

Association between change in suicidal ideation, and distinct symptoms of depression and sleep changes during COVID-19

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COVID-19 has created a situation that has never been experienced before, challenging the mobilization of adaptive coping strategies. There has been a marked increase in suicides and suicidal ideation following the onset of COVID-19 likely reflecting the toll of the pandemic on mental health. The aim of our study to investigate the associations between depressive symptoms and distinct symptom clusters and lifestyle changes related to sleep, eating and physical activity and change in suicidal thoughts and thinking about death during the pandemic. Analyses involved data from the Hungarian part of the COMET-G (COVID-19 MEntal health inTernational for the General population) study, including 763 Hungarian adults, who completed a detailed questionnaire focusing on changes in behavior, lifestyle, activity and mental health during the pandemic. The dataset was analyzed using ordinal regression models adjusted for age and sex. Depression, as well as its symptom clusters, including anhedonia and depressed mood and somatic complaints had a significant, but small effect increasing suicidal ideation, while the effect of irritability and social relationship problems was more marked. In case of lifestyle factors no associations was found between change in eating habits or physical activity and change in suicidal ideations, however, sleep-related changes were associated with a significant increase in suicidal thoughts during the pandemic. Our findings show that not all symptoms related to mood disturbance have an equally marked effect on suicidal ideation and thus suicide risk, emphasizing the role of detailed screening and evaluation even in subclinical populations in times of such crises, and also highlight the importance of considering sleep problems when evaluating suicide risk. Thus, our findings help identify relevant targets for screening and intervention in decreasing suicide risk during crises.

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INTRODUCTION

The first appearance of the SARS-CoV-2 virus was soon followed by governmental restrictions worldwide, parallel to the announcement of a Public Health Emergency of International Concern on January 30, 2020 and the declaration of the Covid-19 Pandemic on March 11, 2020 (WHO, 2022). Naturally, the focus of society was first directed towards the medical and biological aspects of this fatal disease such as the consequences of infection and the formulation of vaccination. However, such global crises are also known to have long-term effects on public mental health, a drastic outcome of which is an increase in suicide attempts. This unfortunate association seems to emerge in relation to the Covid-19 Pandemic as well (Efstathiou et al., 2022). Importantly, a better understanding of risk factors that force individuals to eventually take their life may contribute to the prevention of this serious outcome.

Suicide is a multifactorial, complex human behavior with many aspects contributing to its prediction (Turecki et al., 2019). Undoubtedly, one of the most reliable risk factors of suicidality are psychological disorders, known to be determinant in approximately 90% of suicide attempts (Arsenault-Lapierre et al., 2004). Likewise, psychological symptoms are also the most common indicators of public mental health suggesting that both clinical and sub-clinical levels of mood and anxiety disorders as well as post-traumatic stress disorder have increased since the outbreak of the Covid-19 Pandemic (Cénat et al., 2021; Lakhan et al., 2020; Necho et al., 2021; Salari et al., 2020), highlighting the importance of prevention regarding both the above disorders and the consequently increased risk of suicidality.

Despite the strong association, suicidal behavior may occur without the presence of a psychological disorder (Cho et al., 2016) which directs attention to other potential risk factors. A tragic but well-known example of the link between environmental factors on suicide rates is the increase often seen in relation to economic crises (Dos Santos et al., 2016; Fountoulakis et al., 2014; Luo et al., 2011; Nandi et al., 2012; Oyesanya et al., 2015). Relatedly, a number of psychosocial factors have been identified as potential risk factors of either suicidal ideation or attempts or both, some of which are: socioeconomic status, unemployment and recent job loss, age, sex or social isolation (Batty et al., 2018; Fitzpatrick et al., 2020; Large, 2022; Milner et al., 2013; Näher et al., 2020). Besides these more-or-less stable social

factors, the relevance of major life events especially those occurring within the past 12 months are also associated with different forms of suicidal behavior and the link strengthening with severity, ideation being less strongly associated than death by suicide (Liu & Miller, 2014).

