: A Web-Based Community Survey

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Abstract

Background: The aim of the present study was to determine the increase in psychosomatic complaints during the COVID-19 pandemic and to identify the factors associated with psychosomatic complaints.
Methods: Five-hundred and thirty-three participants were included in the study. The participants completed the following self-reported scales: Personal Information Form, Perceived COVID-19 Threat Form, Intolerance of Uncertainty Scale, Biological Rhythms Interview of Assessment in Neuropsychiatry and Patient Health Questionnaire-15 (PHQ-15). The data were gathered online. The participants filled PHQ-15 scale twice. In the one interrogation, they were asked to fill the scale according to the current time, and in the other interrogation, they were asked to retrospectively report their status before the COVID-19 outbreak started.
Results: The psychosomatic symptom levels of the participants increased (M = 9.08, SD = 5.98) after the COVID-19 outbreak compared to before. The first and second PHQ scores were both positively related to perceived COVID-19 threat, intolerance of uncertainty and biological rhythms. However, the correlation coefficients of the second PHQ scores (after the outbreak) were higher than the first. Perceived COVID-19 threat predicted intolerance of uncertainty, but did not predict biological rhythms. The relationship between perceived COVID-19 threat and the present PHQ score was partially mediated by intolerance of uncertainty. Also, the relationship between perceived COVID-19 threat and present PHQ score were partially mediated by both intolerance of uncertainty and biological rhythms.
Conclusion: Psychosomatic complaints were increased during the COVID-19 outbreak period, and the changes in perceived threat and biological rhythm, especially intolerance of uncertainty, were effective in this increase. Results of our study revealed the importance of including the patient's ability to tolerate uncertainty in therapeutic approaches during COVID-19 and similar pandemics. In addition, the importance of the attempt to protect the circadian rhythm in the quarantine process has been demonstrated once again in order to reduce mental influences of the COVID-19 outbreak.

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INTRODUCTION

Recent studies on the COVID-19 outbreak as well as studies performed in previous epidemic periods emphasize that large-scale infectious outbreaks have a wide spectrum of psychosocial effects. Among these psychosocial effects, symptoms such as the intense stress, irritability, anxiety, fear, complaints of depression and posttraumatic stress disorder are endemic [1-5]. Likewise, the psychophysiological field is expected to be affected. In an internet-based study conducted with 7000 patients in China after the COVID-19 outbreak, attention was drawn to sleep problems and insomnia [6]. However, to our knowledge, there are no published studies yet on psychosomatic symptoms [7, 8] that are severely related to stress and strain.

Biological, psychological and social factors are considered to play an essential role in the aetiology of psychosomatic symptoms and related disorders [9]. In particular, stressful life events and traumas seem to be closely related to various physical diseases with primarily somatic symptoms such as chronic pain, gastrointestinal (GI) disorders and headache [10, 11]. Psychosomatic complaints may develop after traumatic events. For example, high rates of somatic

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symptoms have been reported among civilians exposed to war [12, 13] and military veterans and emergency personnel [11, 14, 15].

After the development of the COVID-19 outbreak, the health of individuals and their loved ones has been threatened. In addition, the pandemic has generated severe economic uncertainties both globally and individually. Moreover, uncertainties regarding how long the process will continue and whether or not a vaccine would be found have been rife. In many psychiatric diseases such as generalized anxiety disorder, obsessive-compulsive disorder and depressive disorder, intolerance to uncertainty may play a role in the development and maintenance of the disease [16-19]. In panic disorder, patients experience uncertainty about when the attacks will occur, and the alarm about this uncertainty may be the trigger of a panic attack [20, 21]. In social anxiety disorder, anxiety and uncertainty about evaluation in the social environment exist [22]. Some researchers even suggest handling uncertainty intolerance via a transdiagnostic approach during the patients therapy [23-25]. To our knowledge, only one published study has evaluated the relationship between uncertainty and psychosomatic complaints. In this study, the psychosomatic symptoms and well-being of employed and unemployed people were examined and it was shown that future uncertainty and high psychosomatic symptom scores were more prevalent among unemployed people [26].

