


# The Psychological Impact of COVID-19 Pandemic on Graduating Class Students at the University of Gondar, Northwest Ethiopia

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Enyew Getaneh Mekonen <sup>1</sup>  
Belayneh Shetie Workneh<sup>2</sup>  
Mohammed Seid Ali<sup>3</sup>  
Niguse Yigzaw Muluneh<sup>4</sup>

<sup>1</sup>Department of Surgical Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; <sup>2</sup>Department of Emergency and Critical Care Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; <sup>3</sup>Department of Pediatrics and Child Health Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; <sup>4</sup>Department of Psychiatry, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

**Introduction:** A poorly known contagious disease outbreak, like COVID-19, leads to unavoidable stress, fear, and anxiety. During the pandemic, University students suffer from adverse mental health outcomes resulted from the continuous spread of the disease, sensational media reporting, and implementation of social lockdown. Graduating class students are more affected due to cancellation and postponing of anticipated events such as exchange studies and graduation ceremonies. This study aimed to assess the prevalence and associated factors of anxiety, depression, and stress among graduating class students.

**Methods:** Institution-based cross-sectional study was conducted from November 10 to 30, 2020 at the University of Gondar. A simple random sampling technique was employed to select 350 students. Data were collected using a structured self-administered questionnaire, entered in EPI DATA version 3, analyzed using SPSS version 21, and presented in frequencies, percentages, tables, and graphs. Bivariable and multivariable analysis was investigated using a binary logistic regression model.

**Results:** The prevalence of stress, anxiety, and depression among graduating class students was 22.2%, 39.6%, and 40.2% respectively. Living in an urban area, living with a family, sedentary lifestyle, unable to practice COVID-19 preventive measures, and having a contact history increases the risk of developing stress. Living in an urban area, substance use, sedentary lifestyle, and fear of infecting family increase the risk of developing anxiety. Students who came from an urban area, live with a family, study non-health departments, had confirmed cases in the family and did not perform physical exercise had higher odds of developing depression.

**Conclusion:** More than one-fifth, more than one-third, and nearly two-fifths of graduating students had stress, anxiety, and depression respectively. It is better to develop effective strategies and interventions, train students about self-protection, and establish a psychological crisis intervention team to minimize the psychological impact of the COVID-19 pandemic.

**Keywords:** anxiety, COVID-19, depression, stress, graduating class students

## Introduction

Coronavirus Disease 2019 (COVID-19) is a disease caused by a novel coronavirus (SARS-CoV-2) that emerged in a seafood and poultry market in the Chinese city of Wuhan in 2019. The World Health Organization (WHO) characterized the outbreak as a pandemic on March 11, 2020, as cases have been detected in most countries worldwide.<sup>1</sup> As of October 30, 2020, there have been 45,608,024 laboratory-confirmed coronavirus cases, including 1,189,139 deaths worldwide according to Johns

Correspondence: Enyew Getaneh Mekonen  
Tel +251 946607528  
Email enyewgetaneh12@gmail.com

Hopkins University. The pandemic has interrupted the learning of more than one billion students in 129 countries around the world according to the United Nations Educational, Scientific, and Cultural Organization (UNESCO).<sup>2</sup>

The first case of COVID-19 was confirmed in Ethiopia on 13 March 2020 which was the first one to be reported since the beginning of the outbreak in China in December 2019.<sup>3</sup> On 8 April 2020, the Council of Ministers declared a five-month-long state of emergency in response to the growing number of coronavirus cases, and schools, sporting events, and public gatherings were closed.<sup>4</sup> According to the ministry of health, Ethiopia there were 95,789 COVID-19 reported cases and 1464 (1.53%) deaths in Ethiopia until October 30, 2020.

The COVID-19 pandemic affects mental health and well-being in addition to physical health.<sup>5,6</sup> University graduating class students are more affected psychologically by the pandemic due to cancellation and postponing of anticipated events such as exchange studies and graduation ceremonies.<sup>7</sup> A poorly known contagious disease outbreak, like COVID-19, leads to unavoidable stress, fear, and anxiety.<sup>8</sup> The mental well-being of university students can be negatively affected by shifting face-to-face classes to online, suspension of the semester-end final examinations, and unavailability of books, computers, and high-speed internet connection at home.<sup>9</sup>

During the pandemic, University students are at significant risk of adverse mental health outcomes resulted from the continuous spread of the disease, conspiracy theories, myths, and blame games, sensational media reporting of COVID-19, frustration and boredom, implementation of social lockdown with classmates, friends, and teachers, lack of personal space at home, and family financial loss due to lockdown.<sup>10</sup> The careers of this years' university graduates may be seriously impacted due to the pandemic since they experience major interruptions in teaching and assessment in the final part of their studies, and late graduation.<sup>9</sup>

The pandemic has potentially affected students physically, academically, financially, and psychologically. In a short period, students' lives have dramatically changed as they have been asked to leave campus, adjust to new living circumstances, and adapt to online learning platforms.<sup>11</sup> Different studies showed that the prevalence of depression, anxiety, and stress was high among university students. From studies conducted in Pakistan and Bangladesh, the

prevalence was 34% and 82.4% for depression and 45% and 87.7% for anxiety respectively.<sup>10,12</sup>

One study in Nigeria indicated that the prevalence of anxiety and depression was 31.9% and 41.4% respectively.<sup>13</sup> In Ethiopia, two studies reported that the prevalence of depression, anxiety, and stress was 21.2% and 77.2%, 27.7% and 71.8%, and 32.5% and 48.5% respectively.<sup>14,15</sup> Kinds of literature also indicated that age, sex, history of medical illness, living in a State/Region with a high incidence of COVID-19, family income, having family members infected with the disease, the practice of preventive measures, and residence were determinants of depression, anxiety, and stress.<sup>10,12,14,15</sup>

The ongoing spread of COVID-19, strict isolation measures, delays in starting school, and postponing graduation across the country influences the mental health of graduating class university students. As a result, estimating the psychological impact of the COVID-19 pandemic on graduating class students is important for health authorities to develop preventive strategies and effective treatment modalities to alleviate its negative outcome. Therefore, this study is intended to assess the prevalence and associated factors of depression, anxiety, and stress among graduating class students at the University of Gondar, northwest Ethiopia.

