

# How Has the COVID-19 Pandemic Changed BMI Status and Physical Activity – Its Associations with Mental Health Conditions, Suicidality: An Exploratory Study

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**Background:** The COVID-19 pandemic has psycho-socially impacted people of all age groups. The consequences related to this crisis may increase the suicide mortality rate as reported in prior pandemics. Although many studies have been conducted identifying suicidal behavior attributing factors, there is a lack of knowledge on the associations of body mass index (BMI) and physical activities, their changes, and suicidal behavior, which were explored herein for the first time.

**Methods:** An online-based, cross-sectional study was carried out with a total of 324 Bangladeshi people (mean age = 26.99 ± 8.17 years). The measures included questions on socio-demographics, health-related variables, physical activities-related variables, and mental health problems (eg, depression, anxiety and suicidal behavior).

**Results:** About 41.0% and 29.3% of the participants reported being depressed and anxious, respectively, whereas suicidal behavior after the pandemic's inception was found to be 6.5%. Although the role of BMI status either prior to or during the pandemic in mental health conditions was not statistically significant, the changes of BMI status were (that is, those with decreasing BMI status compared to no change in BMI status were at greater risk of depression and anxiety, which was followed by increasing BMI status). Besides having no outside space for exercise and performing more physical activities prior to the pandemic were reported to increase anxiety levels, but no significant associations between changes in physical exercise frequency and other mental health problems were observed.

**Conclusion:** In summary, the present findings showed that people with either decreased or increased BMI status after the inception of the pandemic were at greater risk of mental instabilities, which is a concern which should be considered when adopting any preventive approaches.

**Keywords:** anxiety, body mass index, COVID-19, depression, pandemic and mental health, physical activities, psychological impact, suicidal behavior, suicide in Bangladesh

## Introduction

The ongoing COVID-19 pandemic has already disrupted people's quality of life.<sup>1-4</sup> The outbreak originated from Wuhan, China, one year ago; still, it is not controlled. As all of the countries were attacked by the virus, people were at higher risk of being infected except those following preventive measures.<sup>5</sup> In this regard, the Government of Bangladesh, and likely other countries, imposed lockdown and

suggested necessary preventive measures to mitigate social interaction to suppress the disease transmission.<sup>6</sup> But, the expeditiously spreading and highly deadly nature of the virus has significantly impacted people's mental health due to social isolation, fear of an epidemic, financial strain, uncertainty about the future etc., as consequences of lockdown related confinement.<sup>7,8</sup> Studies conducted across the world suggest increased mental health effects such as depression, anxiety, mood disturbances, post-traumatic stress, sleep problems, paranoia, low self-esteem, loss of self-control, and so forth in both people infected with the virus or not.<sup>7-9</sup> Besides, other outbreak-related psychosocial effects, including fear of death, solitude or loneliness, boredom, distress, social alienation or contagion, also contribute to long-term psychiatric suffering as well as thoughts of suicide.<sup>7</sup> During and after prior outbreaks, suicidality rates unexpectedly increased; for instance, Cheung et al<sup>10</sup> observed elderly suicide mortality increment in Hong Kong as an effect of the 2003 SARS pandemic. In the COVID-19 pandemic context, a similar assertion has already been established.<sup>11-14</sup>

Several studies based on media reports rapidly assessed the nature and reasons of suicide related to COVID-19. For example, Dsouza et al<sup>5</sup> and Mamun et al<sup>15</sup> investigated the suicide case of Indian people in general and celebrities, respectively; in the same manner, Bangladeshi,<sup>16,17</sup> Pakistani,<sup>18</sup> even global<sup>19,20</sup> suicide cases were assessed. But, limited studies investigating suicidal behavior related to COVID-19 have been conducted throughout the world. For instance, 17.5% and 4.9% suicidal ideation and attempted suicide rates, respectively, were reported in the US based on a survey conducted within the first week of April 2020,<sup>21</sup> whereas another US study conducted in June 24-30, 2020, claimed that 10.7% of the participants seriously considered thinking for suicide in the past 30 days.<sup>22</sup> Similarly, 18% and 5% of the UK participants reported experiencing suicide (or self-harm) thoughts and attempts, respectively, within the first month of lockdown.<sup>23</sup> About 7.6% of Colombian people had high suicide risk (assessing the four items CES-D-IS (9/12 cut-off point)).<sup>24</sup> However, two Bangladeshi studies assessing suicidal behavior reported the prevalence rate as 5% to 6.1%,<sup>25,26</sup> to the best of our knowledge.<sup>25,26</sup>

