A Comparative Study of Mental Health, Body Composition, and Physical Activity in American vs. Romanian College Students Post-COVID-19 Lockdown

Original Research

Manuela C. Caciula[1], Luis Torres[2], Simion A. Tomoioaga[3]

[1]Department of Population Health and Exercise Science, New Jersey City University, Jersey City, New Jersey; U.S.A.
[2] Department of Exercise Science and Physical Education, Montclair State University, Montclair, New Jersey; U.S.A.
[3] Department of Accounting, Business, Analytics, CIS, and Law, Manhattan College, New York City, New York; U.S.A.

Abstract

Introduction: The COVID-19 pandemic and its lockdown restrictions forced college students to spend less time on campuses and more time indoors at home, increasing their sedentary behaviors. We aimed to better understand trends among assumed decreased physical activity levels, increased mental health symptoms, and increased poor nutritional habits. The results will serve healthcare clinicians in developing targeted interventions for improving overall health in college students. **Methods:** American college students ($n = 90$) and Romanian college students ($n = 85$) were assessed for current self-reported levels of physical activity, mental health symptoms, and body composition values in the post-COVID-19 lockdown era. **Results:** All participants ($N = 185$; 100 females) reported being highly active (82.3%) and experiencing a current level of heightened depressive and anxious symptomatology (58.2%). Differences were seen between the measured body fat percentages (BF) and skeletal muscle masses (SKMM) of the American (BF: males 26.66 $\pm$ 12.24%, females 32.88 $\pm$ 10.13%) and Romanian (BF: males 11.76 $\pm$ 6.68%, females 18.07 $\pm$ 9.30%) college students. Despite these differences, all participants collectively displayed a positive relationship between depressive and anxious symptomatology and BF ($R = 0.23$; $p = 0.0018$) and a negative relationship between depressive and anxious symptomatology and SKMM ($R = -0.15$; $p = 0.04$). **Conclusions:** Although cultural differences may help to explain the found differences among body fat percentages and skeletal muscle masses, both groups of college students did similarly struggle with symptoms of depression and anxiety. The post-lockdown coping mechanisms embraced by both groups of college students have not been fully effective in improving their mental health.

Key Words: body fat, depression, anxiety

Corresponding author: Manuela C. Caciula - mcaciula@njcu.edu

Introduction

The COVID-19 pandemic has brought unprecedented changes to the lives of college students worldwide, particularly in terms of social interactions, academic routines, and lifestyle. The transition from in-person classes to online learning

has diminished the social and emotional support that college students traditionally receive from friends, family, peers, and professors. Various studies have highlighted that reduced support systems can contribute to an increase in mental health problems among students.[1,2] The COVID-19 lockdown further exacerbated social isolation and resulted in escalated rates of depressive and anxiety disorder among undergraduate college students.[4,5,6]

Regional differences further emphasized the impact of the pandemic on students' mental health. French university students in Eastern France, an area heavily affected by COVID-19, reported elevated levels of depression (43%), anxiety (31%), and distress (43%).[4] Similarly, Chinese students reported severe levels of acute stress (35%), depression (21%), and anxiety (11%).[7] Additionally, in a study conducted by Torres et al.[8] at a four-year public institution in the United States, 58% of the participants reported heightened depressive and anxiety symptomatology. Similarly, a study conducted by Silisteanu et al.[9] revealed a notable upsurge in anxiety levels among Romanian students in response to the physical restrictions, quarantine, and self-isolation imposed during the COVID-19 lockdown. The study documented heightened reporting of affective, cognitive, behavioral, and physical symptoms.