## Methods and Materials

### Study Design and Period

An institution-based cross-sectional study was conducted from November 10 to 30, 2020.

### Study Setting

The study was conducted at the University of Gondar, Gondar, Ethiopia. The University of Gondar, until 2003 known as the Gondar College of Medical Sciences, is the oldest medical school in Ethiopia. Established as the Public Health College in 1954. It is located in northwest Ethiopia 750 km far from Addis Ababa, the capital of Ethiopia. In 2010, the university offered 42 undergraduate and 17 postgraduate programs. As of 2016, the University offers 56 undergraduate and 64 postgraduate. These are organized under the College of Medicine and Health Sciences, College of Business and Economics, College of Natural and Computational Sciences, College of Social Sciences and Humanities, and Faculty of Veterinary Medicine and Faculty of Agriculture, and three schools (School of Law, School of Technology, and School of

Education). According to the information from the president's office, currently, there are 2546 Academic staff, 5473 Administrative staff, 41,730 undergraduate students, and 5497 postgraduate students at the University of Gondar. There are a total of 5396 graduating class students on the five campuses (source: University of Gondar Main Registrar Office).

## Participants of the Study

Graduating class students at the University of Gondar and available during the data collection period were included in the study. Those graduating class students who were absent from the class during the data collection period were excluded from the study.

## Sample Size Determination and Sampling Procedure

The sample size was calculated using the single population proportion formula by taking the estimated proportion of depression, anxiety, and stress among graduating class students: 21.2%, 27.7%, and 32.5%, respectively from a study conducted in southwest Ethiopia,<sup>14</sup> 95% confidence interval, and a 5% margin of error and the largest number was taken. The final sample size was 350 after using the correction formula and adding a 10% non-response rate. To select study participants from the five campuses, all campuses were listed down with their total number of graduating students. The proportional allocation formula was used to allocate the number of students to the five campuses. Then the sampling frame was prepared for each campus by having lists of students from the main registrar's office. Finally, the study subjects of each campus were selected using a simple random sampling technique.

## Operational Definitions

### Anxiety

Participants who score below 8 on the Depression, Anxiety, and Stress Scale - 21 Items (DASS-21) were considered as having no anxiety and those who score 8 and above were considered as having anxiety.<sup>26</sup>

### Depression

Participants who score below 10 on the Depression, Anxiety, and Stress Scale - 21 Items (DASS-21) were considered as having no depression and those who score 10 and above were considered as having depression.<sup>26</sup>

### Stress

Participants who score below 15 on the Depression, Anxiety, and Stress Scale - 21 Items (DASS-21) were considered as having no stress and those who score 15 and above were considered as having stress.<sup>26</sup>

### Substance Use

Use of chat, alcohol, cigarette smoking, or others at least once in the last three months.

### Perform Physical Activity

Exercising or doing any kind of sports activity including walking at least 20 min/day.<sup>25</sup>

## Data Collection Instruments and Procedures

Data were collected using a structured pre-tested self-administered questionnaire. The questionnaire contained 38 questions arranged into five sections; the first section contains six questions regarding the socio-demographic characteristics of the participants, the second section contains three questions regarding clinical related conditions of graduating students, the third section contains two behavioral related questions, the fourth section contains six personal related questions, and the fifth section contains 21 questions regarding the depression, anxiety, and stress status of graduating students. Depression, anxiety, and stress was measured using the Depression, Anxiety, and Stress Scale - 21 Items (DASS-21). The DASS-21 comprises 3 components: stress, anxiety, and depression. Each has 7 scales, and the final score of each part will be obtained by summing the scores of the related questions. Each item scores from 0 (did not apply to me at all) to 3 (applied to me very much).<sup>26</sup> The reliability and validity of this questionnaire have been investigated. Its test-retest reliabilities for depression, anxiety, and stress were reported as 0.80, 0.76, and 0.77, respectively. For examining the validity of this scale, the confirmatory factor analysis method and the main component technique were implemented.<sup>27</sup> In the present study, the scale's face validity will be examined by the psychology and research methods expert. Data were collected with the help of five trained BSc nurse data collectors and three MSc nurse supervisors. A written guideline was given to the administrator of the questionnaire to assure that every graduating student received the same directions and information. During data collection data collectors and supervisors follow the recommended precautions to prevent COVID-19.

## Data Processing and Analysis

Data clean-up and cross-checking was done before analysis. Checked, cleaned, and coded data were entered into EPI DATA version 3 and exported to SPSS version 21 for analysis. Descriptive statistics like frequencies, percentages, mean and standard deviation, tables, and figures were used to present data. To assess the association between the different independent variables with the dependent variable, first, bivariable relationships between each independent variable and outcome variable was investigated using a binary logistic regression model. Those independent variables with a  $p$ -value  $< 0.2$  at the bivariable level were included in multivariable analysis to control potential confounding factors. After adjusting their effect on the outcome variable, those variables with a  $p$ -value  $< 0.05$  with a 95% confidence interval were regarded as factors significantly associated.