While the individual loss people had to bear since the beginning of this global crisis may differ, social isolation and the significant decrease of living space, home offices and home schooling, unemployment and an anticipated economic crisis all increased the possibility of stressful life events and changes in one's social status. Such changes can be expected to impact the lifestyle and daily rhythm of people during the Covid-19 Pandemic (Salehinejad et al., 2022), which increases the likelihood of the emergence of psychological symptoms, while it may also affect suicidal behavior through evoking a misalignment in one's circadian rhythm (Geoffroy & Palagini, 2021). Comprehending the above, insomnia, a delay in sleep and decrease in daily activity have been linked to an increased suicidal ideation (Rumble et al., 2020).

Together the above findings suggest that there is a high risk of a pandemic-related increase in suicidal behavior through the emergence of a number of direct and indirect risk factors. However, suicidal behavior is a complex psychological phenomenon, varying forms of which may be vulnerable to specific risk factors to a different degree (Liu & Miller, 2014). Additionally, while potential risk factors seem to be generalizable between nations, cultural differences may modulate the relevance each factor as well as the prevalence of the different aspect of suicidal behavior (Eskin et al., 2011; McKinnon et al., 2016; Perez-Rodriguez et al., 2008).

In this present study our goal was to investigate suicidal ideation in relation to some potential risk factors in a Hungarian sample during the first lock-down of the Covid-19 Pandemic. Specifically, we focused on depressive symptoms and lifestyle-related changes associated with a disturbance in one's circadian rhythm.

SUBJECTS AND METHODS

Methods

The present analysis included data from the Hungarian leg of the COMET-G (COVID-19 MEntal health inTernational for the General population) study. The COMET-G is an international study with the participation of 42 countries, which examines

the associations between the COVID-19 virus and related lockdown restrictions and mental health. Data were collected online and anonymously using snowball method between April 2020-March 2021. The Hungarian part of the study was approved by the Regional, Institutional, Scientific and Research Ethics Committee of Semmelweis University, and involved 763 Hungarian adults. The participants completed a detailed questionnaire assessing changes in several parameters during the pandemic including physical activity (importance and activity affected by pandemic), sleeping (staying up late and sleeping during the day, need for sleeping pills, disturbing dreams) and eating habits (eating in a healthier way, change in body weight); CES-D (Center for Epidemiologic Studies Depression Scale) to measure depression including its three symptom clusters, and change in suicidal thoughts.

Participants

763 participants were enrolled in the Hungarian population, including 617 women with an average age of 41.98 (range 18-80 years). Inclusion criteria merely encompassed willing to participate and capacity to complete the online questionnaire while exclusion criteria included acute psychotic state, intellectual disability and being under the influence of alcohol or other psychotropic substances. Participation was voluntary and no compensation or reward of any sort followed. The sample was collected via social media platforms using snowball method. Before completing the online questionnaire, all participants received an informed consent, thus ensuring anonymity and confidentiality of the data.

Procedure

Data were collected online and anonymously between April 2020-March 2021, during the first lockdown of the COVID-19 pandemic, specifically focusing on the association between depressive symptoms, lifestyle related changes specific to disturbances in one's circadian rhythm.

MEASURES

The depressive symptoms were measured by the Hungarian version of the Center for Epidemiological Studies Depression Scale (CES-D), including its three symptom clusters, such as anhedonia/lack of positive affects (CES-D PA) (items: 3, 4, 8, 12, 14, 16),

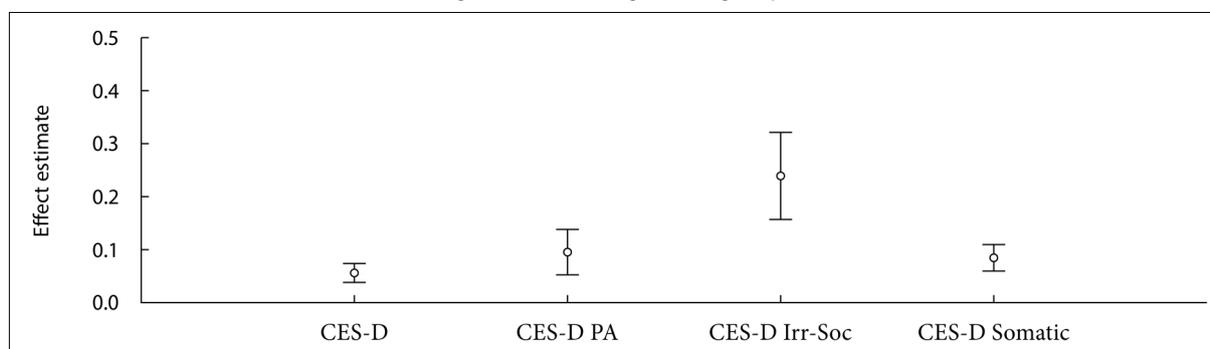
irritability and problems with social relationships (CES-D Irr-Soc) (items: 1, 11, 15, 19) and depressive mood and somatic complaints (CES-D Dep-Som) (items: 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 17, 18, 20) (Fountoulakis et al., 2001). The questionnaire consists of 20 items, each scored on a Likert-scale from 0-3 (including reverse items).