With the COVID – 19 epidemic, habits such as sleep, eating, daily activities (sports etc.) and social activities have been restricted due to changes in working conditions, and enforcement of quarantine or curfews. In addition, a decrease in sleep duration and efficiency reduces sleep quality and impairs daytime functionality [27]. It is reported that all these components can directly cause somatic complaints [27]. Similarly, there are studies suggesting a relationship between circadian rhythm and biological rhythm and psychosomatic complaints among university students [28, 29]. In this context, in the current study, we focused on sleep problems and also evaluated the biological rhythm with different dimensions (sleep, activities, social rhythm and eating pattern).

The current study was designed to determine the increase in psychosomatic complaints after the development of the COVID-19 pandemic and to identify the factors (intolerance to uncertainty, biological rhythm etc.) associated with psychosomatic complaints. The results of our research are substantial in emphasizing the importance of psychological factors in the evaluation of the patients who visit the hospital with symptom features in the psychosomatic spectrum after the pandemic and to direct the patients to the relevant branches for psychological support. In addition, the current study sheds light on the necessary psychological interventions in the identification of areas that are effective for rehabilitation after the pandemic. Prior to initiating the study, we hypothesized that i) there would be an increase in the frequency of psychosomatic symptoms following the COVID-19 outbreak, ii) psychosomatic symptoms would be related to biological rhythm, intolerance to ambiguity, and perceived COVID-19 threat from scores, and iii) the intolerance to uncertainty and biological rhythm parameters would have a mediator role in the relationship between perceived COVID-19 threat from scores and scores of psychosomatic symptoms.

METHODS

Participants

The study sample was composed of 533 adult participants. Three-hundred and four (57%) were female, and 229 (43%) were male (M_{age} = 34.98, *SD* = 10.04). The participants age ranged from 18 to 70 years. The criteria for recruitment included age of 18 years and above, voluntary participation, and answering all questions in the questionnaires provided. Thirty-eight participants stated that they have a psychiatric disease, and these participants were excluded from the sample. Before the study, all participants received an informed consent form stating the details about the research, and participants who consented to volunteer approved this form. All participants (or their guardians) provided their written informed consent. The study protocol was approved by the Turkish Ministry of Health, General Directorate of Health Services (Approval Date/ Number: 29.04.2020/ŞAKİR GICA-2020-04-29-T16_26_23). Moreover, the Research Institute's committee on human research also approved the study (IRB Date/Number: 08.05.2020/2020-2484).

MEASURES

Personal Information Form

A personal information form was created to obtain demographic information about the participants. The form included questions about age, gender and psychiatric diagnosis.

Perceived COVID-19 Threat Form

This form was developed by Kavaklı, Ak, Uğuz and Türkmen (30). The form has seven items and five point-Likert type scale ranging from never (score of 1) to always (score of 5). These authors stated that the form has a one-factor structure according to parallel analysis. This form aims to measure the participants' perceived COVID-19 threat levels; higher total points correspond to higher perceived threat from the COVID-19 pandemic. The form's Cronbach Alpha reliability score was calculated as .75 in the current study. The Turkish form of the scale is shown in Appendix 1.

Intolerance of Uncertainty Scale

The Intolerance of Uncertainty Scale was developed by Freeston, Rhéaume, Letarte, Dugas, & Ladouceur (1994), and was adapted to English by Buhr and Dugas (2002) [31, 32]. The same scale was adapted to Turkish by Sarı and

Dağ (2009) [33]. This scale has a four-factor structure, and its psychometric properties appreciate. The scale has 27 items and a five point-Likert type scale ranging from *not at all characteristic of me* (score of 1) to *entirely characteristic of me* (score of 5). Also, the scale provides a total intolerance of uncertainty score, and this overall score was used in the current study. Moreover, the scale's Cronbach Alpha reliability score was calculated as .95 in the current study.

Biological Rhythms Interview of Assessment in Neuropsychiatrt

This scale was developed by Giglio et al. (2009), and the adaptation study into Turkish was conducted by Aydemir et al. (2012) [34, 35]. This scale measures eating pattern, sleep, activities and social rhythm; in the current study, the total score obtained from the scale was used to evaluate general biological rhythms. The scale consists of 21 items and a four point-Likert type scoring ranging from *no difficulties* (score of 1) to *serious difficulties* (score of 4). According to the Turkish validity and reliability study, the psychometric properties of the scale were deemed to be suitable. The whole scale's Cronbach Alpha reliability score was calculated as .85 in the current study.