## Data Quality Assurance

The tool was pretested before the actual data collection time at Debre Tabor University which was not included in the study using 5% of the total sample size. Amendments on the instrument, such as unclear questions and ambiguous words made accordingly. The pretest was also used to estimate how much time it takes to administer the entire questionnaire. The tool was first developed in the English language and translated to the Amharic language with back translation to English for consistency. The one-day training was given to data collectors and supervisors on the objective of the study, instrument, and data collection procedures by the principal investigators. Supervision was conducted by the principal investigators and supervisors. To ensure data quality, each data collector checked the questionnaire from each study participant for completeness daily. The supervisors and principal investigators review each questionnaire daily and checked for completeness.

## Results

### Socio-Demographic Characteristics of Graduating Class Students

A total of 338 graduate class students participated in this study, with a 96.6% response rate. More than half (56.2%) of the respondents were male. The mean age of the respondents was  $24.70 \pm 2.78$  SD years and more than half (58.6%) of them fall in the age range of 20–24 years. Concerning their residence more than half (57.7%) of the respondents live in an urban area. More than three fourth (77.5%) of the respondents were orthodox. Regarding their

field of study majority (81.1%) of them was other than the health field of studies (Table 1).

### Behavioral and Clinical-Related Characteristics of Graduating Class Students

The majority (88.5%) and (89.9%) of the participants were not diagnosed with any chronic disease and had no family members/relatives confirmed or suspected for COVID-19 respectively. Three hundred eleven (92.0%) of the participants had no history of mental disorders. More than three-fourths (81.1%) of the participants did not use a substance like chat, cigarette, and alcohol at least once in the last three months. More than two-thirds (68.0%) of the respondents perform any kind of sports activity including walking for at least 20 min per day (Table 2).

### Personal Characteristics of Graduating Class Students

Among the total 338 participants in the study, about 94.7% of the students had good knowledge about preventive measures of COVID-19. The majority of the participants (88.8%) in the study have a positive attitude towards the importance of the preventive measures of COVID-19. More than half (53.0%) of the participants in the study have practiced COVID-19 preventive measures. More than

**Table 1** Socio-Demographic Characteristics of Graduating Class Students in the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables	Category	Frequency (n= 338)	Percentage (100%)
Age	20–24 years	198	58.6
	25–29 years	118	34.9
	$\geq 30$ years	22	6.5
Sex	Male	190	56.2
	Female	148	43.8
Residence	Rural	143	42.3
	Urban	195	57.7
Religion	Orthodox	262	77.5
	Muslim	29	8.6
	Protestant	38	11.2
	Catholic	9	2.7
Field of study	Health	64	18.9
	Non-Health	274	81.1
Living with family	Yes	294	87.0
	No	44	13.0

**Table 2** Behavioral and Clinical-Related Characteristics of Graduating Class Students in the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables	Category	Frequency (n= 338)	Percentage (100%)
Diagnosed with chronic disease	Yes	39	11.5
	No	299	88.5
Confirmed/suspected case in the family	Yes	34	10.1
	No	304	89.9
History of mental disorders	Yes	27	8.0
	No	311	92.0
Substance use	Yes	64	18.9
	No	274	81.1
Perform physical exercise	Yes	230	68.0
	No	108	32.0

three-fifths (62.4%) of the participants worried about infecting family members. Two hundred eighty-six (84.6%) of the participants had no previous contact history with suspected or confirmed COVID-19 cases. Almost one-third (34.9%) of the participants had a family member aged greater than 60 years (Table 3).

## Prevalence of Stress, Anxiety, and Depression

The prevalence of stress, anxiety, and depression among graduate class students of the University of Gondar was 22.2% with a 95% CI (17.8%, 26.6%), 39.6% with a 95%

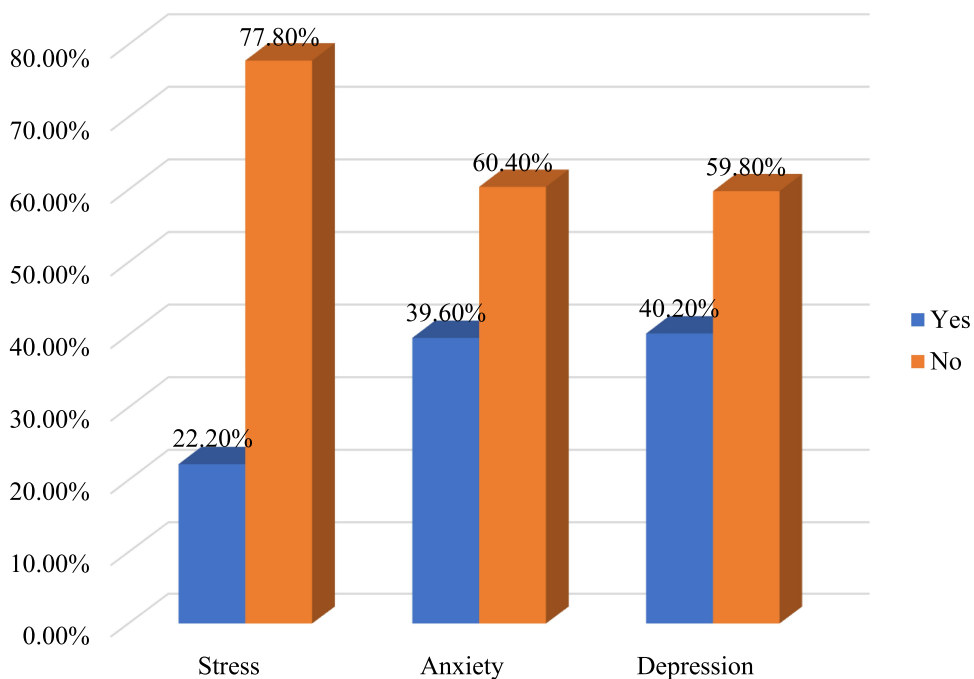
**Table 3** Personal Characteristics of Graduating Class Students at the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables	Response	Frequency	Percent (%)
Knowledge about COVID-19 preventive measures	Good	320	5.3
	Poor	18	94.7
Attitude towards COVID-19 preventive measures	Positive	300	88.8
	Negative	38	11.2
Practicing COVID-19 preventive measures	Yes	179	53.0
	No	159	47.0
Fear of infecting family members	Yes	211	62.4
	No	127	37.6
Contact history	Yes	52	15.4
	No	286	84.6
Living with a family aged > 60 years old	Yes	118	34.9
	No	220	65.1