The risk factors and/or reasons of COVID-19-related suicidal behaviors were also investigated. For instance, high perceived stress related to COVID-19, risk of depressive episode, and insomnia were reported as risk factors of higher suicide risk in Columbia;<sup>24</sup> similar findings were

reported by Killgore et al.<sup>27</sup> Whereas female gender, Black, Asian and minority ethnic groups, economic disadvantage, unemployment, disability, chronic physical illnesses, psychiatric disorders and being COVID-19 positive were the risk factors.<sup>23</sup> In Bangladesh, being female, young, divorced, having no children, cigarette smoker, and having comorbid diseases, higher fear related to COVID-19, and insomnia were observed as risk predictors for suicidality.<sup>25,26</sup>

Evidence suggests a positive relationship between BMI increment and psychiatric conditions such as depression, anxiety, mania, panic attacks, social phobia, suicidal ideation etc.<sup>28</sup> Similarly, during the COVID-19 pandemic-related lockdown, people were confined which leads to performing less physical activities, which has been reported to increase their psychological burden.<sup>29-32</sup> Moderate to regular frequency physical exercises result in immune-modulatory effects, which instigate multi-step processes in the organ system to boost up the immune system and provide an anti-inflammatory response. Thus, less physical activities resulted because of long-term confinement related to the COVID-19 pandemic, worsening mood profiles and increasing psychological impact.<sup>33</sup> Vice-versa COVID-19 related mental health problems also negatively impact behavioral intention of performing regular physical activities.<sup>34</sup> More specifically, individuals with a higher BMI had increased perceived burdensomeness, which is the pathway of suicide completion.<sup>34</sup> A systematic review and meta-analysis claimed that being less physically active was associated with higher suicidality.<sup>35</sup> But, there has been no study in Bangladesh investigating the associations of body mass index (BMI) and physical activities, their changes, and suicidal behavior, which was explored herein for the first time in the COVID-19 pandemic context.

## Methods

### Study Procedure, Participants, and Ethics

An online-based cross-sectional study was conducted among the general Bangladeshi people utilizing a structured questionnaire. Participants were surveyed in the month of November 2020; a total of 326 people participated, and after omission of incomplete questionnaires, 324 samples were finally analyzed (mean age = 26.99 ± 8.17 years). The study followed the highest degree of ethical standards. The study protocol was initially reviewed and supported by the CHINTA Research

Bangladesh. To oversee the project, an external ethics board approval was granted by the Institute of Allergy and Clinical Immunology of Bangladesh (Reference number: IRBIACIB/CEC/03202028/653). In addition, before partaking in the online survey, along with mandatorily providing informed consent, the participants were informed about ethical aspects as suggested by the Helsinki Declaration, 2013.

## Measures

The survey questionnaire included questions regarding socio-demographics, health-related variables, physical activities-related variables, and mental health problems (eg, depression, anxiety and suicidal behavior). A short description of the studied variables is given in the following paragraphs.

### Sociodemographic Factors

The basic socio-demographic information including gender, age, current residence (eg, village, Upazila [sub-city], or district [city]), type of house (eg, lower, middle or high quality) and occupation (eg, student, service holder, health care professional, businessman, engineer, housewife, other) were asked in the survey.

### Health-Related Measures

A dichotomous response (ie, yes/no) was used to assess if the participants tested positive for COVID-19. Besides, a 4-point Likert scale (never to always) concerning experiencing COVID-19 like symptoms was also assessed. Self-reported anthropometric measurement relating to body mass index (BMI) was collected based on prior to and during the COVID-19 pandemic, where before and 6 months after the outbreak were considered for reporting weight and height. Lastly, the changes in BMI status after the lockdown were calculated in considering the anthropometric measurement changes prior to the pandemic.

### Physical Activity-Related Variables

First of all, having (or not having) outdoor space for performing physical activities near the participants' residence was asked. The status of performing physical activities [ie, engaging in cricket, football, fitness exercise, etc., for at least 30 minutes once a day<sup>36</sup>] was asked based on prior to and during the COVID-19 period. Physical activity frequency of a week was also investigated herein, similar to Maugeri et al.<sup>31</sup> Lastly, the changes in physical exercise status after the lockdown were calculated compared to physical exercise prior to the pandemic.