A detailed questionnaire measured the status and changes of mental health-relevant lifestyle factors specifically focusing on the period of the pandemic that were scored on a 5 item Likert-scale. Questions regarding change in eating habits included "Please mark the answer that best represents you during the period of the lockdown: 1=I eat in a healthier way; 0=My eating habits and preferences have not changed; -1=I eat in a more unhealthy way" (DIET1), "Please mark the answer that best represents you during the period of the lockdown: -2=My body weight has significantly decreased (more than 2-3 kilos); -1=My body weight has slightly decreased (less than 2 kilos lost); 0=My body weight is stable; 1=My body weight has slightly increased (less than 2 kilos put); 2=My body weight has significantly increased (more than 2-3 kilos)" (DIET2). Questions assessing physical activity and its changes during the pandemic included "Do you consider that exercise is important during this pandemic?" (SPORT1) and "How much has your physical activity been affected by this epidemic of COVID-19?" (SPORT2). Questions focusing on changes in quality and quantity of sleep during the pandemic included "The quality of my sleep has changed recently" (SLEEP1), "I tend to stay up late and sleep for many hours during the day" (SLEEP2), "I take sleeping pills to help me sleep at night" (SLEEP3), and "I am having dreams in which I feel trapped, over the last 3 weeks" (SLEEP4).

The question regarding change in suicidal ideation during the pandemic was "How much has your tendency to think about death and/or suicide changed, compared to before the outbreak of COVID-19?", scored on a 5 item Likert-scale (-2= Very much decreased, -1 = Decreased a bit, 0 = Neither increased, nor decreased, 1 = Increased a bit, 2 = Very much increased).

Statistical analysis

As the outcome variable was ordinal, the dataset was analyzed using ordinal regression models. The assumption of proportional odds for ordinal regression models was tested using Brant tests, and was occasionally violated, but results were

Figure 1. Associations between depression and its symptom clusters (as measured by CES-D) and changes in suicidal thoughts during the pandemic

Note: CES-D: Center for Epidemiologic Studies Depression Scale; CES-D Dep-Som: depressive affect and somatic complaints; CES-D PA: lack of positive affects; CES-D Irr-Soc: irritability and problems with social relationships

Table 1. Associations between overall CES-D score, and its three individual depressive symptom clusters and change in suicidal ideation and thinking of death during the first two waves of the pandemic

	Beta	Std. Err.	p	95% CI	
<i>Change in suicidal thoughts during the pandemic</i>					
CES-D overall	0.06	0.009	<0.001	0.004	0.07
Lack of positive affects (CES-D PA)	0.09	0.02	<0.001	0.05	0.13
Irritability and problems with social relationships (CES-D Irr-Soc)	0.24	0.04	<0.001	0.16	0.32
Depressive mood and somatic complaints (CES-D Dep-Som)	0.08	0.01	<0.001	0.06	0.11

