Received: 22 May 2023 | Revised: 3 November 2023 | Accepted: 6 November 2023

DOI: 10.1002/mhs2.48

RESEARCH ARTICLE

WILEY

The relationship between anxiety and COVID-19-associated isolation and lifestyle changes in the university community as a result of the SARS-CoV-2 pandemic

Felipe Saceanu Leser[1,2] | Mirella Araújo Ribeiro[3] | Lucas Dalsente Romano da Silva[4] | Renato Garcia Domingues[5] | Tiago Fleming Outeiro[5,6,7,8] | Kevin Boyé[2] | Eduardo Coelho Cerqueira[9] | Fabiano Lacerda Carvalho[3] | Phelippe do Carmo Gonçalves[3]

[1]Institute of Biomedical Sciences, Federal University of Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil

[2]French Institute of Health and Medical Research, Paris Cardiovascular Research Center (INSERM–U970, PARCC), Paris, France

[3]Faculty of Pharmacy, Health Sciences Center (CCS), Serra dos Órgãos University Center (UNIFESO), Teresópolis, Rio de Janeiro, Brazil

[4]Institute of Studies in Collective Health (IESC), Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro, Rio de Janeiro, Brazil

[5]Department of Experimental Neurodegeneration, Center for Biostructural Imaging of Neurodegeneration, University Medical Center Göttingen, Göttingen, Germany

[6]Max Planck Institute for Experimental Medicine, Göttingen, Germany

[7]Translational and Clinical Research Institute, Faculty of Medical Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom

[8]German Center for Neurodegenerative Diseases (DZNE), Göttingen, Germany

[9]Federal Institute of Education, Science and Technology of Rio de Janeiro (IFRJ), Rio de Janeiro, Rio de Janeiro, Brazil

Correspondence

Felipe Saceanu Leser, Institute of Biomedical Sciences, Federal University of Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil.
Email: felipe.saceanu-leser@inserm.com

Phelippe do Carmo Gonçalves, Faculty of Pharmacy, Health Sciences Center (CCS), Serra dos Órgãos University Center (UNIFESO), Teresópolis, Rio de Janeiro, Brazil.
Email: pgoncalves@cei-mplbior.unr.edu.ar

Abstract

In 2020, the novel severe acute respiratory syndrome coronavirus outbreak emerged as a public health emergency. Three years later, we are still assessing the effects caused by the coronavirus disease (COVID-19) and by the lifestyle changes due to prevention measures, like social isolation. Here, we assessed the profile of both the anxiety screening scores and anthropometric variables in the university community, associated with the isolation due to the COVID-19 pandemic. We analyzed social and epidemiological associated factors for anxiety and weight change to address and better identify the physical and mental conditions aggravated during the pandemic. This is a cross-sectional study based on the 7-item Generalized Anxiety Disorder Scale questionnaire applied virtually to university students and professors in the State of Rio de Janeiro (n = 480). In our population cohort, we showed that the majority of individuals showed moderate to severe anxiety and increased body weight during the COVID-19 pandemic. The major demographic associated factors for higher anxiety levels were young age, female gender, and low family income. The main modifiable associated factors for both anxiety and weight gain were the negative changes in living habits. In addition, there was a trend toward severe anxiety and greater weight change in people with increased time in social isolation. In view of these results, we suggest that bad

habits, adopted during the COVID-19 pandemic, were the main reason for the high anxiety levels found in the studied population.

1 | INTRODUCTION

In December 2019, the novel severe acute respiratory syndrome coronavirus (SARS-CoV-2) was reported in China, causing the coronavirus disease 2019 (COVID-19). The World Health Organization (WHO) has considered it a public health emergency of international concern due to an increasing number of cases and deaths and the socioeconomic consequences that it may cause (Li et al., 2020). COVID-19 spread rapidly worldwide, causing symptoms such as fever, dry cough, sore throat, headache, fatigue, myalgia, and dyspnea, which can progress to an acute respiratory syndrome in varying severity, and death (Santos, 2020).

Currently, after Asia, the American continent has the second-highest number of confirmed cases. More specifically, the United States of America and Brazil are the most affected American countries (WHO, n.d.). In Brazil, Noronha et al. (2020) reported the critical situation of the health system with regard to the COVID-19 pandemic, including support for patients in critical conditions and highlighting the need for measures that aim to reduce COVID-19 spreading speed and the socioeconomic damage. However, preventive measures are challenging in the Brazilian population due to social inequalities, experienced by the large part of the population that lives in extremely crowded conditions, in precarious housing, and with defective basic sanitation (Werneck & Carvalho, 2020).

The main preventing measures used worldwide to contain COVID-19 spreading consisted of social distancing, social isolation, and, once they became available, active immunization (Killgore et al., 2020; Werneck & Carvalho, 2020; Wiersinga et al., 2020). These measures aimed at reducing social contact by closing or restricting schools, workplaces, leisure places, public transport, and social events. In addition, guidelines and recommendations for personal protection were published by the government and consisted of physical distancing, personal hygiene, and usage of individual protective equipment, such as face masks (Banerjee et al., 2021; Werneck & Carvalho, 2020; Wiersinga et al., 2020).

By the time active immunization became available for the majority of the population, with verified effects against serious complications of COVID-19 (Al Kaabi et al., 2021; Nemet et al., 2022; Singanayagam et al., 2022), the need for isolation and social measures to prevent the spreading of the disease was questioned in multiple countries. However, waves of increased cases are still appearing worldwide 3 years after the COVID-19 outbreak and are associated with new variants that often present higher transmissibility and antibody escape (Barouch, 2022). Faced with these new challenges, whether it is worth returning to social isolation or not remains an open question.

In this context, it is evident that the social distancing and isolation measures adopted at different stages of the COVID-19 pandemic drastically affected lifestyle habits and imposed serious consequences on the physical and mental health of individuals (Killgore et al., 2020; King et al., 2020; Martinez-Ferran et al., 2020). Among these changes, the lack of physical activity and bad eating habits had an important impact on the population's health, such as overweight and obesity. (King et al., 2020; Navarro-Cruz, et al., 2021; Santana et al., 2021; Soysal et al., 2023). In this sense, two independent studies reported that harmful changes in eating habits during the pandemic led to weight gain among university students in Chile (Navarro-Cruz et al., 2021) and Turkey (Soysal et al., 2023) and was related to an increase in depressive symptoms (Soysal et al., 2023). Furthermore, habit changes due to social isolation may be related to the appearance of new pathologies and clinical worsening of diseases such as dyslipidemia, insulin resistance, hypertension, and visceral obesity (King et al., 2020).

Moreover, the psychological impact of these changes is also extremely relevant. It can impair mental health and cause the appearance of mood disorders such as anxiety and depression (Cao et al., 2020; Moccia et al., 2020; Odriozola-González et al., 2020). Interestingly, recent studies show that the academic community is sensitive to the impact of social isolation and the associated change on their lifestyle and more prone to psychological disorders during suspension of academic activities associated with COVID-19 pandemic (Charles et al., 2021; Chen et al., 2020; Fu et al., 2021; Huckins et al., 2020; Odriozola-González et al., 2020; Perz et al., 2022; Son et al., 2020).

In this study, we investigated the changes in mental health, anthropometric variables, and the life habits of the academic community during the COVID-19 pandemic in the State of Rio de Janeiro, Brazil. We assessed the responses to the 7-item Generalized Anxiety Disorder Scale (GAD-7) questionnaire, the self-reported weight change, and lifestyle changes in university students and professors. We also described associated factors for the higher scores on this anxiety disorder screening test and for higher weight changes and looked for correlations between changes in habits, weight variation, and GAD-7 results. Then, we suggested some options that sought to aid the academic community both mentally and physically.

2 | METHODS

2.1 | Study design and population

This is a quantitative, cross-sectional study, that involves university students and professors from the State of Rio de Janeiro. The sample size was calculated according to data provided by the Brazilian Higher Education Census (Instituto Nacional de Estudos e Pesquisas [INEP], 2019), which is a public survey instrument that annually gathers data on the number of students enrolled in public and private higher education institutions in Brazil. From there, we identified a universe of 722,860 students (undergraduated and graduated) and 33,550 professors enrolled at higher education institutions in the

State of Rio de Janeiro. Considering 95% confidence (Zα = 1.96) and a tolerable absolute error of 5%, the estimated minimum sample size needed for conducting this study was 384 participants.

Respondents were sampled by non-probabilistic convenience sampling. Questionnaires were applied in digital format to all participants directly or through the communication groups of the secretariats of the partner universities in the period between December 1, 2020 and January 1, 2021. Questionnaires did not include any personal identification to ensure anonymity and confidentiality of data. Four hundred and eighty respondents were included in the final analysis related to the anxiety profile of this population, disregarding one duplicate record (Figure S1). A new filtering was performed, in which 35 responses were excluded due to a lack of information on anthropometric variables before the analyses related to weight change. (Supplementary figure 1).

2.2 | Rating instruments

The study instrument comprised a structured questionnaire that includes social, demographic, economic, and academic information. Also, participants were asked about how the pandemic interfered with academic activities and what type of contact they had with the COVID-19 disease.