CI (34.3%, 45.6%), and 40.2% with a 95% CI (34.8%, 46.0%) respectively (Figure 1). Fifty-five (16.3%), 32.2%, and 34.9% of the respondents faced difficulty relaxing to some degree, a considerable degree, and very much respectively. Nervous arousal was experienced by 28.1%, 39.1%, and 12.1% of them to some degree, a considerable degree, and very much respectively. Nearly three fourth (74.6%), 72.5%, 82.8%, 65.7%, and 50.6% of the study participants reported that they were easily upset, agitated, irritable, over-reactive, and impatient (Table 4). Two hundred eight (61.6%), 62.1%, 40.5%, and 34.6% of the respondents did not develop autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect respectively (Table 5). Nearly two thirds (64.2%), 72.2%, 68%, 65.5%, 55%, 57.4%, and 57.7% of the respondents develop dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia respectively (Table 6).

## Factors Associated with Stress

Variables like sex, residence, living with a family, the field of study, diagnosed with chronic disease, confirmed/suspected cases in the family, history of mental disorders, perform physical activity, attitude towards COVID-19 preventive measures, practicing COVID-19 preventive measures, fear of infecting family members, contact history with suspected or confirmed cases, and living with a person aged >60 years were found to be significantly associated with stress using bivariable logistic regression analysis. In multivariable logistic regression analysis, factors like residence, living with a family, perform physical exercise, practicing COVID-19 preventive measures, and contact history with suspected or confirmed cases were significantly associated with stress. Students who came from the rural residence were 56% times less likely to develop stress compared with students came from urban residence [AOR: 0.44; 95% CI (0.24, 0.80)]. Those study participants who lived alone were 75% times less likely to experience stress compared with students who lived with their family [AOR: 0.25; 95% CI (0.07, 0.85)]. Those students who did not perform physical activity were 2.2 times at a higher risk of developing stress compared with students who perform physical activity [AOR: 2.18; 95% CI (1.20, 3.96)]. Students who did not practice COVID-19 preventive measures appropriately were nearly two times at a higher risk of developing stress compared with their counterparts [AOR: 1.94; 95% CI (1.08, 3.50)]. Students



**Figure 1** The prevalence of stress, anxiety, and depression among graduating class students at the University of Gondar, northwest Ethiopia, 2020 (n= 338).

who had a contact history with suspected or confirmed cases were nearly seven times at a higher risk of developing stress compared with those who had not a contact history [AOR: 6.55; 95% CI (3.18, 13.53)] (Table 7).

### Factors Associated with Anxiety

Bivariable logistic regression analysis was carried out and the variables significantly associated with anxiety were; place of residence, the field of study, having a chronic disease, having a history of mental disorders, substance use, physical exercise, fear of infecting family members, confirmed/suspected cases in the family. Finally, multi-variable logistic regression analysis was carried out to

identify factors significantly associated with anxiety. The factors were the place of residence, substance use, physical exercise, and fear of infecting the family members. The odds of anxiety were 64% times less likely to occur among students who live in a rural area than in an urban area [AOR: 0.36; 95% CI (0.22, 0.61)]. Those students who did not use a substance like a cigarette, chat or alcohol were 73% times less likely to develop anxiety as compared to students who use substances in the last three months [AOR: 0.27; 95% CI (0.14–0.54)]. Those students who did not perform physical exercise were two times more likely to develop anxiety as compared to their counterparts [AOR: 2.12; 95% CI (1.24–3.62)]. Students who did not

**Table 4** Responses of Graduating Class Students to the Stress Scale at the University of Gondar, Northwest Ethiopia, 2020 (n=338)

Statements	Response (Frequency (Percentage))			
	Did Not Apply to Me at All	Applied to Me to Some Degree	Applied to Me to a Considerable Degree	Applied to Me Very Much
I found it hard to wind down	56 (16.6%)	55 (16.3%)	109 (32.2%)	118 (34.9%)
I tended to over-react to situations	68 (20.1%)	95 (28.1%)	132 (39.1%)	43 (12.1%)
I felt that I was using a lot of nervous energy	86 (25.4%)	103 (30.5%)	69 (20.4%)	80 (23.7%)
I found myself getting agitated	93 (27.5%)	61 (18.0%)	84 (24.9%)	100 (29.6%)
I found it difficult to relax	58 (17.2%)	76 (22.5%)	92 (27.2%)	112 (33.1%)
I was intolerant of anything that kept me from getting on with what I was doing	116 (34.3%)	93 (27.5%)	75 (22.2%)	54 (16.0%)
I felt that I was rather touchy	167 (49.4%)	92 (27.2%)	30 (8.9%)	49 (14.5%)