Patient Health Questionnaire-15

Patient Health Questionnaire was developed by Kroenke, Spitzer, and Williams (2002), and the adaptation study into Turkish was conducted by Yazıcı Güleç et al. (2012) [36, 37]. The scale has 15 items and a three point-Likert type scale ranging from *not bothered at all* (score of 0) to *bothered a lot* (score of 2). According to the Turkish validity and reliability study, the psychometric properties of the scale are suitable, and the scale's Cronbach Alpha reliability score was calculated as .87 in the current research.

Procedure

Approval was obtained from the Necmettin Erbakan University Faculty of Medicine Ethics Committee prior to the initiation of the study. The data was gathered online due to restrictions on face to face encounters with the participants because of the COVID-19 outbreak. All participants received an informed consent form stating the details about the study, and individuals to volunteered to participate approved this form. Then, a questionnaire booklet was created and prepared considering the order effect.

Statistical Analysis

A retrospective examination of the psychosomatic symptoms of the participants was conducted using the patient health questionnaire. The participants filled this scale twice in total in two consecutive sessions. In the first session, the patients retrospectively recalled their previous state prior to the COVID-19 outbreak while in the second session, the participants answered the form based on their current situation. Both sessions were completed in approximately 15 minutes. A correlation analysis was carried out to investigate the relationships between the variables analysed in this research. Mediation analysis was conducted to examine the mediating role of intolerance of uncertainty and biological rhythms in the relationship between perceived COVID-19 threat and the current patient health questionnaire score [38].

RESULTS

Descriptive Statistics

Descriptive statistics on the demographic data of the participants are given in Table 1.

Table 1. Descriptive data of the participants included in the study.

Demographic Variables		N	M	SD
Gender	Female	304 (57%)		
	Male	229 (43%)		
Age		533	34.98	10.04
Education	Primary school graduates	15 (2.8%)		
	Secondary school graduates	11 (2.1%)		
	High school graduates	104 (19.5%)		
	University graduates	286 (53.7%)		
	MSc or PhD	117 (22%)		
Marital Status	Single	165 (31%)		
	Married	353 (66.2%)		
	Widow	6 (1.1%)		
	Divorced	9 (1.7%)		
Income		533	5892.89	7914.97
Working Status	Working	343 (64.4%)		
	Not working	180 (33.8%)		
	Retired	10 (1.9%)		
Change in Working Conditions After COVID	Yes	395 (74.1%)		
	No	138 (25.9%)		
Psychiatric Diagnosis	Yes	38 (6.7%)		
	No	533 (93.3%)		

N = Number of participants, M = Mean, SD = Standard deviation

The Differences in PHQ Scores of the Participants

The differences in the participants PHQ scores obtained at the first and second session were examined retrospectively with a paired sample t-test (see also Table 2). The first and second patient health questionnaire scores of the participants were significantly different from each other ($t = -10.28$, $p<.001$). After the COVID-19 outbreak, the psychosomatic symptom levels of the participants were found to be increased ($M = 9.08$, $SD = 5.98$) compared

to before (M = 7.13, SD = 5.43). It can be concluded that the COVID-19 outbreak increased the psychosomatic complaints of the participants.

Table 2. Differences in patient health questionnaire before and after COVID-19 outbreak

Variables	N	M	SD	t	df	p
PHQ_1	533	7.13	5.43	-10.28	532	.001
PHQ_2	533	9.08	5.98			

PHQ_1: First patient health questionnaire score (before outbreak), PHQ_2: Second patient health questionnaire score (after outbreak), N: Number of participants, M: Mean, SD: Standard deviation, df: degree of freedom