In addition, participants were asked about their height, previous weight, and absolute weight variation (gain or loss) during the isolation period related to the COVID-19 pandemic. With the data obtained, we calculated the percentage of gain or loss and the previous and current body mass index (BMI) in kg/m^2. Participants were then categorized, according to the denomination proposed by the WHO in 2000 (National Institutes of Health, 1998; WHO, 2000), in underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obesity class I (30.0–34.9 kg/m^2), class II (35.0–39.9 kg/m^2), and class III (≥40.0 kg/m^2).

Moreover, the participants responded to the GAD-7 questionnaire, a widely recognized tool for objectively assessing anxiety levels and screening for anxiety disorders in different populations. GAD-7 was first idealized by Spitzer and most recently validated for application in the context of assessing the psychological impact of the COVID-19 pandemic on university students (Cao et al., 2020; Dhira et al., 2021; Spitzer et al., 2006). In this questionnaire, elevated scores are associated with an increased likelihood for the individual to experience an anxiety disorder. The quantitative results obtained from the participants' responses to the GAD-7 were transformed into a ranked categorical variable using the original cutoffs proposed by Spitzer and collaborators. We categorized anxiety screening scores as minimal if 0–4, mild if 5–9, moderate if 10–14, and severe if 15–21 (Spitzer et al., 2006).

Finally, a questionnaire composed of 20 questions regarding changes in eating habits, patterns of daily physical, recreational activities, and sleep patterns of participants during the pandemic period was applied to assess the behavior and lifestyle changes related to the COVID-19 pandemic (see Questionnaire in Supporting Information Content). This questionnaire was previously developed and validated by Kumari et al. (2020). Its construct validity was successfully established through factor analysis, and it exhibited strong internal consistency with a Cronbach's α value of 0.72 (Kumari et al., 2020). Notably, this questionnaire underwent validation amidst the backdrop of the COVID-19 pandemic, within a population resembling the characteristics of the current study's participants, composed mainly of young, middle-class, well-educated individuals, and residing in urban areas (Kumari et al., 2020). This aspect further enhances its suitability and relevance for the specific population of interest within this study. All responses use a 5-item Likert rating scale ranging from 2 (significantly decreased) to −2 (significantly increased). Noticeably, the final score of the questionnaire varies from −29 to 29, with negative scores related to the most beneficial lifestyle changes and positive scores related to the most harmful changes.

2.3 | Data analysis

Data were exported and statistically analyzed using the software IBM SPSS Statistics® Version 25.0. Normal distribution of continuous variables was assessed by Kolmogorov–Smirnov and Shapiro–Wilk tests. To verify significant associations between demographic variables and the anxiety score based on GAD-7 we used Pearsons' chi-square test of independence (χ^2). Standardized residual values analysis (Bonferroni post hoc) was used to identify exact values that significantly differ from the expected count between groups. The assumptions of the chi-square test were checked before carrying out the test and in cases where there was a minimum expected frequency <1, Fisher's exact test was used (Cochran, 1954; Fisher, 1925).

Spearman's nonparametric test was performed to assess the correlation between results of COVID-19-related behavior and lifestyle changes scale and GAD-7 scores, as well as other quantitative variables, such as age, BMI, and percentual weight variation. Correlation analysis was followed by performing a simple linear regression model and residual analysis to ensure homoscedasticity requirement between variables.

Kruskal–Wallis nonparametric test with Dunn's multiple comparison post hoc was used to verify the association between weight variation and categorical variables, such as contact with COVID-19 and ranked categories of the habits change score.

Statistically significant variables were included in two different multivariate ordinal logistic regression models (forward method, logit function) with anxiety (GAD-7 results) or weight change categories as dependent variables. As a measure of association strength, we used the prevalence odds ratio with a 95% confidence interval. The multicollinearity was verified by variance inflation factor (VIF), considering absent VIF = 1 and acceptable VIF < 5. A level of statistical significance of 95% ($p < 0.05$) was applied. Graphics were built in both GraphPad Prism Software® Version 8.0 and *ggplot2* library from R Version 4.2.1.

2.4 | Ethical considerations

The Institutional Ethics Committee approved the project with a Presentation Certificate for Ethical Appreciation registered at the Brazilian National Platform with the number 40277220.0.0000.5247. All participants voluntarily gave their Informed Consent to participate in the study after being notified about the purpose of the study. The procedures of this study complied with the provisions of the Declaration of Helsinki regarding research on human participants.

All data that supports the findings of this study is available from the corresponding author upon reasonable request.

3 | RESULTS

3.1 | Social, demographic, economic, and academic profile of the sample

The cohort studied in this work, referred to throughout the text as the "academic community," corresponds to undergraduate, graduate, and postdoctoral students (in Brazil, postdoctoral researchers are considered students) and professors from different university institutions across all regions of the state of Rio de Janeiro, Brazil. Table 1 shows the social, demographic, economic, and academic profiles of the studied academic community. Briefly, the cohort was composed mainly of young (20–29 years old), female students. Most of our participants were middle class (earning between 2 and 5 minimum wages—Brazilian minimum wage corresponded to approximately $200 per month at the time of the survey), single, residing in urban areas, especially in the metropolitan region (Table 1).

3.2 | GAD-7 results in the academic community of Rio de Janeiro

To assess anxiety screening scores in the academic community, we applied the GAD-7 questionnaire. Among the 480 respondents, 193 (40.21%) demonstrated severe scores (15–21 points), followed by 25.42% and 19.58% of the participants who presented moderate and mild scores, respectively (10–14 and 5–9 points, respectively). On the other hand, only 14.79% of the studied population had normal/minimum levels of anxiety (0–4 points) (Table 2).

3.3 | Association between GAD-7 and sociodemographic variables, weight, and lifestyle

Among the studied sociodemographic and economic variables, age, gender, and family income were significantly associated with GAD-7 scores (Table S1). In a post hoc analysis, we observed that females were more likely to have moderate to severe levels of anxiety when compared to males. In addition, younger participants (<20 and 20–29 years old)

TABLE 1 Descriptive data of the sociodemographic and academic characteristics analyzed in the studied population of the university community in Rio de Janeiro (n = 480).

	Total	
Variables	***N***	**%**
Age (years)		
<20	21	4.38
20–29	262	54.58
30–39	104	21.67
40–49	63	13.13
50–59	21	4.38
60–69	8	1.67
70–80	1	0.21
Gender		
Female	317	66.04
Male	160	33.33
Others	3	0.62
Marital Status		
Single	329	68.54
Married/common-law marriage	137	28.54
Divorced	12	2.50
Widow(er)	2	0.41
Region		
Metropolitana	327	68.13
Serrana	108	22.50
Norte Fluminense	16	3.33
Centro-Sul Fluminense	10	2.08
Região dos Lagos	8	1.67
Costa Verde	5	1.04
Noroeste Fluminense	3	0.63
Médio Vale do Paraíba	3	0.63
Place of residence		
Rural	19	3.96
Urban	461	96.04
Family income (no. of minimum wage/month)		
<1	22	4.58
1/2	98	20.42
2/5	163	33.96
5/10	92	19.17
>10	105	21.88
Live with parents/friends		
No	48	10.00
Yes	432	90.00

TABLE 1 (Continued)

Variables	Total N	Total %
Symptoms of COVID-19 confirmed disease, or contact		
No contacts, symptoms or confirmed disease	189	39.38
Contact with individuals with COVID-19	151	31.46
COVID-19 with laboratory confirmation	71	14.79
Symptoms of COVID-19 without laboratory confirmation	69	14.38
Activity		
Graduate	298	62.08
Postgraduate	95	19.79
Postdoctoral	8	1.67
Professor	79	16.46
Institution		
Private university	243	50.62
State university	24	5.00
Federal university	213	44.37
Year of studies		
1st	25	5.21
2nd	38	7.92
3rd	46	9.58
4th	45	9.37
5th	40	8.33
6th or more	99	20.62
Not aplicable	187	38.96
Field of studies		
Agrarian sciences	9	1.87
Biological sciences/health sciences	283	58.96
Exacts and earth sciences	73	15.21
Human sciences	35	7.29
Social sciences	19	3.96
Engineering and technologies	49	10.21
Linguistics, literature e arts	12	2.50
Downtime for presential activities		
No	29	6.04
<3 months	26	5.42
3–6 months	70	14.58
>6 months	355	73.96

TABLE 1 (Continued)

Variables	Total N	Total %
Total downtime of academic activities (presential and virtual)		
No	185	38.54
<3 months	87	18.13
3–6 months	112	23.33
>6 months	96	20.00
Did you participate in virtual academic activities during this period?		
No	26	5.42
Yes	454	94.58
Total isolation time without other presential activities		
No	108	22.50
<3 months	106	22.08
3–6 months	130	27.08
>6 months	136	28.33
Total	**480**	**100.00**

TABLE 2 Descriptive data of responses to the GAD-7 questionnaire and anxiety levels of the academic community during the COVID-19 pandemic ($n = 480$).