## Depression

For assessing depression, the Patient Health Questionnaire (PHQ-2) scale was used.<sup>37,38</sup> The scale consists of two items (eg, "little interest or pleasure in doing things" and "feeling down, depressed, or hopeless"), and participants were supposed to respond on a 4-point Likert scale (0= not at all to 3=nearly every day). The total score ranges from 0 to 6, and a score of  $\geq 3$  is considered as the presence of depression.<sup>37,38</sup> The Cronbach's alpha was 0.76.

## Anxiety

For assessing anxiety, the Generalized Anxiety Disorder (GAD-2) scale was used.<sup>37,39</sup> The scale consists of two items (eg, "feeling nervous, anxious or on edge" and "not being able to stop or control worrying"), and participants were supposed to respond on a 4-point Likert scale (0= not at all to 3=nearly every day). The total score ranges from 0 to 6, and a score of  $\geq 3$  is considered as the presence of anxiety.<sup>37,39</sup> The Cronbach's alpha was 0.76.

## Suicidal Behavior

For assessing suicidal behaviors, the prior studies conducted either prior to or during the COVID-19 periods were followed.<sup>21,22,40,41</sup> Consistent with the concept of suicidal behavior (ie, thinking about ending your life, making a plan to go ahead with it, and attempting to end your life<sup>42</sup>), the present study used a single-item for assessing suicidal behavior. Which was, "do you think about committing suicide, and are these thoughts persistent and have you moved forward to plan and/or attempt it?"<sup>25,26</sup> For assessing suicidal behavior history, one year before the inception of the pandemic was considered, whereas the current suicidal behavior was evaluated considering the pandemic's inception to survey time.

## Statistical Analysis

Initially, collected data from the Google Forms were entered into Microsoft Excel 2019 and were cleaned and prepared for formal analysis in IBM SPSS Statistics. Frequencies, percentages, ANOVA tests, and chi-square d tests were performed investigating relationships with the outcome variables. Depression, anxiety, and current suicidal behavior were considered the outcome variables in the present study. However, a value of  $p < 0.05$  was set as statistically significant with 95% confidence interval for the tests.

**Table 1** Associations Between the Socio-Demographic Variables and Mental Health Problems

Variables	Total Sample (n%)	Suicidal Behavior			Probable Depression			Probable Anxiety		
		Yes (n%)	$\chi^2/f$ Test Value	p-value	Yes (n%)	$\chi^2/f$ Test Value	p-value	Yes (n%)	$\chi^2/f$ Test Value	p-value
<b>Gender</b>										
Female	111 (34.3)	5 (4.5)	1.089	0.297	46 (41.4)	0.011	0.918	33 (29.7)	0.014	0.907
Male	213 (65.7)	16 (7.5)			87 (40.8)			62 (29.1)		
<b>Age group</b>										
<23 years	125 (38.6)	7 (5.6)	12.376	0.002	53 (42.4)	0.156	0.925	39 (31.2)	1.191	0.551
23–30 years	114 (35.2)	14 (12.3)			46 (40.4)			35 (30.7)		
>30 years	85 (26.2)	0 (0.0)			34 (40.0)			21 (24.7)		
<b>Age</b>										
Mean $\pm$ SD (vs No)	26.99 $\pm$ 8.17	23.52 $\pm$ 2.58 (vs 27.23 $\pm$ 8.37)	4.085	0.044	26.49 $\pm$ 7.360 (vs 27.34 $\pm$ 8.69)	0.835	0.361	26.33 $\pm$ 6.48 (vs 27.27 $\pm$ 8.782)	0.896	0.345
<b>Current residence</b>										
Village	60 (18.5)	5 (8.3)	0.425	0.808	25 (41.7)	0.503	0.778	16 (26.7)	0.741	0.690
Upazilla	102 (31.5)	6 (5.9)			39 (38.2)			28 (27.5)		
District	162 (50)	10 (6.2)			69 (42.6)			51 (31.5)		
<b>House type</b>										
Lower	67 (20.7)	7 (10.4)	3.931	0.140	27 (40.3)	0.110	0.946	17 (25.4)	0.675	0.714
Middle	68 (21.0)	6 (8.8)			27 (39.7)			20 (29.4)		
High	189 (58.3)	8 (4.2)			79 (41.8)			58 (30.7)		
<b>Occupation</b>										
Student	173 (53.4)	15 (8.7)	10.231	0.115	75 (43.4)	2.637	0.853	53 (30.6)	5.650	0.464
Service provider	78 (24.1)	1 (1.3)			28 (35.9)			20 (25.6)		
HCPs	16 (4.9)	0 (0)			6 (37.5)			7 (43.8)		
Businessman	11 (3.4)	1 (9.1)			6 (54.5)			4 (36.4)		
Others	13 (4.0)	1 (7.7)			5 (38.5)			1 (7.7)		
Engineer	18 (5.6)	3 (16.7)			8 (44.4)			6 (33.3)		
Housewife	15 (4.6)	0 (0)			5 (33.3)			4 (26.7)		