Evaluation of Relationships Among the Variables Used in This Study

The relationship among variables were examined with Pearson correlation analyses. Perceived COVID-19 threat was positively associated with intolerance of uncertainty (r = .60, p<.001), biological rhythms (r = .29, p<.001), first (r = .20, p<.001), the second (r = .36, p<.001) PHQ scores, and PHQ index (r = .12, p<.01). The first and second PHQ scores (representing psychosomatic symptoms before and after the start of the COVID-19 outbreak, respectively) were both positively correlated to perceived COVID-19 threat, intolerance of uncertainty and biological rhythms. However, the correlation coefficients of second PHQ score were higher than the first PHQ score. Furthermore, the first PHQ score was negatively correlated with PHQ index, while the second PHQ score was positively correlated with the PHQ index (See also Table 3)

Table 3. The Relationship among variables used in this study

Variables	M	Sd	1	2	3	4	5	6
PC19T	19.26	5.27	-					
UNC	74.04	20.63	.60***	-				
BIO	47.56	10.43	.29***	.44***	-			
PHQ_1	7.13	5.43	.20***	.23***	.27***	-		
PHQ_2	9.08	5.98	.36***	.40***	.45***	.71***	-	
PHQ_IND	53.43	120.67	.12**	.13**	.13**	-.37***	.25***	-

PC19T: Perceived COVID-19 Threat, UNC: Intolerance of Uncertainty, BIO: Biological Rhythms, PHQ_1: First patient health questionnaire score (before outbreak), PHQ_2: Second patient health questionnaire score (after outbreak), PHQ_IND: Patient Health Questionnaire Index, *p<.05, **p<.01, ***p<.001

The Mediating Roles of Intolerance of Uncertainty and Biological Rhythms

The mediating model was tested with the help of process macro (Model 6 with 5000 bootstraps was used for mediation analysis). In total, three indirect effects were tested in this mediation model. Perceived COVID-19 threat predicted intolerance of uncertainty (t = 17.49, p<.001), but did not predict biological rhythms (t = .87, p>.05). Intolerance of uncertainty predicted biological rhythms (t = 8.52, p<.001). Biological rhythms predicted the present PHQ score (t = 7.97, p<.001). Intolerance of uncertainty also predicted the present PHQ score (t = 2.82, p<.01). Biological rhythms did not mediate the relationship between perceived COVID-19 threat and present PHQ score (β = .02, S.E. = .02, 95% CI [-.02, .05]). The relationship between perceived COVID-19 threat and present PHQ score were partially mediated by intolerance of uncertainty (β = .10, S.E. = .04, 95% CI [.02, .17]). Also, the relationship between perceived COVID-19 threat and present PHQ score were partially mediated by both intolerance of uncertainty and biological rhythms (β = .09, S.E. = .02, 95% CI [.06, .14]). Furthermore, the third mediation model (mediating roles of intolerance of uncertainty and biological rhythms together) was found to be stronger than the second mediation model (the mediating role of intolerance of uncertainty alone). This might mean that the perceived COVID-19 threat may not be influenced directly biological rhythms, but affect uncertainty; uncertainty in turn influences biological rhythms. Finally, the present PHQ score was affected by two mediator variables (See Table 4 and Figure 1).

Table 4. The mediating roles of intolerance of uncertainty and biological rhythms

Path	β	S.E.	95% Confidence Interval	
			Lower	Upper
Total Effect				
PC19T→PHQ_2	.41	.05	.32	.50
Direct Effect				
PC19T→PHQ_2	.21	.05	.10	.31
Indirect Effects				
PC19T→UNC→PHQ_2	.10	.04	.02	.17
PC19T→BIO→PHQ_2	.02	.02	-.02	.05
PC19T→UNC→BIO→PHQ_2	.09	.02	.06	.14

PC19T: Perceived COVID-19 Threat, UNC: Intolerance of Uncertainty, BIO: Biological Rhythms, PHQ_2: Second patient health questionnaire score (after outbreak)