GAD-7 Score	Mean (SE)	95% CI
	12.25 (0.29)	(11.68–12.82)
Anxiety level	***N***	**Ratio (%)**
Normal/minimum	71	(14.79)
Mild	94	(19.58)
Moderate	122	(25.42)
Severe	193	(40.21)
Questions	***N***	**Ratio (%)**
Feeling nervous, anxious, or on edge		
Not at all	49	(10.21)
Several days	114	(23.75)
More than half of the days	117	(24.37)
Nearly every day	200	(41.67)
Not being able to stop or control worrying		
Not at all	76	(15.83)
Several days	107	(22.29)
More than half of the days	126	(26.25)
Nearly every day	171	(35.62)
Worrying too much about different things		
Not at all	62	(12.92)

(Continues)

TABLE 2 (Continued)

Questions	N	Ratio (%)
Several days	110	(22.92)
More than half of the days	130	(27.08)
Nearly every day	178	(37.08)
Trouble relaxing		
Not at all	62	(12.92)
Several days	110	(22.92)
More than half of the days	122	(25.42)
Nearly every day	186	(38.75)
Being so restless that it's hard to sit still		
Not at all	130	(27.08)
Several days	143	(29.79)
More than half of the days	105	(21.87)
Nearly every day	102	(21.25)
Becoming easily annoyed or irritable		
Not at all	71	(14.79)
Several days	128	(26.66)
More than half of the days	126	(26.25)
Nearly every day	155	(32.29)
Feeling afraid as if something awful might happen		
Not at all	125	(26.04)
Several days	117	(24.37)
More than half of the days	92	(19.17)
Nearly every day	146	(30.42)

Abbreviation: CI, confidence interval.

tended to have higher levels of moderate to severe anxiety, when compared to those of older age (>40 years old) (Table S1; Figure 1). Also, family income was associated with minimal to mild levels of anxiety when higher than 10 minimum wages per month (Table S1; Figure 1).

With regard to the region of residence and housing conditions, there was no significant difference in GAD-7 results between academics who live alone compared with those who live with parents or friends ($\chi^2 = 4.94$, $p = 0.176$). Similarly, no difference was observed between individuals living in different regions of the State of Rio de Janeiro ($\chi^2 = 12.87$, $p = 0.94$), nor between urban or rural area ($\chi^2 = 0.59$, $p = 0.115$) (Table S1; Figure S1).

Furthermore, we investigated the association between the activity performed by the participant at the university and the degree of anxiety related to the COVID-19 pandemic (Table S1). In a post hoc analysis, we observed that students had higher proportions of moderate anxiety scores, while professors had milder anxiety symptoms. This result is in line with increased GAD-7 scores of younger participants and those of low family income (Table S1; Figure 1).

We also considered the interruption of academic activities during the pandemic and whether the participants had direct or indirect contact with the disease (Table S1). We showed that individuals who remained in total isolation for 3–6 months during the pandemic (without any type of in-person activity, such as trips, courses, or work-related activities) had a higher degree of severe anxiety, while those who isolated completely for less than 3 months showed a lower degree of severe anxiety (Table S1; Figure 1). This data suggests that higher levels of anxiety are correlated with increased isolation periods.

Next, we assessed whether participants had symptoms of COVID-19, confirmed disease, or if they had contact with confirmed cases of COVID-19. We did not observe a statistically significant association between the development of symptoms or confirmed disease and the prevalence of anxiety in the population studied (Table S1; Figure 1). These results suggest that GAD-7 results in the studied population are primarily related to social isolation, rather than the disease itself.

3.4 | Anthropometric profile of the sample

Next, we asked participants questions about changes in lifestyle and weight during the COVID-19 pandemic (Table 3). Thus, we investigated whether these changes were related to different levels of anxiety.

Among the participants, the average weight at the time of the study was 70.86 ± 0.77 kg with an increase of 4.05 ± 0.45% compared to their previous weight. Furthermore, participants' average BMI increased from 24.72 ± 0.24 kg/m^2 before COVID-19 to 25.38 ± 0.24 kg/m^2 (Table S2).

Also, 53.54% of the participants reported weight gain during the pandemic. Among this subpopulation, there was an increase of +8.11 ± 0.32% compared to their initial weight. Besides, 18.75% of the participants reported no weight change, while 22.7% reported weight loss. Among those who reported weight loss, a decrease of −7.18 ± 0.45% in body weight was detected.

3.5 | Association of weight change with GAD-7, isolation time, and COVID-19 contact

Interestingly, a significant association was observed between the reported weight change during the isolation period due to the COVID-19 pandemic and the participants' GAD-7 score. Those who demonstrated weight gain had a higher prevalence of moderate anxiety, while those who maintained their weight stable displayed mainly minimal and mild anxiety (Table S1; Figure 1).

Next, we investigated the association between the participants' weight change and demographic variables. We found that the number of years studied at university, having their presential activities paused and, most notably, changes of habit resulting from

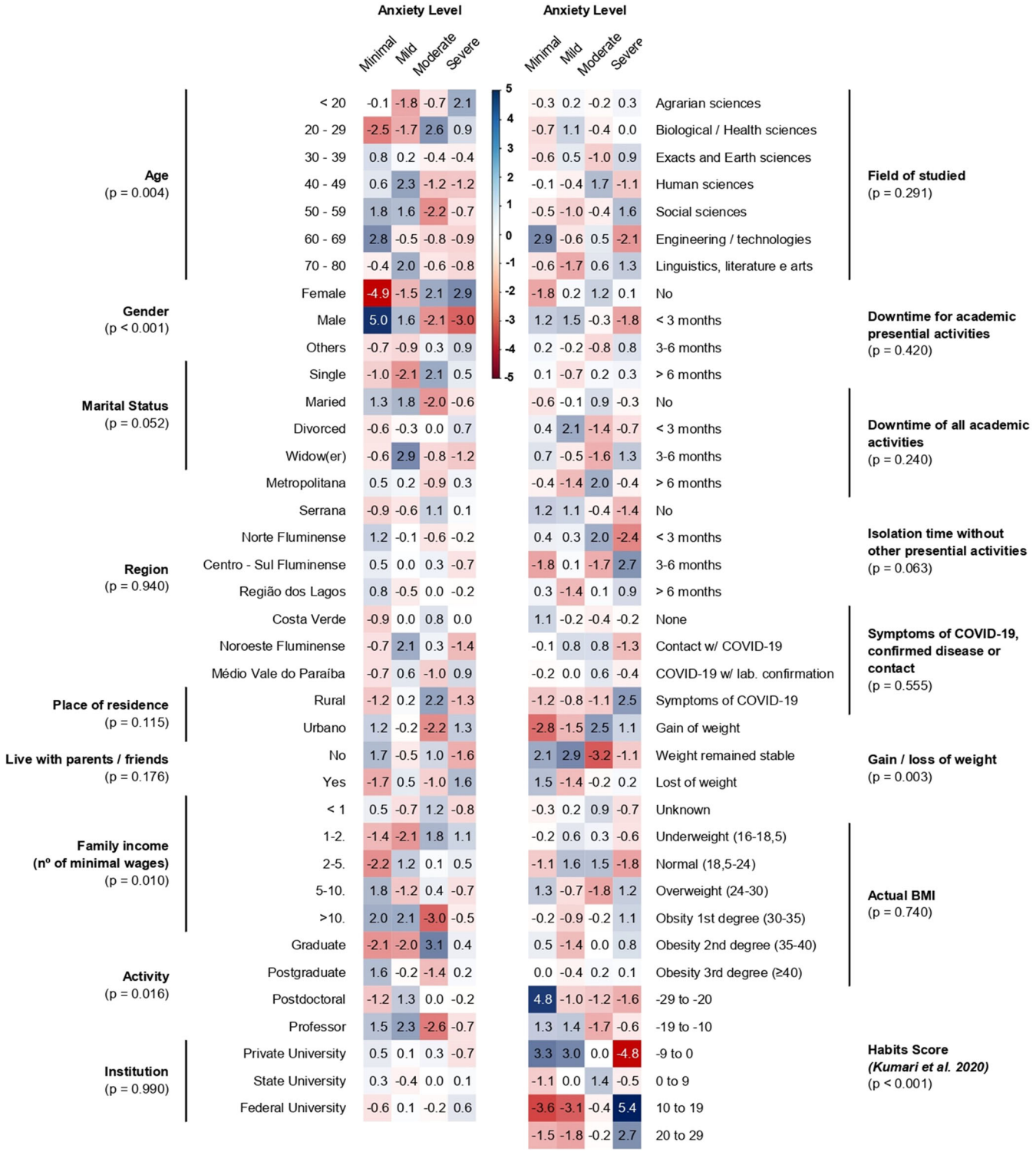

FIGURE 1 Heatmap of standardized residuals adjusted by the Bonferroni method. Post hoc results of univariate analysis of academic community anxiety level about the COVID-19 pandemic (minimal, mild, moderate, or severe) and relationship with sociodemographic and anthropometric variables ($n = 480$). p Value refers to the chi-square test. Values of standardized residuals are represented as color range visualizing in blue the positively associated values and in red the negatively associated values.

TABLE 3 Descriptive data of the anthropometric variables analyzed and habits change score in the studied population of the university community in Rio de Janeiro ($n = 480$).