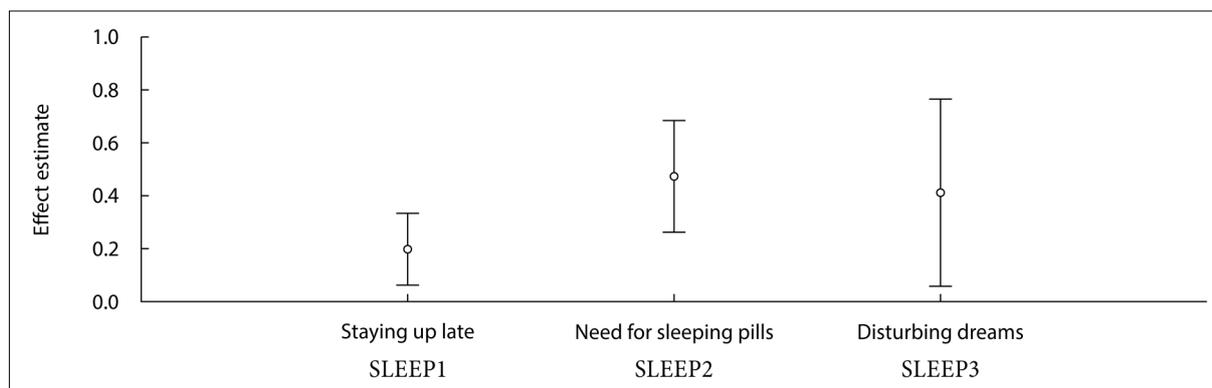
interpreted regardless, with the intention to provide an approximation to the average odds ratio instead of separate estimations for all levels of the dependent variables. All analyses were carried out using the R software (version R-4.1.1) and Rstudio (version 2021.9.0.351).

RESULTS

Associations between depression and its different symptom clusters and change in suicidal ideations and thinking of death during the pandemic

Depression as measured by CES-D score ($\beta=0.06$, $p<0.001$, $95\%CI=0.04-0.07$), and its three symptom clusters (lack of positive affects/anhedonia: $\beta=0.09$, $p<0.001$, $95\%CI=0.05-0.13$; irritability and social relationship problems: $\beta=0.24$, $p<0.001$, $95\%CI=0.16-0.32$; depressive mood and somatic complaints: $\beta=0.08$, $p<0.001$, $95\%CI=0.06-0.11$) showed a significant association with increased suicidal ideation, with small effects observable for CES-D total score, lack of positive affects/anhedonia, and depressed mood and somatic complaints, and a more robust effect for irritability and social relationship problems (Figure 1, Table 1).

Figure 2. Associations between sleep-related factors and changes in suicidal thoughts during the pandemic



Note: SLEEP1: "I tend to stay up late and sleep for many hours during the day" 0=Almost never, 1=Rarely, 2=Sometimes, 3=Often, 4=Almost always; SLEEP2: "I take sleeping pills to help me sleep at night" 0=Almost never, 1=Rarely, 2=Sometimes, 3=Often, 4=Almost always; SLEEP3: "I am having dreams in which I feel trapped, over the last 3 weeks" 0=Almost never, 1=Rarely, 2=Sometimes, 3=Often, 4=Almost always

Table 2. Associations between changes in sleep cycle and change in suicidal ideations and thinking of death during the pandemic

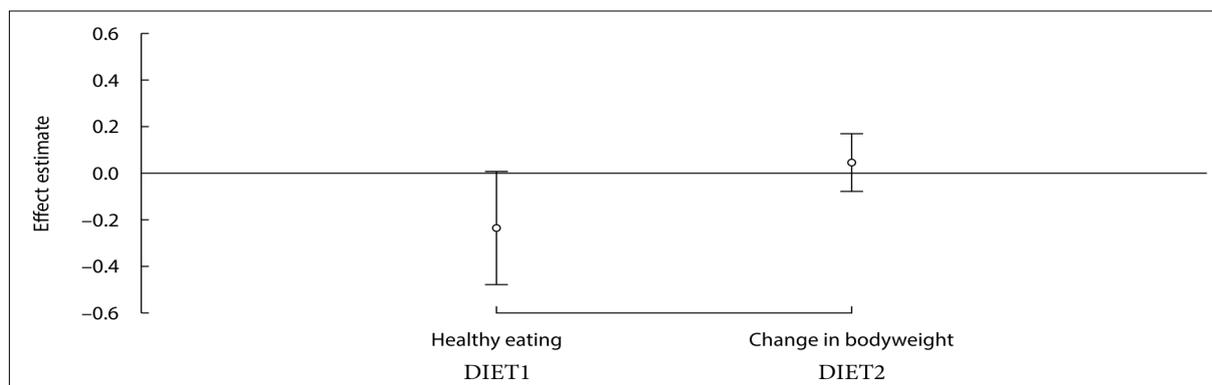
	Beta	Std. Err.	p	95% CI	
Sleep-related questions					
SLEEP1	0.19	0.06	<0.01	0.05	0.33
I tend to stay up late and sleep for many hours during the day 0=Almost never 1=Rarely 2=Sometimes 3=Often 4=Almost always					
SLEEP2	0.46	0.11	<0.01	0.26	0.63
I take sleeping pills to help me sleep at night 0=Almost never 1=Rarely 2=Sometimes 3=Often 4=Almost always					
SLEEP3	0.41	0.18	<0.05	0.05	0.7
I am having dreams in which I feel trapped, over the last 3 weeks 0=Almost never 1=Rarely 2=Sometimes 3=Often 4=Almost always					