Beyond mental health challenges, social isolation, a sedentary lifestyle, and the lack of physical activity have emerged as significant factors influencing students' well-being. Findings indicated an increase in food consumption and unhealthy habits, such as alcohol and tobacco use, or experiencing insomnia.[9] The shift to remote learning has contributed to an increase in sedentary behavior, with a larger proportion of students spending extended periods in front of electronic devices.[10,11] Notably, increased screen time and reduced physical activity were found to be associated with unhealthy dietary habits.[12] These alterations in diet and physical activity during the COVID-19 pandemic have contributed to changes in the body weight of students. A significant proportion of college students experienced weight gain, particularly those with pre-existing overweight conditions.[13]

The post-COVID lockdown coping mechanisms have made progress in addressing some of the physical and mental health challenges faced by college students. Some approaches include increased awareness, remote counseling centers, online support communities and flexible academic policies.[14,15,16] Additionally, many institutions have introduced wellness programs that focus on promoting healthy lifestyles, stress management techniques, mindfulness practices, and physical activities. [17] However, the post-lockdown coping mechanisms have not fully addressed the mental health challenges faced by college students, especially in relation to regional and cultural differences. Furthermore, the correlation between mental health, physical activity levels and body composition has not been fully explored and understood. Our study aimed to identify potential cultural differences between American and Romanian students that could explain assumed decreased physical activity levels, increased mental health symptoms, and increased poor nutritional habits in the post Covid-19 lockdown era.

Methods

Using a cross-sectional study design, data was collected from two separate groups of college students starting in November 2022 and ending in May 2023. The first group of college students consisted of undergraduate students enrolled at a 4-year public university located in New Jersey, United States. The second group of college students consisted of undergraduate students enrolled at a 4-year year public university located in central Romania. The study was advertised to students of all majors through email, flyers, and personal in-class pleas from associated faculty. Once students agreed to participate in this study, they were scheduled for a testing session at their respective testing location and provided with messaging via email that instructed them to avoid exercise and food intake for at least 3 hours prior to testing, avoid alcohol and caffeine intake for at least 24 hours prior to testing, and refrain from using the shower or sauna immediately before testing. These instructions were crucial to reduce confounding factors in body composition assessments.[18] Upon arrival at their testing session, participants were provided with a paper informed consent form approved by the university IRB committee, and then a demographic questionnaire via a google form that was accessed with the use of a QR code. After completion of the demographic data, participants were provided with the Hospital Anxiety and Depression Scale (HADS) and the International Physical Activity Questionnaire - Long Form (IPAQ-LF). These instruments allowed the collection of self-reported mental health symptoms and self-reported physical activity levels, respectively.

The HADS[19] is a 14-item questionnaire designed to measure symptoms of depression and anxiety and it consists of a 7-item subscale for depression (HADS-D) and another 7-item subscale for anxiety (HADS-A). Each item on the questionnaire is individually scored on a scale from 0 to 3 with high scores indicating a higher level of symptom frequency. The combined symptom scores can range from 0 to 42. Scores of 11 or higher indicate a clinically significant mood disorder (i.e., depression or anxiety) and scores that range from 0 to 8, from 9 to 11, and 11 or higher coincide

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with normal, borderline, and abnormal HADS categories, respectively. The HADS boasts sensitivity and specificity values of approximately 0.80 and correlational values that range from 0.49 to 0.83 to other commonly used mental health questionnaires such as the Beck Depression Inventory (BDI), the Clinical Anxiety Scale, and the Spielberger's State-Trait Anxiety Inventory (STAI).[20]

The IPAQ-LF[21] is a 27-item questionnaire designed to assess levels of self-reported physical activity over the span of five separate activity domains: (1) job-related physical activity, (2) transportation physical activity, (3) housework, house maintenance, and caring for family, (4) recreation, sport, and leisure-time physical activity, and (4) time spent sitting. For each domain, participants are asked to consider all the time that they spend on vigorous-intensity activities, moderate-intensity activities, and low-intensity activities within the last 7 days through a series of example-guided questions. The IPAQ-LF can be scored through 2 separate mechanisms; results can be reported in categories (high activity levels, moderate activity levels, low activity levels) or as a continuous variable of MET minutes per week (estimated metabolic equivalent minute expenditures per week). Good concurrent validity for the IPAQ-LF has been previously found in comparing it to data collected via accelerator monitoring.[22] Additionally, appropriate convergent validity has also been found for this instrument in comparison with other instruments that measure walking, total moderate-intensity physical activity, vigorous-intensity physical activity, and total physical activity (corrected mean effect size = 0.32, 0.45, 0.49, and 0.39, respectively).[23]