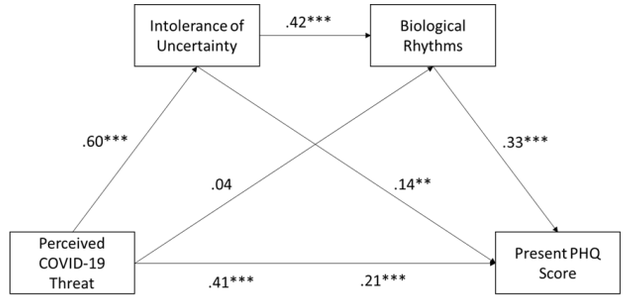

Figure 1. Path estimates

DISCUSSION

This study was designed to determine the extent of changes in psychosomatic complaints in the society before and after the COVID – 19 outbreak and to investigate

the psychological factors affecting these changes. Our findings show an increase in psychosomatic symptoms after the outbreak. Correlation analyses indicate that the level of the psychosomatic symptoms after the outbreak were more strongly correlated with perceived threat of COVID-19, intolerance to uncertainty and biological rhythm compared to the level of psychosomatic symptoms before the outbreak. In total, three different mediation analyses were tested. Intolerance of uncertainty was found to play a partial mediator role between the perceived COVID-19 threat and psychosomatic symptoms. Additionally, intolerance of uncertainty and biological rhythm were found to play a mediating role together, and analysis results showed that the mediating roles of these two variables alone were stronger than the mediating effect of intolerance to uncertainty. The mediation analysis suggests that the perceived threat of COVID-19 did not directly affect biological rhythm. However, it affected the intolerance to uncertainty; intolerance to uncertainty in turn affected the biological rhythm. It was also seen that deterioration in biological rhythm increased the psychosomatic symptoms of the respondents.

Psychosomatic disorders are diseases affecting the mind and body simultaneously. The mind and body have a single identity; therefore, an interaction between diseases of the body and mind is natural. The relationship between the mind and the body is reliant on the relationship between the central nervous system and the rest of the body, the relationship between the emotional, intellectual and physical organs and the relationship between the subconscious and unconscious field and the body [39].

Although many scientific studies have been performed in the fields of biology and psychology, the aetiology of psychosomatic symptoms has not been described yet. Nevertheless, when evaluated in general, psychiatric and psychosomatic states can be explained by molecular events such as genetics and epigenetic modifications, as well as childhood trauma and other challenging life events, aging, and non-adaptability to the existing situation [40]. After the COVID-19 outbreak, it appears that negative health-related conditions caused by the outbreak itself and the measures taken to slow the spread of the outbreak both resulted in lifestyle changes in the majority of the society. Adaptability to such rapid and massive changes has undoubtedly been a challenging process. In this context, an increase in stress levels of many individuals is expected during this challenging process. Although the term stress has very broad and different definitions, most of us use the term stress for both threatening and worrying situations [41]. The responses of the human body to stress can be classified in roughly three different categories; emotional, behavioural and physiological. The physiological response cycle developing after the stress can potentially explain the relationship between stress and somatic complaints and even diseases [41]. Stress usually causes activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, followed by many physiological changes, from hypertension to immune suppression and from tachycardia to insulin resistance [39]. Moreover, activation of the HPA axis is known to affect inflammatory processes in tissues, which can contribute to pain perception by affecting multiple levels throughout the pain transmission pathway, both in the peripheral tissues and in the central nervous system [42]. Thus, dysfunction in the HPA axis may play a role in the development of neuropathic pain [43]. Indeed, significant HPA axis abnormalities have been observed in many clinical chronic pain conditions, including fibromyalgia, low back pain, irritable bowel syndrome, and rheumatoid arthritis [44]. Similarly, the increase in the level of cortisol and corticotropin-releasing hormone (CRH), which is also observed after activation of the HPA axis, was reported to affect reproductive hormones levels. As a result, clinical symptoms such as anovulation or amenorrhea may occur [45-47].