## Results

### Characteristics of the Participants

Of the total sample (N=324), the majority of the participants were male (65.7%) and young adults (38.6%). Over half of them were students (53.4%) and lived in a high-quality house (58.3%) and district area (50%) (Table 1). About 62.3% reported experiencing COVID-19 like

symptoms, but only 7.4% tested positive for the virus. Nearly half of the participants (ie, 49.1%) reported an increment in their BMI status during the COVID-19 period, whereas 31.8% reported decreasing of it (Table 2). Correspondingly, about 44.1% reported no changes in their weekly frequency of performing physical activities, whereas a 38.9% reduction was found (Table 3).

**Table 2** Associations Between the Health-Related Variables and Mental Health Problems

Variables	Total Sample (n%)	Suicidal Behavior			Probable Depression			Probable Anxiety		
		Yes (n%)	$\chi^2$ Test Value	p-value	Yes (n%)	$\chi^2$ Test Value	p-value	Yes (n%)	$\chi^2$ Test Value	p-value
<b>Tested positive for COVID-19</b>										
Yes	24 (7.4)	2 (8.3)	0.147	0.702	12 (50.0)	0.858	0.354	10 (41.7)	1.906	0.167
No	300 (92.6)	19 (6.3)			121 (40.3)			85 (28.3)		
<b>Experiencing COVID-19 like symptoms</b>										
Almost times	17 (5.2)	2 (11.8)	12.364	0.006	9 (52.9)	2.459	0.483	6 (35.3)	10.462	0.015
Frequently	49 (15.1)	8 (16.3)			21 (42.9)			21 (42.9)		
Fewer	136 (42)	4 (2.9)			59 (43.4)			44 (32.4)		
Never	121 (37.3)	6 (5)			44 (36.4)			24 (19.8)		
<b>Experiencing migraine pain</b>										
Frequently	116 (35.8)	9 (7.8)	1.429	0.489	63 (54.3)	13.911	0.001	43 (37.1)	5.927	0.052
Sometimes	62 (19.1)	2 (3.2)			18 (29.0)			13 (21.0)		
Never	146 (45.1)	10 (6.8)			52 (35.6)			39 (26.7)		
<b>Prior to the pandemic – BMI status</b>										
Underweight	30 (9.3)	0 (0.0)	4.350	0.226	17 (56.7)	4.914	0.178	9 (30.0)	3.086	0.379
Normal	193 (59.6)	14 (7.3)			72 (37.3)			53 (27.5)		
Overweight	78 (24.1)	4 (5.1)			33 (42.3)			23 (29.5)		
Obese	22 (6.8)	3 (13.6)			11 (50.0)			10 (45.5)		
<b>During the pandemic – BMI status</b>										
Underweight	29 (9.0)	1 (3.4)	3.136	0.371	17 (58.6)	7.450	0.059	9 (31.0)	0.874	0.832
Normal	181 (55.9)	13 (7.2)			73 (40.3)			50 (27.6)		
Overweight	92 (28.4)	4 (4.3)			31 (33.7)			28 (30.4)		
Obese	22 (6.8)	3 (13.6)			12 (54.5)			8 (36.4)		
<b>BMI status changes during the pandemic</b>										
Increased	159 (49.1)	10 (6.3)	0.027	0.987	62 (39.0)	8.587	0.014	44 (27.7)	8.718	0.013
Decreased	103 (31.8)	7 (6.8)			53 (51.5)			40 (38.8)		
Neutral	62 (19.1)	4 (6.5)			18 (29.0)			11 (17.7)		
<b>Probable depression</b>										
Normal	191 (59)	8 (4.2)	4.036	0.045				26 (13.6)	55.402	<0.001
Depressive	133 (41)	13 (9.8)						69 (51.9)		
<b>Probable anxiety</b>										
Normal	229 (70.7)	10 (4.4)	5.762	0.016	64 (27.9)	55.402	<0.001			
Anxious	95 (29.3)	11 (11.6)			69 (72.6)					

(Continued)

Table 2 (Continued).