After all the questionnaires were completed, the participants were then asked to remove their shoes and socks for a bioelectrical impedance analysis (BIA) body composition assessment. The InBody 570 was used for the American college student group, while the Tanita BC-148 Segmental Body Composition Analyzer was used for the Romanian college student group to complete these analyses. Both instruments can be used to estimate body composition with a particular emphasis on body fat percentage (BF%) and skeletal muscle mass (SKMM). BIA assessments are commonly used in the fitness industry, clinical setting, and research due to their non-invasiveness, simplicity of use, and cost-effectiveness compared to other body composition methods such Dual-Energy X-ray Absorptiometry (DEXA) scans.[24] It has been shown that the multi-frequency BIA used by the InBody 570 device is a valid method for determining BF and SKMM. At the conclusion of testing, the participants were thanked for their time and provided with a complimentary individualized Inbody 570 or Tanita BC-148 informative handout.

All collected data were de-identified, kept confidential, and stored in a password-encrypted google drive account. Paired-samples t-tests were run to look for differences among the variables of HADS scores, weekly METs, body fat percentage, and SKMM between the two groups of participants. A multiple linear regression model was constructed to assess the impact of various predictors on mental health scores, HADS. The model was specified as follows: the dependent variable, HADS score, was regressed on independent variables including body fat percentage, skeletal muscle mass, and weekly METS. Additionally, categorical predictors, sex (male or female) and ethnicity (coded to reflect American and Romanian students), were included to explore differences between groups. This model was implemented using the R 4.3.3 statistical package, with data stored and managed securely. Each variable was chosen based on its relevance and potential impact on mental health, informed by previous research.[8] The model included both continuous and categorical variables, allowing for an examination of linear associations and demographic effects. Prior to running the regression analysis, assumptions such as linearity, independence, homoscedasticity, and normality of residuals were verified.

Results

The sample of this study consisted of a total of 175 undergraduate college students (M age = 22.16 $\pm$ 0.30; 75 males, 100 females; 90 American college students, 85 Romanian college students). The ethnicity classifications of the participants consisted of 53.14% White/Caucasian, 25.14% Hispanic/Latino, 9.14% Black/African, 7.43% Other/mixed, and 5.14% Asian. Within the American college student sample, 81.11% of the participants were non-White/Caucasian, while contrarily, within the Romanian college student sample, only 10.59% of the participants were non-White/Caucasian. The descriptive statistics for the outcome variables (HADS score, weekly METS, BF%, and SKMM) are reported in Table 1.

Table 1. Outcome differences between American and Romanian college students

Group	N	%	HADS Mean and SD	Weekly METs Mean and SD	BF% Mean and SD	SKMM (kg) Mean and SD
All	**175**	**100**	13.23±6.88	11250±9243	22.06±11.55	27.05±7.25
Male	75	22.9	11.75±6.26	10883±9243	14.57±8.19	32.92±5.73
Female	100	28.6	14.34±7.15	11524±9618	27.69±10.50	22.65±4.7
American	**90**	**51.4**	13.4±6.80	10673±9243	25.8±12.2	29.68±7.2
Male	40	22.9	11.95±6.1	9607±8087	17.01±8.66	34.86±6.72
Female	50	28.6	14.5±7.2	11526±10603	32.89±9.93	22.53±4.3
Romanian	**85**	**48.6**	13.08±7.01	11860±8907	18.08±9.31	24.27±6.23
Male	35	20	11.5±6.5	12341±10367	11.76±6.69	30.7±3.2
Female	50	28.6	14.187.2	11523±7818	22.5±8.31	19.78±3.1