	Total	
Variables	***N***	**%**
Gain or loss of weight		
Gain of weight	257	53.54
Weight remained stable	109	22.70
Lost of weight	90	18.75
Unknown	24	5.00
Weight change		
Class 1 (<−10%)	16	3.33
Class 2 (−10 a −1%)	70	14.58
Class 3 (0 a 9%)	289	60.20
Class 4 (10 a 20%)	64	13.33
Class 5 (>20%)	7	1.45
Not informed	34	7.08
Actual BMI		
Underweight (16–18.5)	29	6.04
Normal (18.5–24)	231	48.12
Overweight (24–30)	132	27.50
Obesity first degree (30–35)	65	13.54
Obesity second degree (35–40)	16	3.33
Obesity third degree (≥40)	7	1.45
Habits score (Kumari et al., 2020)		
−29 to −20	4	0.83
−19 to −10	31	6.46
−9 to 0	126	26.25
0 to 9	210	43.75
10 to 19	96	2.00
20 to 29	13	2.71
Total	480	100.00

isolation periods, showed a positive association with weight gain of participants (Table S3).

Furthermore, we observed that the presence of COVID-19 symptoms or reported contact with a patient were also associated with higher weight gain compared to those who had the disease (Table S3; Figures S2 and 2a). Finally, this suggests that the risk of COVID-19 infection had a higher impact on weight gain than having the disease itself.

Surprisingly, in a post hoc analysis of the chi-square test, we identified that participants who had their presential activities interrupted presented greater weight stability, while those who maintained their activities showed a greater tendency to weight variation (Table S3; Figure S2).

However, other variables such as gender, marital status, living region, family income, main activity at the University, participation in virtual academic activities, and reported anxiety levels did not correlate with changes in weight (Table S3).

3.6 | Lifestyle changes during COVID-19 and association with GAD-7 and weight variations

We investigated the changes in living habits during the pandemic. For this matter, we applied a questionnaire regarding changes in eating habits, daily physical and recreational activities, and sleep patterns during the pandemic period (see Questionnaire in Supporting Information Content). We further transformed the results of this questionnaire into a variable with six ranked categories ranging from the most beneficial lifestyle changes (negative scores) to the most harmful changes (positive scores). Bivariate analysis of these data showed both an association and a positive correlation between unhealthy changes in lifestyle and the presence of higher anxiety scores (Table S1; Figure 2b) and weight gain (Figure 2c).

Furthermore, we investigated the relationship between the variation of the participants' weight and the response given to each of the questions regarding behavior and COVID-19-related lifestyle changes. The answers that were most significantly associated with weight changes were: increased "habit of snacking between meals" ($\chi^2(16) = 60{,}600$; $p < 0.001$); "increased quantity/portions of meals and snacks" ($\chi^2(16) = 92.598$; $p < 0.001$); and lower "family support for maintaining healthy eating habits" ($\chi^2(16) = 37.549$; $p = 0.002$) (Table S4).

Individuals who reported a higher probability of skipping the main meals of the day also presented weight loss, reflecting that an irregular diet is an important factor related to weight instability ($\chi^2(16) = 29.827$; $p = 0.019$) (Table S4).

Sleep habits are known to interfere with weight variation. Participants who slept less also tended to have higher weight gain ($\chi^2(16) = 26.949$; $p = 0.042$), although the sleep quality did not seem to be associated (Table S4).

Self-reported stress and anxiety levels were also shown to be significantly related. Participants who reported a reduction in stress and anxiety levels also had greater weight loss ($\chi^2(16) = 28.478$; $p = 0.028$) (Table S4).

Finally, we corroborated the previously reported findings by using an alternative statistical approach of correlation matrix analysis. We performed an unbiased assessment of intercorrelation between all five quantitative variables considered in this study. We investigated the relationship between the score of lifestyle changes, weight variation, anxiety score, and participants' age and BMI. We identified a moderate correlation between the final score of COVID-19-related lifestyle changes and the total weight gain ($r = 0.3080$; $p < 0.0001$) (Figure 2d,e). A mild although significant positive correlation was

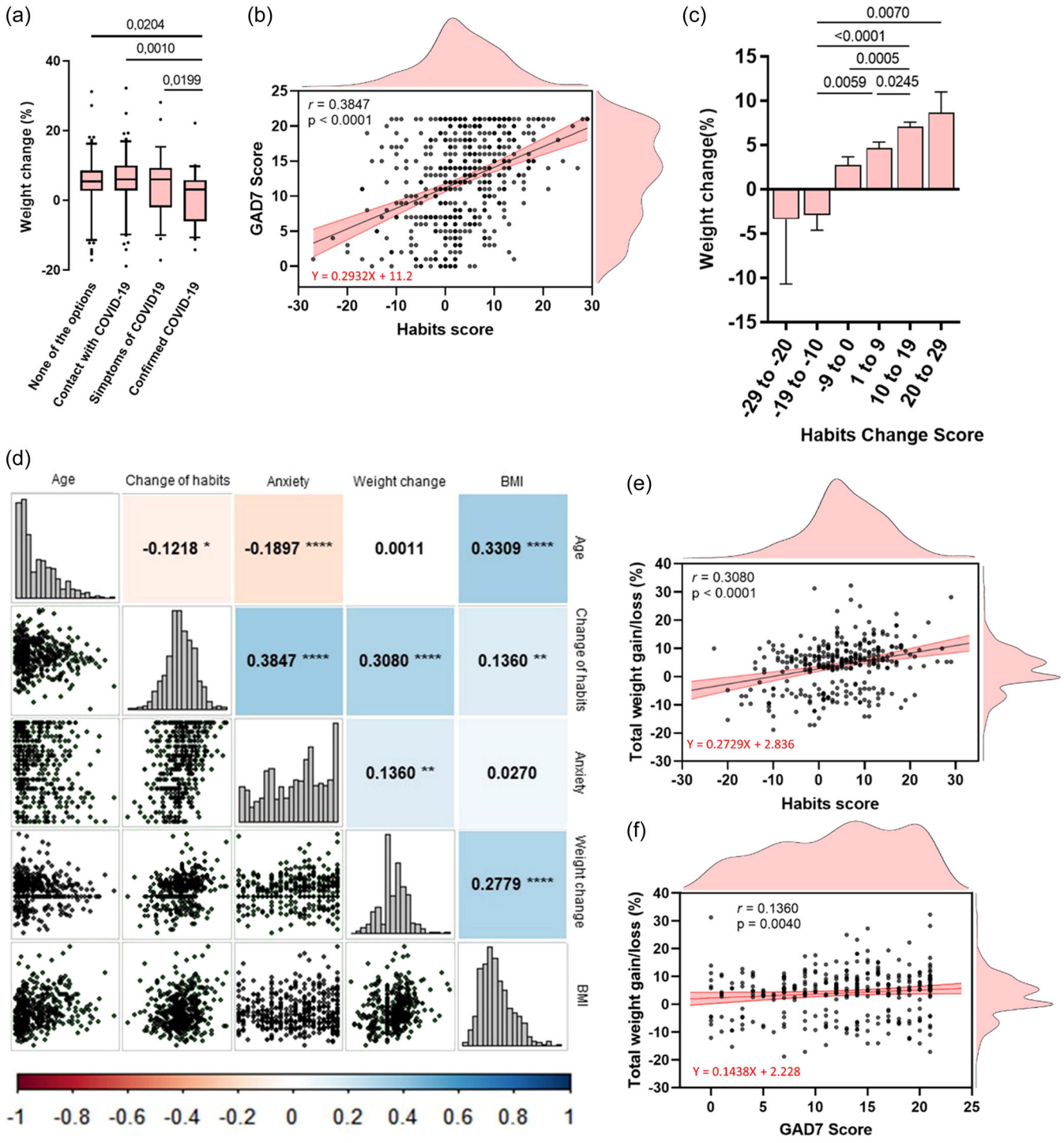

FIGURE 2 (a) Bivariate analysis of comparison between weight change and contact with patients with COVID-19. *p* Value refers to the Kruskal–Wallis test with Dunn's multiple comparison post hoc. Boxes represent median ± interquartile interval. Bars represent maximum and minimum values of the distribution ($n = 445$). (b) Scatterplot with marginal density representing the bivariate analysis of anxiety level (GAD-7 Score) about the COVID-19 pandemic and habits change. *r* and *p* value refer to Spearmans' correlation test. Red line represents simple linear regression with 95% confidence interval ($n = 480$). (c) Bivariate analysis of comparison between weight change and the habits change score. *p* Value refers to the Kruskal–Wallis test with Dunn's multiple comparison post hoc. Bars represent mean ± SEM ($n = 445$). (d) Correlogram with variables histogram (central part), summary of correlation significance (upper part) and distribution (lower part) of age, habit change score results, anxiety score results (GAD-7), total weight change and BMI. Distribution of each variable is represented with a central histogram and correlation values are represented as a range of colors, being blue the positively correlated values and red the negatively correlated values. *r* and *p* value refer to Spearmans' correlation test. *Significant correlation at 0.05 level (two tails). **Significant correlation at 0.01 level (two tails). ***Significant correlation at 0.001 level (two tails). ****Significant correlation at 0.0001 level (two tails). (e, f) Scatterplot with marginal density representing the bivariate analysis of correlation between weight change and result of the habits change score (e) or between weight change and anxiety level (GAD-7 score) considering the COVID-19 pandemic (f). *r* and *p* value refer to Spearmans' correlation test. Red line represents simple linear regression with 95% confidence interval ($n = 445$).