Variables	Total Sample (n%)	Suicidal Behavior			Probable Depression			Probable Anxiety		
		Yes (n%)	$\chi^2$ Test Value	p-value	Yes (n%)	$\chi^2$ Test Value	p-value	Yes (n%)	$\chi^2$ Test Value	p-value
<b>Suicidal behavior history</b>										
No	296 (91.4)	8 (2.7)	80.688	<0.001	120 (40.5)	0.366	0.545	83 (28.0)	2.710	0.100
Yes	28 (8.6)	13 (46.4)			13 (46.4)			12 (42.9)		
<b>Current suicidal behavior</b>										
No	303 (93.5)				120 (39.6)	4.036	0.045	84 (27.7)	5.762	0.016
Yes	21 (6.5)				13 (61.9)			11 (52.4)		

## Prevalence of Mental Health Problems

About 41.0% and 29.3% of the participants reported being depressed and anxious, respectively, whereas only 6.5% were found to have suicidal behavior after the pandemic inception (Figure 1).

## Associations Between the Studied Variables and Mental Health Problems

The role of socio-demographics (except age) was not significantly associated with any of the mental health conditions. Similarly, there was no significant relationship between the participants being infected with COVID-19 and mental suffering; but, experiencing more COVID-19-like symptoms was significantly responsible for increasing suicidal behavior and anxiety rates (ie,  $\chi^2=12.364$ ,  $p=0.006$ ; and  $\chi^2=10.462$ ,  $p=0.015$ ; respectively). In addition, participants experiencing migraine pain had significantly increased the risk of mental health problems. But, the associations were heterogeneously distributed; that is, participants suffering from moderate migraine pain had a lower tendency of being depressed and anxious (ie,  $\chi^2=13.911$ ,  $p<0.001$ ; and  $\chi^2=5.927$ ,  $p=0.052$ ; respectively) (Table 2).

There was no significant role of BMI status, either prior to or during the pandemic, in mental health conditions, but the changes of BMI status were significantly associated with depression and anxiety (ie,  $\chi^2=8.587$ ,  $p=0.014$ ; and  $\chi^2=8.718$ ,  $p=0.013$ ; respectively). That is, participants reporting decreasing BMI status (compared to no changes of BMI status) were at greater risk of depression and anxiety, which was followed by increasing BMI status (Table 2). Besides, having no outside

space for exercise, performing more physical activities was reported to be associated with rising anxiety prevalence rates (Table 3). In addition, there were significant positive relationships between depression, anxiety, and suicidal behavior; that is, participants suffering from depression and anxiety were at a higher risk of suicidality. But, the suicidal behavior history was not associated with any of the outcome variables (ie, current suicidal behavior, depression, and anxiety) (Table 2).

## Discussion

The COVID-19-related lockdown and preventive measures taken to control disease transmission have undoubtedly disrupted people's quality of life. Evidence suggests that preventative measures like social movement restriction, being isolated or quarantined etc., have a negative impact on mental health.<sup>7,8</sup> For instance, many of the quarantined people during the SARS outbreak period in 2003 did not think that they should have been placed into quarantine,<sup>43</sup> which reflects the fact that people are at greater risk of mental and emotional instabilities due to confinement. Besides, there is an excellent effect on the economy – leading to people losing their jobs, along with other stressors such as fear of being infected, experiencing more deaths, the uncertainty of essential supplies (eg, food, water, clothes etc.), inadequate information and misinformation, and stigma etc., all exacerbate mental suffering.<sup>7,8</sup>