**Table 5** Responses of Graduating Class Students to the Anxiety Scale at the University of Gondar, Northwest Ethiopia, 2020 (n=338)

Statements	Response (Frequency (Percentage))			
	Did Not Apply to Me at All	Applied to Me to Some Degree	Applied to Me to a Considerable Degree	Applied to Me Very Much
I was aware of the dryness of my mouth	196 (58.0%)	69 (20.4%)	37 (10.9%)	36 (10.7%)
I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	220 (65.1%)	57 (16.9%)	39 (11.5%)	22 (6.5%)
I experienced trembling (e.g. in the hands)	210 (62.1%)	71 (21.0%)	32 (9.5%)	25 (7.4%)
I was worried about situations in which I might panic and make a fool of myself	120 (35.5%)	101 (29.9%)	65 (19.2%)	52 (15.4%)
I felt I was close to panic	136 (40.2%)	74 (21.9%)	80 (23.7%)	48 (14.2%)
I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	155 (45.9%)	91 (26.9%)	60 (17.8%)	32 (9.5%)
I felt scared without any good reason	117 (34.6%)	73 (21.6%)	89 (26.3%)	59 (17.5%)

**Table 6** Responses of Graduating Class Students to the Depression Scale at the University of Gondar, Northwest Ethiopia, 2020 (n=338)

Statements	Response (Frequency (Percentage))			
	Did Not Apply to Me at All	Applied to Me to Some Degree	Applied to Me to a Considerable Degree	Applied to Me Very Much
I could not seem to experience any positive feeling at all	121 (35.8%)	99 (29.3%)	70 (20.7%)	48 (14.2%)
I found it difficult to work up the initiative to do things	94 (27.8%)	76 (22.5%)	96 (28.4%)	72 (21.3%)
I felt that I had nothing to look forward to	108 (32.0%)	81 (24.0%)	66 (19.5%)	83 (24.6%)
I felt down-hearted and blue	116 (34.5%)	74 (21.9%)	73 (21.6%)	75 (22.2%)
I was unable to become enthusiastic about anything	152 (45.0%)	92 (27.2%)	52 (15.4%)	42 (12.4%)
I felt I was not worth much as a person	144 (42.6%)	86 (25.4%)	60 (17.8%)	48 (14.2%)
I felt that life was meaningless	143 (42.3%)	67 (19.8%)	53 (15.7%)	75 (22.2%)

worry about family members who could be infected were 49% times less likely to develop anxiety as compared to those who worried [AOR: 0.51; 95% CI (0.31–0.87)] (Table 8).

## Factors Associated with Depression

In bivariable logistic regression analysis, the following variables were found to be significantly associated with depression. Residence, living with family, the field of study, having a chronic disease, having suspected/infected relatives with COVID-19, history of mental disorders, substance use, physical activity, and contact history. Residence, living with a family, the field of study, having suspected/infected relatives with COVID-19, and physical exercise were factors significantly associated with depression using multivariable logistic regression. Students who live in the rural area were 45% times less likely to develop depression compared with those living in urban areas [AOR: 0.55, 95% CI (0.33, 0.89)]. Those students staying with their families were nearly four times at a higher risk

of developing depression compared with students staying alone [AOR: 4.06, 95% CI (1.54, 10.73)]. Graduating students who study in health science were 58% times less likely to develop depression compared to students who study non-health departments [AOR: 0.42, 95% CI (0.21, 0.84)]. Having suspected or infected cases in the family/relatives increase the risk of developing depression by nearly 3.5 times [AOR: 3.47, 95% CI (1.10, 10.95)]. Those students who did not perform physical exercise were nearly two times at higher risk of developing depression compared with those who perform physical exercise [AOR: 1.74; 95% CI (1.04, 2.93)] (Table 9).

## Discussion

After the first onset of the COVID-19 in china Wuhan city, it has had various effects on the Globe. The closure of universities due to the virus caused students to drop out of school. Especially it has a huge psychological impact on graduate class students. The current study revealed that 22.2%, 39.6%, and 40.2% of the respondents experienced stress, anxiety,