No differences were found between the American and Romanian participants among the HADS scores ($p = 0.79$) and weekly METS ($p = 0.40$); however, as seen in Figure 1, differences were found among the body composition outcome variables across both sexes ($p = 0.00$). American male participants had on average 5.25% more BF% and 4.16 kg more SKMM than Romanian male participants, while American female participants had on average 10.39% more BF% and 2.75 kg more SKMM than Romanian female participants. Within the collective sample, 72.57% of the participants reported either a borderline elevated (N = 25) or abnormal (N = 102) level of depressive and anxious symptomatology, and 82.29% self-reported themselves as partaking in the high physical activity category. To better understand the found relationships, a linear regression analysis model with all participants was utilized to explore the impact of sex, ethnicity, academic year, weekly METS, BF%, and SKMM on HADS scores (F-statistic: 3.189, $p = 0.00$). The results indicated that BF% had a significant positive relationship with HADS score ($p = 0.01$) and that SKMM had an almost significant negative relationship with HADS score ($p = 0.06$). Every percentage increase in BF% correlated with an average HADS score increase of 0.14 (see Figure 2), while every kilogram increase in SKMM correlated with an average HADS score decrease of 0.24. The results show that despite the differences in body composition, both American and Romanian college students suffer from similar elevated levels of depressive and anxious symptoms.
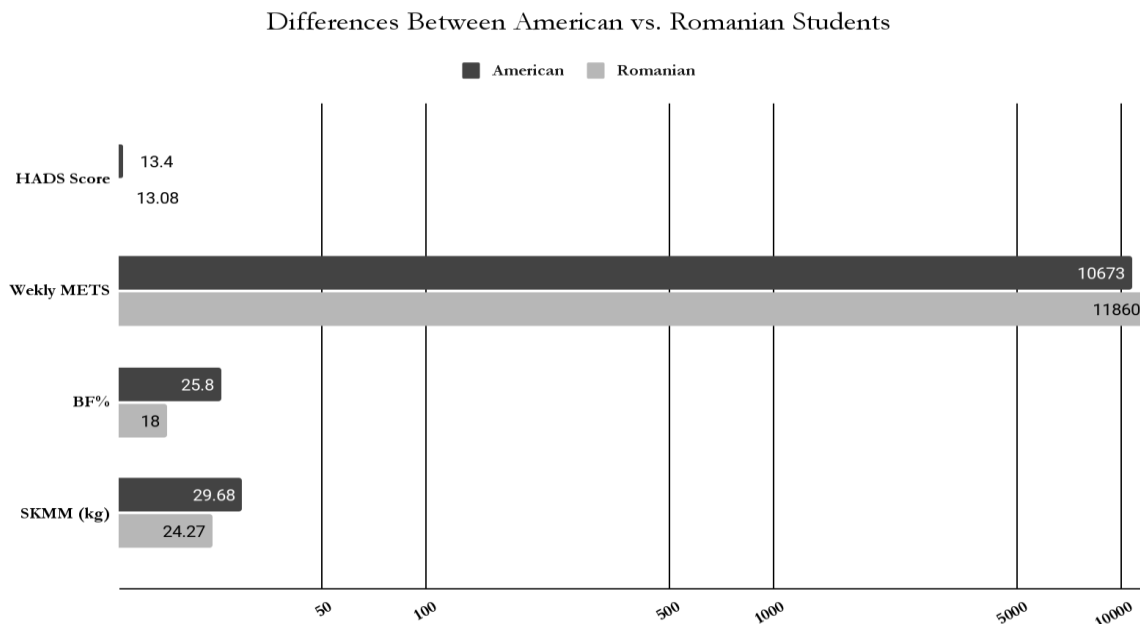
Figure 1. Explored differences between American and Romanian college students for HADS scores ($p = 0.79$), weekly METS ($p = 0.40$), BF% ($p = 0.00$), and SKMM ($p = 0.00$).

Figure 2. Correlation between body fat percentage and HADS score. *Note.* N = 175. Every percentage increase in body fat correlations with an average HADS score increase of 0.14 ($p = 0.01$).

Discussion

The COVID-19 pandemic and subsequent lockdown measures have profoundly impacted various aspects of individuals' lives, particularly college students around the world. [1,4,6]Some of the lockdown restrictions imposed to prevent the spread of SARS-CoV-2 included, but were not limited to, stay-at-home orders, travel restrictions, social distancing measures, and isolation and quarantine requirements. [25] Many universities across the world canceled in-person activities and transitioned to online instruction, which resulted in an increased sedentary behavior, and a reduced daily energy expenditure among college students. [11, 26, 27] This study focused on understanding the repercussions of lockdown restrictions on physical activity, mental health, and body composition among American and Romanian college students. The results shed light on several critical findings that contribute significantly to the understanding of how these unprecedented circumstances have affected young adults.