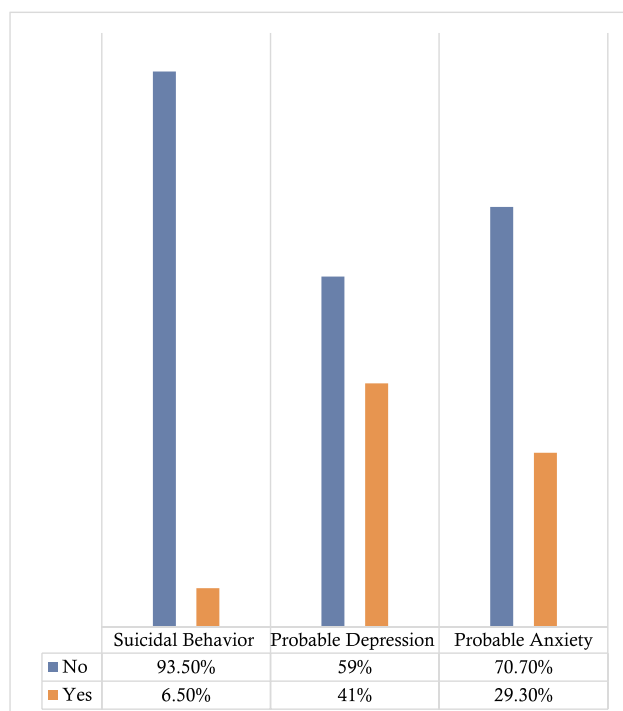
About 6.5% of the present respondents reported suicidal behavior after the inception of the COVID-19 pandemic in Bangladesh, which is remarkably similar to the prior studies. More specifically, the first-ever Bangladeshi study assessing COVID-19 suicidal behavior reported the rate as 5% from

**Table 3** Associations Between the Physical Activity-Related Variables and Mental Health Problems

Variables	Total Sample (n%)	Suicidal Behavior			Probable Depression			Probable Anxiety		
		Yes (n%)	$\chi^2/f$ Test Value	p-value	Yes (n%)	$\chi^2/f$ Test Value	p-value	Yes (n%)	$\chi^2/f$ Test Value	p-value
<b>Prior to the pandemic – Having outside space for exercise</b>										
No	115 (35.5)	6 (5.2)	0.470	0.493	50 (43.5)	0.435	0.510	43 (37.4)	5.603	0.018
Yes	209 (64.5)	15 (7.2)			83 (39.7)			52 (24.9)		
<b>During the pandemic – Having outside space for exercise</b>										
No	117 (36.1)	9 (7.7)	0.443	0.506	52 (44.4)	0.872	0.350	48 (41.0)	12.106	0.001
Yes	207 (63.9)	12 (5.8)			81 (39.1)			47 (22.7)		
<b>Prior to the pandemic – Performing regular physical activities, including exercise</b>										
No	192 (59.3)	15 (7.8)	1.377	0.241	75 (39.1)	0.769	0.381	48 (25.0)	4.246	0.039
Yes	132 (40.7)	6 (4.5)			58 (43.9)			47 (35.6)		
<b>During the pandemic – Performing regular physical activities, including exercise</b>										
No	171 (52.8)	13 (7.6)	0.751	0.386	64 (37.4)	1.964	0.161	43 (25.1)	3.045	0.081
Yes	153 (47.2)	8 (5.2)			69 (45.1)			52 (34.0)		
<b>Prior to the pandemic – Weekly exercise frequency</b>										
Mean $\pm$ SD (vs No)	3.08 $\pm$ 2.58	3.19 $\pm$ 2.89 (vs 3.06 $\pm$ 2.56)	0.043	0.836	3.33 $\pm$ 2.63 vs 2.89 $\pm$ 2.54	2.314	0.129	2.92 $\pm$ 2.61 (vs 3.14 $\pm$ 2.57)	0.457	0.499
<b>During the pandemic – Weekly exercise frequency</b>										
Mean $\pm$ SD (vs No)	2.29 $\pm$ 2.408	3.00 $\pm$ 2.70 (vs 2.24 $\pm$ 2.38)	1.957	0.163	2.28 $\pm$ 2.50 (vs 2.29 $\pm$ 2.34)	0.001	0.978	2.02 $\pm$ 2.39 (vs 2.40 $\pm$ 2.41)	1.682	0.196
<b>Weekly exercise frequency changes after the pandemic</b>										
Increased	55 (17.0)	5 (9.1)	0.804	0.669	16 (29.1)	3.955	0.138	17 (30.9)	0.101	0.951
Decreased	126 (38.9)	7 (5.6)			54 (42.9)			36 (28.6)		
Neutral	143 (44.1)	9 (6.3)			63 (44.1)			42 (29.4)		

a survey study conducted between 1 and 10 April 2020.<sup>26</sup> After that study (8 to 25 April 2020), the prevalence rate was reported as 6.1% in a comparative study among the general population and healthcare professionals.<sup>25</sup> Although these three studies shared the same method for assessing suicidal behavior, time exposure for considering the suicidal behavior's prevalence rate was somewhat different. Along with the time exposure, experiencing more lockdown-related obstructions was anticipated to increase the present study's suicidal behavior rate, but no detectable increment was found herein.