**Table 7** Bivariable and Multivariable Logistic Regression Analysis of Factors Associated with Stress Among Graduating Class Students in the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables		Stress		OR with 95% CI		P-value
		Yes	No	Crude	Adjusted	
Sex	Female	26	122	0.61(0.36, 1.05)	0.60 (0.33, 1.11)	0.106
	Male	49	141			
Residence	Urban	36	159	0.60(0.36, 1.01)	0.44 (0.24, 0.80)*	0.007
	Rural	39	104			
Living with a family	Yes	71	223	3.18(1.10, 9.21)	0.25 (0.07, 0.85)*	0.026
	No	4	40			
Field of study	Non-health	69	205	3.25(1.35, 7.87)	0.39 (0.15, 1.00)	0.050
	Health	6	58			
Chronic disease	Yes	16	23	2.83(1.41, 5.69)	1.79 (0.79, 4.06)	0.162
	No	59	240			
Confirmed cases in the family	Yes	17	17	4.24(2.04, 8.81)	0.86 (0.27, 2.73)	0.791
	No	58	246			
History of mental disorders	Yes	10	17	2.23(0.97, 5.09)	1.01(0.27, 3.83)	0.991
	No	65	246			
Physical activity	No	35	73	2.28(1.34, 3.86)	2.18 (1.20, 3.96)*	0.010
	Yes	40	190			
Attitude	Good	63	237			0.682
	Poor	12	26	0.58(0.28, 1.21)	1.22 (0.47, 3.19)	
Practice	Poor	45	114	1.96 (1.16, 3.31)	1.94 (1.08, 3.50)*	0.027
	Good	30	149			
Fear of infecting family members	Yes	52	159	1.48(0.85, 2.56)	1.72 (0.93, 3.20)	0.086
	No	23	104			
Contact history	Yes	27	25	5.36 (2.86, 10.02)	6.55 (3.18, 13.53)*	<0.001
	No	48	238			
Living with a person aged >60 years	Yes	38	80	2.35(1.39, 3.97)	1.64 (0.91, 2.98)	0.102
	No	37	183			

**Note:** \*Statistically significant at p-value <0.05.

and depression respectively in response to the COVID-19 pandemic. This result suggests that the coronavirus has a significant psychological impact on graduate class students who need mental health intervention.

The prevalence of stress among graduating class university students in the current study was 22.2%. This finding was lower than studies conducted in Bench-Sheko Zone, South-west Ethiopia (32.5%), Dessie town, Ethiopia (48.5%), United States (71%), China (67.1%), Spain (28.1%), Canada (30%), and Malaysia (28.9%).<sup>14,15,18,21–23,25</sup> The possible justification for the lower prevalence of stress in this study might be due to the difference in time of the study.

Currently, students can get a variety of information regarding the virus than the information they obtained at the beginning of the pandemic. Returning of the students to the university and start learning, the approval and administration of vaccines for COVID-19, and the increased number of patients who recovered from the disease than individuals who newly diagnosed and died might also contribute to the decrement of stress among students in the current study compared with the previous studies. The previous studies were conducted when students were at home and at the beginning of the pandemic which may result in a high prevalence of stress among students.



**Table 8** Bivariable and Multivariable Logistic Regression Analysis of Factors Associated with Anxiety Among Graduating Class Students in the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables	Response	Anxiety		OR with 95% CI		P-value
		Yes	No	Crude	Adjusted	
Sex	Female	58	90	1.22(0.66–1.60)	1.17(0.69–1.97)	0.552
	Male	76	144			
Residence	Urban	61	134	0.44(0.27–0.68)	0.36(0.22–0.61)*	<0.001
	Rural	73	70			
Living with family	Yes	122	172	1.89(0.93–3.82)	0.66(0.29–1.51)	0.334
	No	12	32			
Field of study	Non health	117	157	2.06(1.26–3.77)	0.49(0.23–1.07)	0.071
	Health	17	47			
Chronic disease	Yes	23	16	2.43(1.23–4.80)	0.86(0.35–2.10)	0.753
	No	111	188			
Confirmed cases in the family	Yes	23	11	3.63(1.71–7.73)	1.59(0.52–4.88)	0.921
	No	111	193			
History of mental disorders	Yes	17	10	2.82(1.23–6.36)	0.45(0.15–1.36)	0.163
	No	117	194			
Substance use	Yes	41	23	3.46 (1.96–6.13)	0.27(0.14–0.54)*	<0.001
	No	93	181			
Physical exercise	No	53	55	1.77(1.11,2.82)	2.12(1.24–3.62)*	0.006
	Yes	81	149			
Fear of infecting family members	Yes	95	116	1.85(1.12–2.94)	0.51(0.31–0.87)*	0.013
	No	39	88			
Contact history	Yes	25	27	1.50(0.83–2.72)	1.14(0.54–2.40)	0.714
	No	109	177			
Living with a person aged > 60 years old	Yes	53	65	1.40(0.89–2.21)	0.79(0.47–1.33)	0.382
	No	81	139			

**Note:** \*Statistically significant at p-value <0.05.

The prevalence of anxiety in this study was 39.6%. This finding was higher than studies conducted in Bench-Sheko Zone, southwest Ethiopia; 27.7%,<sup>14</sup> China 24.9%,<sup>16</sup> Chinese university students; 15.43%,<sup>19</sup> another study in China; 7.7%,<sup>20</sup> and Spain; 21.34%.<sup>22</sup> This discrepancy might be due to poor socioeconomic status in Ethiopia which determines the body defense mechanism of preventing coronavirus infection, in developing countries as compared to a developed country like China. Studies provide strong evidence that socioeconomic status impacts the development of mental illness directly, as well as indirectly through its association with adverse economic stressful conditions among lower-income groups.<sup>30</sup> This might be also in China the health care system is well developed and advanced than Ethiopia so that anxiety due to fear of infection was higher in Ethiopia than in China. The prevalence of anxiety in this study was comparable with a

study conducted in Italy; 34.4%,<sup>17</sup> Canada; 35%,<sup>23</sup> and 40.1% conducted in multicountry: Oman, Saudi Arabia, Jordan, Iraq, United Arab Emirates, and Egypt.<sup>31</sup>