TABLE 4 Logistic regression analysis of participants' anxiety level (GAD-7 scores) considering the COVID-19 pandemic and relationship with demographic variables and habits change.

Predictor variables	Total (%)	POR	SE	POR 95% CI	*p* Value[a]
Age					
<20[b]	21 (4.38)	0	–		–
20–29	262 (54.58)	−0.63	0.47	(−1.55, 0.29)	0.18
30–39	104 (21.67)	−1.08	0.49	(−2.04, −0.12)	0.03
40–49	63 (13.13)	−0.93	0.51	(−1.93, 0.08)	0.07
50–59	21 (4.38)	−1.19	0.61	(−2.39, 0.01)	0.05
60–69	8 (1.67)	−1.73	0.81	(−3.32, −0.13)	0.03
70–80	1 (0.21)	0.28	1.89	(−3.42, 3.98)	0.88
Gender					
Female[b]	317 (66.04)	0	–	–	–
Male	160 (33.33)	−0.85	0.19	(−1.23, −0.48)	<0.01
Others	3 (0.62)	0.59	1.34	(−2.04, 3.22)	0.66
Marital status					
Single[b]	329 (68.54)	0	–	–	–
Maried/common-law marriage	137 (28.54)	0.01	0.26	(−0.49, 0.52)	0.96
Divorced	12 (2.50)	0.97	0.63	(−0.27, 2.21)	0.12
Widow(er)	2 (0.41)	−1.10	1.33	(−3.71, 1.51)	0.41
Family income (no. of minimum wage)					
<1	22 (4.58)	0.00	0.47	(−0.91, 0.92)	0.99
1–2	98 (20.42)	0.65	0.30	(0.05, 1.24)	0.03
2–5	163 (33.96)	0.48	0.26	(−0.03, 0.98)	0.05
5–10	92 (19.17)	0.15	0.28	(−0.39, 0.70)	0.59
>10[b]	105 (21.88)	0	–	–	–
Activity					
Graduate[b]	298 (62.08)	0	–	–	–
Postgraduate	95 (19.79)	−0.08	0.25	(−0.57, 0.41)	0.74
Postdoctoral	8 (1.67)	−0.17	0.72	(−1.58, 1.24)	0.82
Professor	79 (16.46)	0.29	0.34	(−0.37, 0.95)	0.39
Total isolation time without other presential activities					
No[b]	108 (22.50)	0	–	–	–
<3 months	106 (22.08)	0.07	0.27	(−0.46, 0.60)	0.66
3–6 months	130 (27.08)	0.55	0.26	(0.04, 1.06)	0.02
>6 months	136 (28.33)	0.24	0.26	(−0.26, 0.74)	0.27
Gain or loss of weight					
Gain of weight	257 (53.54)	0.03	0.23	(−0.42, 0.47)	0.91
Weight remained stable[b]	109 (22.70)	0	–	–	–
Lost of weight	90 (18.75)	0.03	0.25	(−0.45, 0.52)	0.89
Unknown	24 (5.00)	−0.13	0.40	(−0.92, 0.65)	0.74
Habits change (ordinal classification)					
−29 to −20	4 (0.83)	−23.72	0.00	−23.72	–

TABLE 4 (Continued)

Predictor variables	Total (%)	POR	SE	POR 95% CI	*p* Value[a]
−19 to −10	31 (6.46)	−2.18	0.78	(−3.71, −0.65)	0.01
−9 to 0	126 (26.25)	−2.35	0.71	(−3.75, − 0.96)	0.00
1 to 9	210 (43.75)	−1.44	0.70	(−2.82, −0.06)	0.04
10 to 19	96 (2.00)	−0.40	0.72	(−1.82, 1.02)	0.58
20 to 29[b]	13 (2.71)	0	–	–	–
Habits change score	–	0.10	0.04	(0.03, 0.17)	0.00

Abbreviations: CI, confidence inetrval; POR, prevalence odds ratio.

[a]Wald test.

[b]Reference group.

found between the GAD-7 result and weight variation ($r = 0.1360$; $p = 0.0040$) (Figure 2d,f). The score on the GAD-7 questionnaire was also negatively correlated with the participant's age ($r = -0.1897$; $p < 0.0001$) (Figure 2d). Finally, the current BMI was correlated exclusively with the participant's age (Figure 2d).

Altogether, our results suggest that beneficial lifestyle changes and lower GAD-7 results are related to weight stability during the COVID-19 pandemic.

3.7 | Logistic regression analysis of weight change and elevated GAD-7 scores associated factors

Finally, we employed the significantly associated variables from the initial analysis to construct an ordinal logistic regression model. This approach allowed us to evaluate the impact of independent variables and determine robust predictors of the respondents' score in the anxiety screening tool and weight change during the COVID-19 pandemic.

The results have shown that variables, such as age, gender, family income, total isolation time without in-person activities, and change in living habits have a significant impact on GAD-7 results, thus being reliable predictors. On the other hand, some factors, such as marital status, activity performed at the university, and weight change, were not considered predictors of GAD-7 scores. Finally, it was observed that the final model, disregarding the nonassociated variables, showed a good association with the participants' degree of anxiety in the model fitting criteria (final $\chi^2 = 131.87$; $p < 0.001$) (Table 4).

Regarding weight change, the variables that remained in the final model as reliable predictors of the outcome were the habits change score results, age, previous BMI, the fact that they had contact with COVID-19, symptoms or laboratory confirmation of disease, and the year of study at the university. The final best-fitted model showed a high correlation with the weight change outcome (final $\chi^2 = 83.076$; $p < 0.001$) (Table S5).

In summary, we demonstrated that specific demographic, anthropometric and lifestyle variables can be considered reliable predictors for academics' risk of anxiety and weight change amid the COVID-19 pandemic.

4 | DISCUSSION

COVID-19 has impacted the health systems and the lives of many people worldwide, proving to be a major challenge on a global scale (Noronha et al., 2020). Many studies suggest that the pandemic can affect individuals' mental health, causing the appearance of symptoms of depression and anxiety (Cao et al., 2020; Moccia et al., 2020; Odriozola-González et al., 2020).

In this pandemic scenario, the academic population shows a propensity to increased levels of anxiety due to the interruption of their activities, social isolation, and lifestyle changes (Chen et al., 2020; Odriozola-González et al., 2020; Perz et al., 2022; Son et al., 2020). Thus, we sought to address the topic by using an anxiety screening test and monitoring changes in weight and life habits of the academic community of the State of Rio de Janeiro, to find possible associated factors that can contribute to predict and prevent the development of anxiety disorders, as well as the worsening in the anthropometric profile. Also, we assessed the possible effects of the pandemic and its associated lifestyle changes on participants' mental health and weight.

Surprisingly, our results showed that 65.63% of respondents have moderate or severe anxiety levels. This proportion is much higher than previous findings in other studies using the same GAD-7 questionnaire (Cao et al., 2020; Faisal et al., 2022; Liu et al., 2020). For example, Faisal et al. (2022) interviewed, during the COVID-19 outbreak, 879 university students from Bangladesh. They found that 40% of the students presented moderate to severe anxiety levels.

It is known that the workload within the academic community constitutes a significant risk factor for anxiety, particularly during examination and assessment periods (Scholz et al., 2016). In this study, data collection occurred at the conclusion of the academic period, coinciding with the semesters final exams in some universities. Hence, it is important to consider that the exam-related

periodicity of academics' anxiety may play a role in the elevated anxiety phenotype observed in this study.

In this context, we observed noticeably higher GAD-7 scores in our cohort than those reported in previous studies conducted before the COVID-19 pandemic. Notably, Evans et al. (2018) used the same GAD-7 questionnaire to assess anxiety risk in graduate students from 26 different countries. They found that 39% of the participants exhibited moderate to severe anxiety. Interestingly, these values were more than six times higher than the 6% prevalence in the general population (Evans et al., 2018). These findings suggest that this populational subgroup of the academic community is particularly susceptible to the psychological distress caused by the COVID-19 pandemic.

Another group that showed increased levels of psychological distress associated with the pandemic comprises healthcare professionals, notably frontline doctors (Chaix et al., 2020; Conversano et al., 2020; Jacintho Barbosa et al., 2020; Petzold et al., 2020; Qiu et al., 2020; Shacham et al., 2020). A similar pattern is observed in the case of medical students, who exhibit higher baseline levels of anxiety and depression compared to the age-matched population, and even university students from other fields (Dyrbye et al., 2006).

Notably, a multicenter study assessed the prevalence of anxiety in Brazilian medical students, involving 1650 students from 22 universities. The researchers employed the State-Trait Anxiety Inventory, a tool that assesses both state and trait anxiety symptoms, categorizing them into three groups based on scores: low (<33), medium (33–49), and high (>49). Their findings revealed that 81.7% of participants had medium to high state-anxiety symptoms (Brenneisen Mayer et al., 2016). Altogether, these results underline a pronounced vulnerability to anxiety disorders within the medical student population and, to an even greater extent, among Brazilians. Within our studied cohort, we identified a substantial portion of participants from healthcare-related programs, including medical students. This may also be related to the elevated level of anxiety observed in this cohort.

Interestingly, the high anxiety levels experienced by the academic community found in our study seem to be consistent with the interruption of academic activities. This observation can be explained by increased risks of contamination of the participants that maintain their activities, hence more susceptibility of COVID-19 mediated fear and anxiety (Rodríguez-Hidalgo et al., 2020).