Associations between changes in the quality of sleep during the COVID-19 pandemic and change in suicidal ideations and thinking of death during the pandemic

All variables assessing the quality and changes in sleep during the pandemic showed a significant association with the change in suicidal thoughts

during the pandemic. Specifically, disruption of circadian rhythm and sleep cycle had a significant but small effect on suicidal ideation (SLEEP1) ($\beta=0.19$, $p<0.01$, $95\%CI=0.05-0.33$), while the effect of need for sleeping pills reflecting insomnia (SLEEP2) ($\beta=0.46$, $p<0.01$, $95\%CI=0.26-0.63$) and disturbing dreams reflecting sleep problems (SLEEP3) ($\beta=0.41$, $p<0.005$, $95\%CI=0.05-0.7$) were more marked. (Table 2, Figure 2).

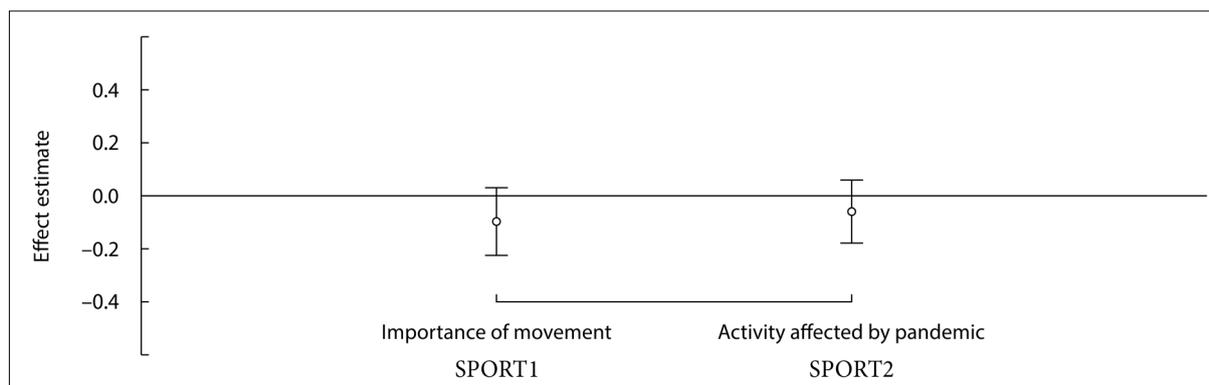
Figure 3. Associations between changes in eating habits and change in suicidal thoughts during the pandemic



Note: DIET1: "Please mark the answer that best represents you during the period of the lockdown: 1=I eat in a healthier way; 0=My eating habits and preferences have not changed; -1=I eat in a more unhealthy way"; DIET2: "Please mark the answer that best represents you during the period of the lockdown: -2=My body weight has significantly decreased (more than 2-3 kilos); -1=My body weight has slightly decreased (less than 2 kilos lost); 0=My body weight is stable; 1=My body weight has slightly increased (less than 2 kilos put); 2=My body weight has significantly increased (more than 2-3 kilos)"

Table 3. Associations between changes in eating habits, and changes in physical activity and change in suicidal ideations and thinking of death during the pandemic