One of the notable findings of our study is the prevalence of elevated levels of depressive and anxious symptomatology among both groups of students, with over 70% reporting borderline or abnormal scores on the HADS. This highlights the substantial mental health challenges faced by college students during and after lockdown periods, regardless of their race, ethnicity, cultural differences and backgrounds. Our results are somehow similar with the findings reported by Essadek et al. [4] in French students, and by Ma et al. in Chinese students. [7] Also, early studies have supported the notion that the pandemic lockdown has significantly worsened the onset of mental health symptoms, such as anxious symptoms, in college students.[28]

More than 80% of the students in this study reported being highly physically active, with no significant differences between the American and the Romanian students. Our findings suggest that college students might have found alternative ways to engage in physical activity, such as home workouts, outdoor activities, online fitness classes, or virtual challenges. Previous studies [29] also reported that those students who met the minimum physical activity recommendations before the lockdown generally met the recommendations during pandemic-related confinements as well. While no significant differences were observed in terms of mental health scores and weekly physical activity levels between American and Romanian participants, notable variations were found in body composition metrics. Specifically, American male and female participants exhibited higher body fat percentages and skeletal muscle mass compared to the Romanian students. This discrepancy in body composition highlights potential cultural and lifestyle differences that may come from diverse dietary habits. Some studies suggested that the Western diet is often associated with a higher consumption of trans fats and sugar, larger portions, and snacking in between the main meals. [30] Also, the American dietary habits are recognized to be rich in processed and calorie-dense foods, as opposed to the European ones which typically include more fruits, vegetables and grains. [31]

The linear regression analysis further elucidated the relationships between mental health outcomes and body composition. A significant positive correlation was identified between body fat percentage and HADS scores, indicating that higher levels of body fat are associated with increased depressive and anxious symptoms. This aligns with existing literature linking obesity and mental health disorders [32], emphasizing the intricate connection between physical and psychological well-being. Conversely, an almost significant negative correlation was found between skeletal muscle mass and HADS scores, suggesting that greater muscle mass might have a protective effect against psychological distress, potentially due to the role of exercise and physical fitness in mental health promotion. Similar effects have been reported by Strickland and Smith [33] who concluded that resistance exercises combined with aerobic exercises could considerably decrease anxiety. Also, the results of a systematic review conducted by Marques et al.[34] suggested that muscular strength has a positive effect on reducing depressive symptoms in adults. The observed associations between body composition and mental health underscore the interconnectedness of physical and psychological well-being, with higher body fat percentages correlating with increased psychological distress and greater muscle mass potentially offering protective benefits.

Conclusions

The findings of this study provide valuable insights into the multifaceted impact of COVID-19 lockdown restrictions on college students' physical activity, mental well-being, and body composition. Despite cultural and demographic differences, both American and Romanian students experienced similar challenges related to mental health, with a substantial proportion reporting elevated depressive and anxious symptoms.

Strategies aimed at promoting healthy lifestyles, including regular physical activity and balanced nutrition, may play a crucial role in mitigating the negative effects of pandemic-induced stressors on college students' mental health. Additionally, targeted interventions addressing mental health issues, such as access to counseling services and mental health awareness campaigns, are essential for supporting students' overall well-being during these challenging times. College students generally display a preference towards interventions delivered via smartphone application. The design of future applications should be all encompassing of strategies that seek to improve the mental health and body composition of college students, regardless of self-reported physical activity levels. Furthermore, these future applications should be specifically tailored to reflect the resources and services that an institution can provide for its college students. For instance, a college student should be able to log the caloric value of their daily meals, access tips for meditations, progressive muscle relaxation, and positive thinking, and easily schedule appointments with the counseling and psychological or nutritional services provided on their campus all from the same application. The conceptual framework developed from the findings of this study and the example provided in the previous sentence should serve as the template for the creation of these institution-specific applications. The lingering negative effects of the COVID-19 pandemic lockdown restrictions on college students around the world have made the exploration and use of these types of interventions more necessary now than ever before.

Conflict of Interest: None

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