In addition, we established a correlation between age, gender, family income, and academic engagement with GAD-7 results. Our data indicated that young age, female gender, and low income are associated factors and serve as good predictors for moderate and severe anxiety scores, as confirmed by the multivariate regression analysis. Furthermore, our results are in line with the findings of Fu et al. (2021), who showed that female students have higher levels of anxiety when compared to male students. Moreover, previous investigations have demonstrated that female students have a higher baseline prevalence of psychiatric comorbidities such as panic disorder, compulsive obsessive disorder, and posttraumatic stress disorder (Kessler et al., 1994), as well as higher scores on anxiety scales when compared to men, both in Brazil (Brenneisen Mayer et al., 2016; Teixeira-Silva et al., 2008) and in other countries (Eaton et al., 2012).

Regarding academic activity, our data indicates that professors had lower levels of anxiety than undergraduate students. This result may be related to a usually older age and higher family income in this studied subgroup of professors. This observation aligns with recent research conducted by Odriozola-González et al. (2020), who examined students and workers in a Spanish university.

Interestingly, we did not observe an important relationship between the region and living conditions with trait anxiety applying the GAD-7 questionnaire. This data is also compatible with what is presented in the existing literature, which shows that housing conditions do not tend to be a mediating factor of anxiety and emotional dysregulation in the university population (Franzoi et al., 2020).

Many studies have identified changes in lifestyle as one of the main consequences of the COVID-19 pandemic that leads to the development of physical and mental health problems (King et al., 2020; Kumari et al., 2020; Son et al., 2020). Worldwide surveys showed that eating behavior, smoking burden, alcohol consumption, and physical activity are the habits most strongly affected during the isolation period by the COVID-19 pandemic (Conversano et al., 2020; Fu et al., 2021; Odriozola-González et al., 2020). In this context, King et al. (2020) showed that an unhealthy diet, increase in weight, decreased physical activity and unsatisfactory sleep can act synergistically on the development of cardiometabolic diseases, and anxiety episodes. However, up to date, little has been demonstrated about the impact of these unhealthy habits on the incidence of psychiatric disorders such as anxiety levels in the academic community.

For this reason, we shed light on how weight variation and lifestyle change can be intimately correlated with anxiety levels. Our results revealed that a majority of the respondents reported weight gain during the COVID-19 pandemic, in agreement with recent studies (Kumari et al., 2020; Sidor & Rzymski, 2020). It is also notable that we found a correlation between GAD-7 scores and weight variation. Participants who presented higher levels of anxiety also reported greater weight gain when compared to less anxious participants who managed to maintain weight stability.

Recently, instruments to objectively assess the mentioned changes in lifestyle have been studied and validated. The method used by Kumari and colleagues was shown to be one of the most reliable so far (Kumari et al., 2020). Using this proposed questionnaire, our results showed that these changes may be strongly related to the impacts on mental health. This impact seems to be even more relevant than factors such as having contact with cases of suspected/confirmed COVID-19 itself. These findings are especially interesting because, by identifying a modifiable factor that is associated with anxiety levels, it is possible to propose strategies to improve this condition. Our findings suggest that maintenance of healthy lifestyle behaviors during the time of seclusion, such as the regular practice of physical activities, a balanced diet, lower stress levels, and solid family

support might be strategic ways to control the development of anxiety disorders in this studied population.

Several groups have been dedicated to researching and validating strategies to promote resilience and constrain psychological distress. Some of these strategies encompass individual self-care actions and emotional well-being practices, such as physical exercising, sleep hygiene, and mindfulness exercises (Conversano et al., 2020). In a collective approach, universities can take proactive steps in implementing pedagogical initiatives. Promising strategies include computer-based resilience training, educational sessions with a focus on resilience, social activities online, the formation of psychological first aid groups, and the establishment of psychosocial pandemic committees (Ruggieri et al., 2021).

Our findings serve as a warning to those who remain restricted to invest their efforts in maintaining a healthy lifestyle with regular activities, healthy diet, and stress management measures. Although more studies are needed to clarify and quantify the impact of these factors in more detail, our work may have a significant impact on individual and collective decisions to improve the quality of life of the university community during future pandemic scenarios.

Regarding the limitations of this study, we first mean to highlight an intrinsic characteristic of the cross-sectional study. The results obtained suggest associations between epidemiological factors and are naturally a subject to confounding biases, as well as the possibility of reverse causalities. Therefore, the results should not be extrapolated to determine causality without supplementary information from the scientific literature (Flanders et al., 1992).

Thus, more longitudinal studies are needed to address the question of causal relationships between anxiety, weight gain, and changes in lifestyle during the COVID-19 pandemic. However, the present study raises hypotheses, based on the data collected, about an intimate relationship between the three factors anxiety, weight variation, and lifestyle changes that may play an important role in the notorious worsening of the quality of life of the population in this pandemic period (Tahoun et al., 2023).

Regarding the representativeness of the sample and the convenience-based recruitment method employed in this study, it is crucial to acknowledge the potential for selection bias. While self-selecting sampling strategies have been well-validated in the health science, it is well-documented that there is a tendency for outcome overestimation within such studies. Therefore, the need for validating the sample's appropriateness for the target population is recognized (Søgaard, et al., 2004).

Interestingly, the population in this study exhibited demographic and social characteristics compatible with those of the academic population in Rio de Janeiro. We observed a predominance of young, middle-class individuals from the metropolitan region. Nevertheless, the heterogeneity within the regions of Rio de Janeiro and especially across Brazil renders the extrapolation of results susceptible to variations in populations from other regions. These variations may involve differing demographic compositions and even distinct levels of baseline anxiety within the university population (Gama et al., 2008).

However, it is important to highlight the overrepresentation of university professors in our sample. We found that professors accounted for 16.46% of the sample, whereas according to census data they represent only 4% of the university population (INEP, 2019). Given that the subgroup of professors in our study presented milder GAD-7 results, we posit anxiety scores in the wider university population may be severer than the findings observed in this study.

Finally, when considering the limitations associated with the measurement methods used, self-reported weight and height can exhibit notorious variability among participants, as well as a potential bias toward overestimating height, as reported in previous studies (Avila-Funes et al., 2004; Lucca & Moura, 2010). However, it is considered an acceptable method of anthropometric assessment in epidemiological health sciences (Avila-Funes et al., 2004). It correlated well with actual weight and height measured in a study of a British cohort conducted by EPIC-Oxford (Spencer et al., 2002) and is in agreement with actual measurements of BMI among both sexes (Lucca & Moura, 2010). It has greater accuracy in individuals <75 years old (Avila-Funes et al., 2004; Spencer et al., 2002), where 99.79% of our study population is found in.

Regarding the GAD-7 questionnaire, it is widely validated and applied in clinical practice as one of the best-performing scales for screening anxiety in various at-risk populations (Spitzer et al., 2006 and Herr et al., 2014). Notably, Spitzer et al. achieved an optimized sensitivity of 89% and specificity of 82% regarding the GAD-7 questionnaire while screening for anxiety disorders. Despite its accuracy, the GAD-7 serves as a screening tool however, as such, it is not sufficient for diagnosing mental disorders according to the DSM criteria (American Psychiatric Association, 2013). Thus, results obtained through this questionnaire should be carefully interpreted as an assessment of the likelihood of participants having excess anxiety.

5 | CONCLUSIONS

The university community in Rio de Janeiro is contending with critical levels of anxiety during the period of the COVID-19 pandemic, which has not been definitively overcome. This study showed that the main factors associated with this condition were young age, female gender, low family income, weight gain, and negative changes in lifestyle habits. Our work highlights this alarming problem and provides some relevant background information as tools for addressing the mental health challenges experienced by the academic community on both personal and societal levels. It has the purpose of mobilizing and guiding university initiatives toward the provision of mental health support to students and professors, particularly to those who are at an elevated risk of mental health distress.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Felipe Saceanu Leser https://orcid.org/0000-0002-7499-2765
Mirella Araújo Ribeiro http://orcid.org/0000-0003-4961-2895
Lucas Dalsente Romano da Silva https://orcid.org/0000-0001-6078-4247
Renato Garcia Domingues http://orcid.org/0000-0003-3747-4069
Tiago Fleming Outeiro http://orcid.org/0000-0003-1679-1727
Kevin Boyé http://orcid.org/0000-0002-5749-959X
Eduardo Coelho Cerqueira http://orcid.org/0000-0001-8944-7922
Fabiano Lacerda Carvalho http://orcid.org/0000-0003-4961-9763
Phelippe do Carmo Gonçalves http://orcid.org/0000-0002-6971-3194

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/mhs2.48.

REFERENCES

Al Kaabi, N., Zhang, Y., Xia, S., Yang, Y., Al Qahtani, M. M., Abdulrazzaq, N., Al Nusair, M., Hassany, M., Jawad, J. S., Abdalla, J., Hussein, S. E., Al Mazrouei, S. K., Al Karam, M., Li, X., Yang, X., Wang, W., Lai, B., Chen, W., Huang, S., … Yang, X. (2021). Effect of 2 inactivated SARS-CoV-2 vaccines on symptomatic COVID-19 infection in adults: A randomized clinical trial. *Journal of the American Medical Association*, *326*(1), 35–45. https://doi.org/10.1001/JAMA.2021.8565

American Psychiatric Association. (2013). *Anxiety disorders: Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Avila-Funes, J. A., Gutiérrez-Robledo, L. M., & Ponce De Leon Rosales, S. (2004). Validity of height and weight self-report in Mexican adults: Results from the national health and aging study. *Journal of Nutrition, Health & Aging*, *8*(5), 355–361.