Intolerance of uncertainty includes the belief that uncertain events are unfair, unacceptable and threatening [48]. These beliefs make people with intolerance of uncertainty prone to experience extreme and destructive anxiety and trigger permanent physiological arousal [49]. Similarly, in our study, it was found that the COVID-19 threat was perceived to affect intolerance of uncertainty and negatively affect biological rhythm through intolerance of ambiguity, and then increase somatic symptoms both directly and through biological rhythm. There are many studies showing that intolerance of uncertainty is associated with sleep disorders [50, 51]. In a study conducted on parents of adolescents and young adults with cancer, Panzawi et al. reported that therapeutic intervention in uncertainty and sleep problems may affect well-being [51]. The parents of young patients with cancer may be considered to be similar to the participants included in the current study in terms of combating many difficulties, health threats and uncertainty. The results of the current study revealed the importance of transfer of knowledge by administrators in order to reduce uncertainty. This would also enable individuals to tolerate uncertainty and should be applied in therapeutic approaches during COVID-19 and similar pandemic processes. In addition, the importance of trying to preserve the circadian rhythm during the quarantine process has been demonstrated once again in order to reduce detrimental effects on mental health. The importance of intolerance of uncertainty in the therapy of many diseases, especially depressive and generalized anxiety disorder have been emphasized in several studies [52-54]. Although the stress encountered may be the same, many factors are crucial to explain the differences in reactions of individuals. In order for people to perceive the stress factor wholesomely, uncertainties about the factor should be at a minimum level. In addition, a focus on the resources available may make it easier for individuals to tolerate uncertainty and cope with stress. The current study also posits that therapies focused on uncertainty and intolerance may be useful for other psychological effects, especially somatic complaints occurring during the COVID-19 outbreak.

One of the important results of the current study is that

somatic complaints are related to biological rhythms. The biological rhythm scale used in the current study evaluates sleep, nutrition, activity, and the holistic nature of social relationships. Previous studies have emphasized that the circadian cycle has a regulatory effect on systems such as the hypothalamic-pituitary-adrenal (HPA or HTPA) axis and the autonomic nervous system (ANS) [55], while malnutrition can negatively affect coping with stress after an increase in metabolism that occurs after the stress [55-56]. Thus, it is seen that both professional associations in psychiatry and international organizations offer suggestions for sustaining biological rhythm and social relations to cope with stress [57]. In this sense, our study supports the literature and the recommendations for protection of biological rhythm.

Data used in our study were obtained without any direct contact with the participants in the interest of maintaining social distancing during the pandemic. This is an inevitable limitation in terms of data reliability in the current study. Additionally, the validity and reliability studies of the various scales used in the current study were carried out on patient groups. Although we have calculated and reported the internal consistency of the scales in the context of the population examined in the current study, this may be considered as another limitation of our study.

In conclusion, the current study determined that psychosomatic complaints increased during the COVID-19 outbreak period, and the changes in perceived threat and biological rhythm, especially intolerance of uncertainty, were effective in this increase. Intolerance of uncertainty was effective both on biological rhythm changes and on direct effects on psychosomatic complaints. It also played a vital role as a mediating effect in the relationship between the perceived COVID-19 threat and psychosomatic complaints. Results of our study revealed the importance of studying the ability to tolerate uncertainty in the therapeutic approaches that are applied during COVID-19 and similar pandemic processes, and the role of transparent and detailed information sharing by the administrators in order to reduce uncertainty. In addition, the importance of protection of the circadian rhythm to minimize detrimental mental effects during the quarantine was once again demonstrated .

Statement of Ethics: Subjects (or their parents or guardians) have given their written informed consent. The study protocol has been approved by the research institute's committee on human research (IRB Date/Number: 08.05.2020/2020-2484)

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Appendix 1. Perceived COVID-19 Threat From

	Algılanan COVID-19 Tehdidi Formu	Kesinlikle katılmıyorum	Katılmıyorum	Ne katılıyorum Ne katılmıyorum	Katılıyorum	Kesinlikle katılıyorum
1	Virusun bana bulaşma ihtimalini sürekli düşünüyorum	1	2	3	4	5
2	Virüsün beni öldürme ihtimalini sürekli düşünüyorum	1	2	3	4	5
3	Virüsün ekonomik olarak iflas ettireceğini düşünüyorum	1	2	3	4	5
4	Virüsle ilgili sohbetler, haberler, sosyal medya bilgileri beni çok kaygılandırıyor	1	2	3	4	5
5	Virüsün biyolojik saldırı amacıyla üretildiğini düşünüyorum	1	2	3	4	5
6	Virüs salgınından sonra gün boyu mutsuzum	1	2	3	4	5
7	Virüs salgınından sonra umutsuzum	1	2	3	4	5