	Beta	Std. Err.	p	95% CI	
Eating habits related questions					
DIET1	-0.22	0.12	0.06	-0.46	0.02
Please mark the answer that best represents you during the period of the lockdown 1=I eat in a healthier way 0=My eating habits and preferences have not changed -1=I eat in a more unhealthy way					
DIET2	0.04	0.06	0.43	-0.07	0.17
Please mark the answer that best represents you during the period of the lockdown -2=My body weight has significantly decreased (more than 2-3 kilos) -1=My body weight has slightly decreased (less than 2 kilos lost) 0=My body weight is stable 1=My body weight has slightly increased (less than 2 kilos put) 2=My body weight has significantly increased (more than 2-3 kilos)					
Sport habits related questions					
SPORT1	-0.09	0.06	0.15	-0.22	0.03
"Do you consider that exercise is important during this pandemic?" 0=Not at all 1=A little bit 2=Moderately 3=Much 4=Very much					
SPORT2	-0.05	0.06	0.37	-0.17	0.06
How much has your physical activity been affected by this epidemic of COVID-19? -2=It decreased much -1=It decreased a little 0=Neither decreased nor increased 1=It increased a little 2=It increased much					

Figure 4. Associations between changes in physical activity and change in suicidal thoughts during the pandemic

Note: SPORT1: "Do you consider that exercise is important during this pandemic?" 0=Not at all, 1=A little bit, 2=Moderately, 3=Much, 4=Very much; SPORT2: "How much has your physical activity been affected by this epidemic of COVID-19?" -2=It decreased much, -1=It decreased a little, 0=Neither decreased nor increased, 1=It increased a little, 2=It increased much

Associations between change in eating habits during the COVID-19 pandemic and change in suicidal ideation and thinking of death during the pandemic

No significant association was found between change in eating habits and change in suicidal thoughts during the pandemic (eating healthier: $\beta=-0.22$, $p=0.06$, 95%CI=-0.46-0.02; change in body weight: $\beta=0.04$, $p=0.43$, 95%CI=-0.07-0.17) (Figure 3, Table 3).

Associations between change in physical activity during the COVID-19 pandemic and change in suicidal ideations and thinking of death during the pandemic

No association was found between any variables assessing quality and changes in physical activity and the change in suicidal ideations and thinking of death during the pandemic (importance of doing sports during the pandemic: $\beta=-0.09$, $p=0.15$, 95%CI=-0.22-0.03; activity affected by pandemic: $\beta=-0.05$, $p=0.37$, 95%CI=-0.17-0.06) (Figure 4, Table 3).

DISCUSSION

There has been a marked increase in suicides (Pathirathna et al., 2022) following the onset of COVID-19 as the pandemic and the implemented measures took a severe toll on mental health, either directly or via the mediation of various factors

including economic difficulties, isolation, or severe lifestyle changes. Understanding such mediating factors is essential for prevention and intervention.

The aim of our study was to investigate predictors of changes in suicidal ideation during the pandemic, including the effect of different symptom clusters of depression and lifestyle-related changes also impacting the circadian rhythm such as physical activity, sleeping and eating.

In line with evidence suggesting psychological disorders to be important risk factors of suicidal behavior (Arsenault-Lapierre et al., 2004), our data suggests that even subclinical levels of psychological symptoms (i.e. symptoms of depression) seem to be important indicators of potentially increased suicidal risk during the pandemic. Furthermore, the relevance of different aspects of depressive symptoms in the prediction of suicidal behavior may be different, irritability and problems with social relationships being the most pronounced risk factor, preceding anhedonia/lack of positive affects as well as depressive mood and somatic complaints. This draws attention to the importance of understanding the etiological pathways of such distinct depressive symptomatology, with their own contributors, in the emergence of suicidal ideation, and also to the importance of their detailed and separate screening especially in case of subclinical symptoms which may escape attention.

Besides distinct depressive symptom clusters, we also investigated association between suicidal thoughts and changes in different circadian-rhythm related factors during the pandemic such as sleep,

eating, and physical activity. All variables assessing sleep related habits, consistently suggesting a pandemic-related disturbance of the sleep cycle showed a significant association with changes in suicidal ideation. The most pronounced association was found between the need of taking sleeping pills, followed by the presence of disturbing dreams while a still significant but less marked association can be reported between quality of sleep and the increase of suicidal thoughts. Sleep disturbance in general is a known risk factor of suicidal ideation (Bernert et al., 2015; Bernert et al., 2014) independently of public crises or the pandemic, however, understanding the pathways of how such situations increase risk of sleep problems and thus identifying intervention targets to mitigate such effects may provide a tool to reduce the pandemic-related rise in suicidality.