About 41.0% and 29.3% of the present participants reported experiencing symptoms of depression and anxiety, respectively. Considering the COVID-19-related psychiatric epidemiological studies of South Asian countries (including Bangladesh), a recent systematic review pooled the prevalence rates of depression and anxiety and found them to be 34.1% (28.9–39.4%) and 41.3% (34.7 – 48.1%) respectively.<sup>44</sup> The same study also observed that Bangladeshi people were the most psychologically vulnerable within this subcontinent. That is, the pooled prevalence rates for depression and



**Figure 1** Prevalence of mental health problems.

anxiety were reported to be 48.2% (34.8 – 61.8%) and 52.3% (41 – 63.6%), respectively.<sup>44</sup> Although the present study rates seemed lower than the pooled rates, many people were still suffering from mental health problems.

People are facing an unprecedented, life-altering crisis as a result of the COVID-19 pandemic. Steps such as 'social distancing' and 'shelter in place' are expected to act as a new normal yet to come.<sup>5</sup> To take attention away from all negative feelings (eg, fatigue, boredom etc.), people may start unhealthy dietary habits (eg, emotional eating habits, disordered eating etc.), especially those who have high objective self-consciousness,<sup>45</sup> resulting in a large effect on diet patterns and quality of food, and increased weight gain during the lockdown period.<sup>46,47</sup> Overweight or obesity can be a risk factor for poor mental health, which can also cause higher suicidality rate.<sup>48</sup> During the COVID-19 pandemic, 49% of the present sample reported increased BMI status, whereas 31.8% reported a decrease. There were significant associations between the changes in BMI status and mental health. The participants reporting changes in their BMI status were more significantly prone to suffer from depression and anxiety (where BMI status decreasing was at

higher risk), although suicidality was not associated with it. As aforementioned, the BMI status changes lead to suffering from more psychiatric conditions, with the mediation of perceived feelings of burdensomeness,<sup>28,34</sup> which can be a red-flag sign for mental health vulnerabilities.

Regular physical activity and exercise which cause sweat production mediate the release of hormones (eg, endorphins, serotonin, norepinephrine, etc.) and helps with relaxation.<sup>36,49</sup> Thus, following the benefits of physical activities are limited to physical health and help reduce mental and emotional suffering.<sup>50</sup> More specifically, individuals performing more than 5 hours physical activity a week were reported to be 60% less likely to suffer from depression compared to those who performed 2 h, as reported in a recent study.<sup>51</sup> In contrast, performing fewer physical activities are alleged to be associated with higher suicidal risk.<sup>35</sup> However, the present finding supported that being more active in performing physical activities leads to higher anxiety, but this had no significant role in relation to either depression or suicidal behavior. Besides, the present study observed changes in engagement with physical activities during the COVID-19 pandemic compared to before the pandemic, but no significant role in relation to either decrease or increase in physical activities and mental health conditions was found. In contrast to the present finding, an Italian study conducted during the pandemic reported a decreased tendency of physical activities, which had a profoundly negative impact on psychological wellbeing.<sup>31</sup> Perceptibly, there is no explanation for such a finding reported herein, which is subjected to further studies.

The findings from the present study may be limited by their nature (cross-sectional study), sampling technique (convenience), sample size (small), and response-related probable errors (recall bias). Besides, being the study nature exploratory, the psychosocial antecedents are not properly framed in a proper theoretical ground, which may evaluate mental states' effects on a putative psychosocial model. Therefore, further studies considering more rigorous methodologies (eg, longitudinal study) with representative samples are required to generalize the findings.

## Conclusion

This study's findings emphasize how important the role of physical activity and normal BMI status is to minimize the COVID-19-related psychological burden and suicidal behavior. As an exploratory study investigating the role of BMI status and physical activities, and their changes in psychological health, the findings may help facilitate further studies and help policy-makers establish appropriate strategies.



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## Disclosure

The authors report no conflicts of interest in this work.

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