Banerjee, D., Kosagisharaf, J. R., & Sathyanarayana Rao, T. S. (2021). The dual pandemic' of suicide and COVID-19: A biopsychosocial narrative of risks and prevention. *Psychiatry Research*, *295*, 113577. https://doi.org/10.1016/J.PSYCHRES.2020.113577

Barouch, D. H. (2022). Covid-19 vaccines—Immunity, variants, boosters. *New England Journal of Medicine*, *387*(11), 1011–1020. https://doi.org/10.1056/NEJMra2206573

Brenneisen Mayer, F., Souza Santos, I., Silveira, P. S. P., Itaqui Lopes, M. H., De Souza, A. R. N. D., Campos, E. P., De Abreu, B. A. L., Hoffman, II, I., Magalhães, C. R., Lima, M. C. P., Almeida, R., Spinardi, M., & Tempski, P. (2016). Factors associated to depression and anxiety in medical students: A multicenter study. *BMC Medical Education*, *16*(1), 282. https://doi.org/10.1186/s12909-016-0791-1

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*, *287*, 112934. https://doi.org/10.1016/J.PSYCHRES.2020.112934

Chaix, B., Delamon, G., Guillemassé, A., Brouard, B., & Bibault, J.-E. (2020). Psychological distress during the COVID-19 pandemic in France: A national assessment of at-risk populations. *General Psychiatry*, *33*:100349. https://doi.org/10.1136/gpsych-2020-100349

Charles, N. E., Strong, S. J., Burns, L. C., Bullerjahn, M. R., & Serafine, K. M. (2021). Increased mood disorder symptoms, perceived stress, and alcohol use among college students during the COVID-19 pandemic. *Psychiatry Research*, *296*, 113706. https://doi.org/10.1016/J.PSYCHRES.2021.113706

Chen, R., Liang, S., Peng, Y., Li, X., Chen, J., Tang, S., & Zhao, J. (2020). Mental health status and change in living rhythms among college students in China during the COVID-19 pandemic: A large-scale survey. *Journal of Psychosomatic Research*, *137*, 110219. https://doi.org/10.1016/J.JPSYCHORES.2020.110219

Cochran, W. G. (1954). The combination of estimates from different experiments. *Biometrics*, *10*, 101–129. https://doi.org/10.2307/3001666

Conversano, C., Marchi, L., & Miniati, M. (2020). Psychological distress among healthcare professionals involved in the COVID-19 emergency: Vulnerability and resilience factors. *Clinical Neuropsychiatry*, *17*(2), 94–96. https://doi.org/10.36131/CN20200212

Dhira, T. A., Rahman, M. A., Sarker, A. R., & Mehareen, J. (2021). Validity and reliability of the Generalized Anxiety Disorder-7 (GAD-7) among university students of Bangladesh. *PLoS One*, *16*(12), e0261590. https://doi.org/10.1371/journal.pone.0261590

Dyrbye, L. N., Thomas, M. R., & Shanafelt, T. D. (2006). Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. *Academic Medicine*, *81*(4), 354–373.

Eaton, N. R., Keyes, K. M., Krueger, R. F., Balsis, S., Skodol, A. E., Markon, K. E., Grant, B. F., & Hasin, D. S. (2012). An invariant dimensional liability model of gender differences in mental disorder prevalence: Evidence from a national sample. *Journal of Abnormal Psychology*, *121*(1), 282–288. https://doi.org/10.1037/a0024780

Evans, T. M., Bira, L., Gastelum, J. B., Weiss, L. T., & Vanderford, N. L. (2018). Evidence for a mental health crisis in graduate education. *Nature Biotechnology*, *36*(3), 282–284. https://doi.org/10.1038/nbt.4089

Faisal, R. A., Jobe, M. C., Ahmed, O., & Sharker, T. (2022). Mental health status, anxiety, and depression levels of Bangladeshi university students during the COVID-19 pandemic. *International Journal of Mental Health and Addiction*, *20*(3), 1500–1515. https://doi.org/10.1007/s11469-020-00458-y

Fisher, R. A. (1925). *Statistical methods for research workers* (11th ed. rev.). Oliver and Boyd.

Flanders, W. D., Lin, L., Pirkle, J. L., & Caudill, S. P. (1992). Assessing the direction of causality in cross-sectional studies. *American Journal of Epidemiology*, *135*(8), 926–935. https://doi.org/10.1093/oxfordjournals.aje.a116388

Franzoi, I. G., Sauta, M. D., & Granieri, A. (2020). State and trait anxiety among university students: A moderated mediation model of negative affectivity, alexithymia, and housing conditions. *Frontiers in Psychology*, *11*, 1255. https://doi.org/10.3389/fpsyg.2020.01255

Fu, W., Yan, S., Zong, Q., Anderson-Luxford, D., Song, X., Lv, Z., & Lv, C. (2021). Mental health of college students during the COVID-19 epidemic in China. *Journal of Affective Disorders*, *280*, 7–10. https://doi.org/10.1016/J.JAD.2020.11.032

Gama, M. M. A., Moura, G. S., Araújo, R. F., & Teixeira-Silva, F. (2008). Ansiedade-traço em estudantes universitários de Aracaju (SE). *Revista de Psiquiatria do Rio Grande do Sul*, *30*(1), 19–24. https://doi.org/10.1590/S0101-81082008000100007

Herr, N. R., Williams, Jr. J. W., Benjamin, S., & McDuffie, J. (2014). Does this patient have generalized anxiety or panic disorder?: The rational clinical examination systematic review. *Journal of the American Medical Association*, *312*(1), 78–84. https://doi.org/10.1001/jama.2014.5950

Huckins, J. F., da Silva, A. W., Wang, W., Hedlund, E., Rogers, C., Nepal, S. K., Wu, J., Obuchi, M., Murphy, E. I., Meyer, M. L., Wagner, D. D., Holtzheimer, P. E., & Campbell, A. T. (2020). Mental health and behavior of college students during the early phases of the COVID-19 pandemic: Longitudinal smartphone and ecological momentary assessment study. *Journal of Medical Internet Research*, *22*(6), e20185. https://doi.org/10.2196/20185

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira | (INEP). (2019). Censo da Educação Superior. https://www.gov.br/inep/pt-br/areas-de-atuacao/pesquisas-estatisticas-e-indicadores/censo-da-educacao-superior/resultados

Jacintho Barbosa, D., Pereira Gomes, M., Barbosa Assumpção de Souza, F., & Marcos Tosoli Gomes, A. (2020). Vista do Fatores de estresse nos profissionais de enfermagem no combate à pandemia da COVID-19. *Reports in Health Science*, *31*(1), 31–47. https://revistaccs.escs.edu.br/index.php/comunicacaoemcienciasdasaude/article/view/651/291

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshleman, S., Wittchen, H. U., & Kendler, K. S. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from The National Comorbidity Survey. *Archives of General Psychiatry*, *51*(1), 8–19. http://archpsyc.jamanetwork.com/

Killgore, W. D. S., Cloonan, S. A., Taylor, E. C., Lucas, D. A., & Dailey, N. S. (2020). Loneliness during the first half-year of COVID-19 lockdowns. *Psychiatry Research*, *294*, 113551. https://doi.org/10.1016/J.PSYCHRES.2020.113551

King, A. J., Burke, L. M., Halson, S. L., & Hawley, J. A. (2020). The challenge of maintaining metabolic health during a global pandemic. *Sports Medicine*, *50*(7), 1233–1241. https://doi.org/10.1007/S40279-020-01295-8

Kumari, A., Ranjan, P., Vikram, N. K., Kaur, D., Sahu, A., Dwivedi, S. N., Baitha, U., & Goel, A. (2020). A short questionnaire to assess changes in lifestyle-related behaviour during COVID 19 pandemic. *Diabetes & Metabolic Syndrome*, *14*(6), 1697–1701. https://doi.org/10.1016/J.DSX.2020.08.020

Li, S., Wang, Y., Xue, J., Zhao, N., & Zhu, T. (2020). The impact of COVID-19 epidemic declaration on psychological consequences: A study on active Weibo users. *International Journal of Environmental Research and Public Health*, *17*(6), 2032. https://doi.org/10.3390/IJERPH17062032

Liu, J., Zhu, Q., Fan, W., Makamure, J., Zheng, C., & Wang, J. (2020). Corrigendum: Online mental health survey in a medical college in China during the COVID-19 outbreak. *Frontiers in Psychiatry*, *11*, 459. https://doi.org/10.3389/FPSYT.2020.00459

Lucca, A., & Moura, E. C. (2010). Validity and reliability of selfreported weight, height and body mass index from telephone interviews. *Cadernos de Saúde Pública*, *26*(1), 110–122.