No association was found between diet-specific variables and suicidal ideation. Notably, our questions were focused on the changes in quality of diet and body weight during the pandemic, the latter allowing conclusions about diet-related changes but not measuring eating behavior per se. Future research focusing on factors related to the timing of food consumption may contribute to a better understanding of the mediating role of eating habits in the prevalence of suicidal behavior. Similarly, no association was found between sport-related habits and suicidal behavior. Specifically, considering exercise to be important during the pandemic and an overall increase or decrease in physical activity as a consequence of the pandemic was not associated to suicidal ideation. Thus our results suggest that eating and physical activity do not offer straightforward options for identifying targets for preventing increased risk of suicide.

In summary, our results provide some important novel aspects for our understanding of contributors of increased suicidal ideation during the pandemic. Most importantly, we found that some subclinical symptom clusters of depression are more robust predictors than other depressive symptoms highlighting the importance of a detailed screening of symptoms. Furthermore, we found that while changes in eating or physical activity related factors during the pandemic were not associated with changes in suicidal ideation, there was a distinct pattern of association between changes in several aspects of sleep quality and suicidal thinking, which may not only support the importance of maintaining a healthy sleep hygiene during similar crises, but also suggest important targets for suicide prevention. As crises are increasingly becoming more

prevalent in our contemporary world, strategies and targets for maintaining mental health at a public health level will also be increasingly important and valuable to preserve well-being in the face of adversity.

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A szuicid ideáció és depressziós tünetcsoportok valamint az alvás változásának összefüggése a COVID-19 pandémia során

A COVID-19 világvjárvány korábban soha nem tapasztalt kihívások elé állította a társadalmat, így a járvány első hullámában az adaptív megküzdési stratégiák mozgósítása jelentős akadályokba ütközött. A COVID-19 pandémia indulását követően az öngyilkosságok és a szuicid gondolatok gyakoriságának növekedése volt megfigyelhető, a vírus okozta krízishelyzet és az alkalmazott intézkedések mentális egészségre gyakorolt hatásának következtében. Jelen vizsgálatunk célja a depressziós tünetek, a cirkadián ritmussal összefüggő életmód-változók járvány alatti változása és a szuicid gondolatokban bekövetkező változás közötti összefüggések vizsgálata volt. Az adatgyűjtés online történt, kutatásunkhoz a 42 országban zajló COMET-G (COVID-19 MEntal health inTernational for the General population) vizsgálat magyar mintáját használtuk, mely 763 felnőtt adatait tartalmazza. A statisztikai elemzéseket ordinális regressziós modellekkel végeztük, korra és nemre korrigálva. A depresszió, valamint annak tünetklaszterei, az anhedónia, a depresszív hangulat és szomatikus panaszok szignifikánsan, de csekély mértékben növelték az öngyilkossági gondolatok számát, míg az ingerlékenység és a társas kapcsolati problémák hatása markánsabb volt. Az életmódbeli tényezők esetében nem találtunk összefüggést az étkezési szokásokban és a fizikai aktivitásban bekövetkező változások, illetve az öngyilkossági gondolatok változása között, azonban az alvással összefüggő változások az öngyilkossági gondolatok számottevő növekedésével jártak együtt a járvány idején. Eredményeink rámutatnak, hogy az egyes depressziós tünetek eltérő mértékben befolyásolják a szuicid gondolatokat és rizikót, hangsúlyozva ezzel az alapos és részletes vizsgálat és szűrés fontosságát a hasonló krízisek idején, emellett kiemelik az alvászavarok vizsgálatának fontosságát is a szuicid kockázat felmérésekor. Eredményeink segíthetnek klinikailag releváns célpontok azonosításában az öngyilkossági kockázat szűréséhez és a megfelelő beavatkozásokhoz a kockázat csökkentése érdekében.

Kulcsszavak: COVID-19, szuicid ideáció, depresszió, életmód, cirkadián ritmus, étkezési szokások, fizikai aktivitás, alvás