On the other hand, the prevalence of anxiety among graduating class students in this study was lower than studies conducted in Dessie town, Amhara region, Ethiopia; 71.8%,<sup>15</sup> Addis Ababa Ethiopia; 51.6%,<sup>32</sup> and Bangladesh 87.7%.<sup>12</sup> This discrepancy might be due to the higher population density in Addis Ababa than Gondar, so that keeping a social distance is difficult in Addis Ababa than in Gondar, Ethiopia. Also, the prevalence of coronavirus cases was higher in Addis Ababa than in Gondar, due to these reason students in Gondar develops slightly lower than Addis Ababa. Urban living environments are associated with higher rates of prescription for psychotropic medication for anxiety, depression, and psychosis.<sup>33</sup>

**Table 9** Bivariable and Multivariable Logistic Regression Analysis of Factors Associated with Depression Among Graduating Class Students in the University of Gondar, Northwest Ethiopia, 2020 (N= 338)

Variables		Depression		OR with 95% CI		P-value
		Yes	No	Crude	Adjusted	
Residence	Urban	66	129	0.53(0.34, 0.83)	0.55(0.33, 0.89)*	0.016
	Rural	70	73			
Living with a family	Yes	129	165	4.13(1.78, 9.57)	4.06(1.54, 10.73)*	0.005
	No	7	37			
Field of study	Health	14	50			0.015
	Non-health	122	152	0.35(0.18, 0.66)	0.42(0.21, 0.84)*	
Chronic disease	Yes	24	15	2.67(1.35, 5.31)	1.04(0.43, 2.54)	0.928
	No	112	187			
Suspected/infected relatives	Yes	28	6	8.47(3.40, 21.09)	3.47(1.10, 10.95)*	0.034
	No	108	196			
History of mental disorders	Yes	19	8	3.94(1.67, 9.28)	3.07(0.92, 10.27)	0.068
	No	117	194			
Substance use	Yes	31	33	1.51(0.85, 2.61)	0.99(0.50, 1.96)	0.978
	No	105	169			
Physical exercise	Yes	82	148			0.036
	No	54	54	0.55(0.35, 0.88)	1.74(1.04, 2.93)*	
Contact history	Yes	31	21	2.55(1.39, 4.66)	1.59(0.69, 3.68)	0.280
	No	105	181			

Note: \*Statistically significant at p-value <0.05.

The prevalence of depression in this study was 40.2%. This finding was higher than studies conducted in Italy; 27.8%,<sup>17</sup> China, 12.2%,<sup>20</sup> Spanish; 34.19%,<sup>22</sup> and Canada 30%.<sup>23</sup> This might be due to the difference in implementing preventive measures, getting access to preventive equipment, information technology, and health system. According to the World Health Organization, developing countries like Africa could be severely affected by the virus, which leads to more frustration and depression in developing countries. However, this finding was lower than studies conducted in Bangladesh; 82.4%,<sup>12</sup> China, 46.55%,<sup>21</sup> and Dessie Ethiopia; 77.2%.<sup>15</sup> The difference might be due to the difference in the study period. Even though the COVID-19 has been found active and lethal still, humans' fear has been declining over time. As soon as the COVID-19 virus detected there was a restriction in routine activities like lockdown and closing schools including universities and colleges and there was no hint about vaccines which leads humans to more frustration. On the other hand, the previous studies were done at a time when the students were out of school while this study is conducted after the students returned to the school.

Residence, living with a family, perform physical activity, practicing COVID-19 preventive measures, and contact history with suspected or confirmed cases were the factors significantly associated with stress. Students who came from rural residences were 56% times less likely to develop stress compared with students who came from the urban residence. This finding was supported by studies conducted in Dessie town Ethiopia and China.<sup>15,16</sup> This might be due to the high prevalence of COVID-19 in urban residences than the rural. Students who live in an urban area may have a higher risk of developing stress than students who live in a rural part of the country as most positive cases were detected in the urban area. Moreover, repeated media exposure and obtaining daily information regarding the pandemic might also expose them to stress. Students who lived alone were 75% times less likely to experience stress compared with students who lived with their families. This finding was supported by a study conducted in the United States.<sup>18</sup> This might be due to the pandemic increased the level of fear and worry about infecting their families. Students may be worried more if there are more vulnerable family members like

older adults, with existing health problems, and pregnant mothers. They might also worry about their family members whose occupation increased their risk of exposure to the virus-like essential and health care workers which contribute to an increased level of stress.

Those students who did not perform physical exercise were 2.2 times at a higher risk of developing stress compared with students who perform physical exercise. This finding was supported by studies conducted in Turkey, the United Kingdom, and Brazil.<sup>34–36</sup> This might be due to engaging in physical activity regularly is a healthy habit and a protective factor against diseases and harmful risk behaviors. Performing physical activity provides several benefits like improving self-esteem and body image, decreasing stress and nervous tension, improving motor balance, and favoring social relatedness.<sup>37</sup> Students who did not perform physical activity can not relate and socialize with their peers simply by belonging to a team or sports club which increases the risk of developing stress.

Similarly, students who did not practice COVID-19 preventive measures appropriately were nearly two times at a higher risk of developing stress compared with their counterparts. This finding was supported by a study conducted in Dessie town, Ethiopia.<sup>15</sup> This might be due to preventive measures are key to reducing COVID-19 morbidity and mortality. As a result, students who implement COVID-19 preventive measures like wearing a mask, hand washing, and physical distancing appropriately become more confident and less exposed to stress than students who did not implement it. Also, students who had a contact history with suspected or confirmed cases were nearly seven times at a higher risk of developing stress compared with those who had not a contact history. This finding was supported by a study conducted in Mexico.<sup>38</sup> This might be due to fear of being infected with COVID-19 and what could happen can be overwhelming and cause strong emotions. Students who had contact with COVID-19 suspected and positive patients might worry about their health and develop stress.