Martinez-Ferran, M., de La Guía-Galipienso, F., Sanchis-Gomar, F., & Pareja-Galeano, H. (2020). Metabolic impacts of confinement during the COVID-19 pandemic due to modified diet and physical activity habits. *Nutrients*, *12*(6), 1549. https://doi.org/10.3390/nu12061549

Moccia, L., Janiri, D., Pepe, M., Dattoli, L., Molinaro, M., de Martin, V., Chieffo, D., Janiri, L., Fiorillo, A., Sani, G., & di Nicola, M. (2020). Affective temperament, attachment style, and the psychological impact of the COVID-19 outbreak: An early report on the Italian general population. *Brain, Behavior, and Immunity*, *87*, 75–79. https://doi.org/10.1016/J.BBI.2020.04.048

National Institutes of Health. (1998). Executive summary. *Obesity Research*, *6*(S2), 51S–179S. https://doi.org/10.1002/J.1550-8528.1998.TB00690.X

Navarro-Cruz, A. R., Kammar-García, A., Mancilla-Galindo, J., Quezada-Figueroa, G., Tlalpa-Prisco, M., Vera-López, O., Aguilar-Alonso, P., Lazcano-Hernández, M., & Segura-Badilla, O. (2021). Association of differences in dietary behaviours and lifestyle with self-reported weight gain during the COVID-19 lockdown in a university community from Chile: A cross-sectional study. *Nutrients*, *13*(9), 3213. https://doi.org/10.3390/nu13093213

Nemet, I., Kliker, L., Lustig, Y., Zuckerman, N., Erster, O., Cohen, C., Kreiss, Y., Alroy-Preis, S., Regev-Yochay, G., Mendelson, E., & Mandelboim, M. (2022). Third BNT162b2 vaccination neutralization of SARS-CoV-2 omicron infection. *New England Journal of Medicine*, *386*(5), 492–494. https://doi.org/10.1056/NEJMc2119358

Noronha, K. V. M. S., Guedes, G. R., Turra, C. M., Andrade, M. V., Botega, L., Nogueira, D., Calazans, J. A., Carvalho, L., Servo, L., & Ferreira, M. F. (2020). Pandemia por COVID-19 no Brasil: análise da demanda e da oferta de leitos hospitalares e equipamentos de ventilação assistida segundo diferentes cenários. *Cadernos de Saúde Pública*, *36*(6), e00115320. https://doi.org/10.1590/0102-311X00115320

Odriozola-González, P., Planchuelo-Gómez, Á., Irurtia, M. J., & de Luis-García, R. (2020). Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. *Psychiatry Research*, *290*, 113108. https://doi.org/10.1016/J.PSYCHRES.2020.113108

Perz, C. A., Lang, B. A., & Harrington, R. (2022). Validation of the Fear of COVID-19 Scale in a US college sample. *International Journal of Mental Health and Addiction*, *20*(1), 273–283. https://doi.org/10.1007/S11469-020-00356-3/TABLES/3

Petzold, M. B., Bendau, A., Plag, J., Pyrkosch, L., Mascarell Maricic, L., Betzler, F., Rogoll, J., Große, J., & Ströhle, A. (2020). Risk, resilience, psychological distress, and anxiety at the beginning of the COVID-19 pandemic in Germany. *Brain and Behavior*, *10*(9), e01745. https://doi.org/10.1002/BRB3.1745

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *General Psychiatry*, *33*, 100213. https://doi.org/10.1136/gpsych-2020-100213

Rodríguez-Hidalgo, A. J., Pantaleón, Y., Dios, I., & Falla, D. (2020). Fear of COVID-19, stress, and anxiety in university undergraduate students: A predictive model for depression. *Frontiers in Psychology*, *11*, 591797. https://doi.org/10.3389/fpsyg.2020.591797

Ruggieri, S., Ingoglia, S., Bonfanti, R. C., & lo Coco, G. (2021). The role of online social comparison as a protective factor for psychological wellbeing: A longitudinal study during the COVID-19 quarantine. *Personality and Individual Differences*, *171*, 110486. https://doi.org/10.1016/J.PAID.2020.110486

Santana, J. M., Milagres, M. P., Silva Dos Santos, C., Brazil, J. M., Lima, E. R., & Pereira, M. (2021). Dietary intake of university students during COVID-19 social distancing in the northeast of Brazil and associated factors. *Appetite*, *162*, 105172. https://doi.org/10.1016/j.appet.2021.105172

Santos, W. G. (2020). Natural history of COVID-19 and current knowledge on treatment therapeutic options. *Biomedicine & Pharmacotherapy*, *129*, 110493. https://doi.org/10.1016/J.BIOPHA.2020.110493

Scholz, M., Neumann, C., Ropohl, A., Paulsen, F., & Burger, P. H. M. (2016). Risk factors for mental disorders develop early in German students of dentistry. *Annals of Anatomy*, *208*, 204–207. https://doi.org/10.1016/j.aanat.2016.06.004

Shacham, M., Hamama-Raz, Y., Kolerman, R., Mijiritsky, O., Ben-Ezra, M., & Mijiritsky, E. (2020). COVID-19 factors and psychological factors associated with elevated psychological distress among dentists and dental hygienists in Israel. *International Journal of Environmental Research and Public Health*, *17*(8), 2900. https://doi.org/10.3390/IJERPH17082900

Sidor, A., & Rzymski, P. (2020). Dietary choices and habits during COVID-19 lockdown: Experience from Poland. *Nutrients*, *12*(6), 1657. https://doi.org/10.3390/NU12061657

Singanayagam, A., Hakki, S., Dunning, J., Madon, K. J., Crone, M. A., Koycheva, A., Derqui-Fernandez, N., Barnett, J. L., Whitfield, M. G., Varro, R., Charlett, A., Kundu, R., Fenn, J., Cutajar, J., Quinn, V., Conibear, E., Barclay, W., Freemont, P. S., Taylor, G. P., … Lackenby, A. (2022). Community transmission and viral load kinetics of the SARS-CoV-2 delta (B.1.617.2) variant in vaccinated and unvaccinated individuals in the UK: A prospective, longitudinal, cohort study. *The Lancet Infectious Diseases*, *22*, 183–195. https://doi.org/10.1016/S1473-3099(21)00648-4

Son, C., Hegde, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *Journal of Medical Internet Research*, *22*(9), E21279. https://doi.org/10.2196/21279

Soysal, A. N. O., Şimşek, Ş., Özdemir, A. K., & Aslan, U. B. (2023). The effect of the COVID-19 pandemic on weight gain, physical activity and mental health among Turkish university students. *Work*, *74*(2), 415–424. https://doi.org/10.3233/WOR-211161

Spencer, E. A., Appleby, P. N., Davey, G. K., & Key, T. J. (2002). Validity of self-reported height and weight in 4808 EPIC-Oxford participants. *Public Health Nutrition*, *5*(4), 561–565. https://doi.org/10.1079/PHN2001322

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097. https://doi.org/10.1001/ARCHINTE.166.10.1092

Søgaard, A. J., Selmer, R., Bjertness, E., & Thelle, D. (2004). The Oslo Health Study: The impact of self-selection in a large, population-based survey. *International journal for equity in health*, *3*(1), 3. https://doi.org/10.1186/1475-9276-3-3

Tahoun, M. M., Ismail, H. M., Fiidow, O. A., Ashmawy, R., Hammouda, E. A., Elbarazi, I., & Ghazy, R. M. (2023). Quality of life among the Arab population two years after COVID-19 pandemic. *BMC Public Health*, *23*: 1268. https://doi.org/10.1186/s12889-023-16171-z

Teixeira-Silva, F., Magalhães, M., Gama, A., Souza Moura, G., & Araújo, R. F. (2008). Ansiedade-traço em universitários-GAMA ET AL. Artigo original Ansiedade-traço em estudantes universitários de Aracaju (SE) Trait anxiety in Brazilian university students from Aracaju. *Revista de Psiquiatria do Rio Grande do Sul*, *30*(Issue 1), 19–24.

Werneck, G. L., & Carvalho, M. S. (2020). A pandemia de COVID-19 no Brasil: crônica de uma crise sanitária anunciada. *Cadernos de Saúde Pública*, *36*(5), e00068820. https://doi.org/10.1590/0102-311X00068820

Wiersinga, W. J., Rhodes, A., Cheng, A. C., Peacock, S. J., & Prescott, H. C. (2020). Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): A review. *Journal of the American Medical Association*, *324*(8), 782–793. https://doi.org/10.1001/JAMA.2020.12839

World Health Organization (WHO). (2000). *Obesity: Preventing and managing the global epidemic: Report of a WHO consultation*. World Health Organization. https://apps.who.int/iris/handle/10665/42330

World Health Organization (WHO). (n.d.). WHO Coronavirus (COVID-19) Dashboard | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data. https://covid19.who.int/

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Leser, F. S., Araújo Ribeiro, M., Dalsente Romano da Silva, L., Garcia Domingues, R., Fleming Outeiro, T., Boyé, K., Coelho Cerqueira, E., Lacerda Carvalho, F., & do Carmo Gonçalves, P. (2023). The relationship between anxiety and COVID-19-associated isolation and lifestyle changes in the university community as a result of the SARS-CoV-2 pandemic. *Mental Health Science*, 1–16. https://doi.org/10.1002/mhs2.48