Among the factors that affect the prevalence of anxiety in this study was the place of residence. Graduating students who came from the urban area had higher anxiety as compared to those students that came from the rural area. This finding was supported by studies conducted in Bangladesh<sup>12</sup> and China.<sup>16</sup> This might be due to one of the transmissions of coronavirus from an infected person to an uninfected person is physical contact. So people living in the urban area are more condensed than the

rural area and rural areas are more scattered than the urban area. Another factor significantly associated with the prevalence of anxiety in this study was performing physical exercise for at least 20 min per day. Those students who did not perform the physical exercise for at least 20 min per day were almost two times more likely to develop anxiety as compared to those who did perform physical exercise regularly. This finding was supported by a study conducted in Bangladesh.<sup>12</sup> The possible reason might be due to regular exercise may help ease depression and anxiety by releasing feel-good endorphins, natural cannabis-like brain chemicals (endogenous cannabinoids), and other natural brain chemicals that can enhance the sense of well-being.

The graduating students who worried about family members who could be infected were more likely to develop anxiety in comparison with their counterparts. This finding was supported by studies conducted in Bench-Sheko Zone, South-west Ethiopia,<sup>14</sup> and Guangzhou, China.<sup>20</sup> This might be due to the greatest fear of students resulted from the possibility of infecting family members during the pandemic. Substance use like cigarettes, alcohol, or chat was one of the factors associated with anxiety in this study. The risk of developing anxiety was higher among substance users as compared to non-substance users. The possible reason might be due to some substances may help to ease anxiety in the short-term, their effects are temporary, and the use of these substances can create a psychological or physiological dependence, which will cause or worsen other life problems and will ultimately exacerbate anxiety.

Residence, living with families, the field of study, suspected/infected relatives and physical exercise were factors significantly associated with depression. Students who came from rural areas were less likely to develop depression. This finding was supported by the study done in Bangladesh.<sup>12</sup> This might be due to the difference in information and the implementation of preventive measures. As an example, in an urban area, there was a difficulty for implementing physical distancing due to the condensed population and get access to the daily reports of COVID-19 (death and new cases) which leads to the student's depression. Those students staying with family were four times at risk of developing depression compared with those students who stay alone. This finding was supported by a study conducted in Bangladesh.<sup>12</sup> This might be due to the fear of infecting and losing their families. Students who engaged in health science-related

studies had less risk of developing depression compared with students in other fields of studies. This might be due to the healthcare students could have been well-informed on what to expect as the pandemic progresses compared to the students of other fields of studies.

The odds of depression were nearly four times higher among students who have suspected or infected family members/relatives with COVID-19. This finding was supported by a study conducted in China.<sup>20</sup> This might be due to the fear of losing the beloved one, family, and relatives by death due to COVID-19 or fear of getting an infection from the relatives and becoming ill. Those students who did not perform physical exercise were nearly two times at risk of developing depression compared with their counterparts. This finding was supported by the study conducted in Bangladesh.<sup>12</sup> This might be due to the effect of physical exercise on psychological and physical health or spending time with physical exercise instead of only thinking about the severity and consequences of the outbreak.

## This Study Has Some Limitations

The study did not include non-graduating class university students. The cross-sectional nature of the study makes it impossible to draw inferences about the direction of relations and it does not show cause and effect relationship among study variables. The study did not incorporate objective measurements that may be prone to reporting bias since it was based on subjective responses.

## Conclusion

More than one-fifth, more than one-third, and nearly two-fifths of graduating students had stress, anxiety, and depression in response to the COVID-19 pandemic respectively. Living in an urban area, living with a family, sedentary lifestyle, unable to practice COVID-19 preventive measures, and having a contact history with suspected/confirmed cases increases the risk of developing stress. Living in an urban area, substance use, sedentary lifestyle, and fear of infecting family members increase the risk of developing anxiety. Students who came from an urban area, live with a family, a study in non-health departments, had confirmed/suspected cases in the family, and did not perform physical exercise had a higher odds of developing depression. It is better to develop effective strategies and interventions, follow and order students, train students about self-protection, and establish a psychological crisis intervention team to minimize the

psychological impact of the COVID-19 pandemic on graduating class students.

## Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COVID-19, coronavirus disease 2019; DASS, Depression, Anxiety, and Stress Scale; IRB, Institutional Review Board; MERS, Middle East respiratory syndrome; OR, odds ratio; SARS-CoV, severe acute respiratory syndrome coronavirus; SPSS, Statistical Package for Social Sciences; UNESCO, United Nation's Educational, Scientific, and Cultural Organization; WHO, World Health Organization.

## Data Sharing Statement

All data are available upon request. The reader could contact the corresponding author for the underlying data.

## Ethics Approval and Informed Consent

Before conducting the study, ethical clearance was obtained from the institutional review board (IRB) of the University of Gondar (Reference number: V/P/RCS/05/585/2020). A written permission letter was obtained from the campus dean's office. Participants were informed about the purpose of the study and written informed consent was obtained from them. Confidentiality was maintained by omitting direct personal identifiers on the questionnaire, by using code numbers, storing data locked with a password, and not misuse or wrongfully disclose their information. Participants were also informed that participation was voluntary and they can withdraw from the study participation at any stage if they are not comfortable with the investigation. The investigators prepared a one-page information sheet regarding the purpose and nature of the study. This study complied with the Declaration of Helsinki.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the

version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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