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Using Exercise as a Stress Management Technique During the COVID-19 Pandemic: The Differences Between Men and Women in College

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ABSTRACT

International Journal of Exercise Science 14(5): 1234-1246, 2021. Psychological stress is a major concern in college students and can lead to negative mental and physical health outcomes. The COVID-19 pandemic has increased psychological stress. Using exercise as a stress management technique has been shown to have a large effect in preventing and treating psychological stress. This study attempts to understand the gender differences between how using exercise as a stress management technique predicts perceived stress levels during the COVID-19 pandemic. Students completed an online survey to self-report their stress management techniques, perceived stress (PSS-10), grade point average (GPA) and demographics (age, race/ethnicity, sexual orientation, gender identity). Independent samples t-tests compared each PSS-10 item for those who did/not use exercise as a stress management technique for each gender. Separate linear regression models compared perceived stress levels in those who did/not use exercise as a stress management tool for each gender. GPA, sexual orientation, and race/ethnicity were included as covariates. Data from 384 students were analyzed. Four PSS-10 items showed significant differences in women who did/not use exercise as a stress management technique. Women who used exercise as a stress management technique reported significantly lower levels of perceived stress compared to those women who did not ($p < 0.05$); while men showed no significant differences whether or not they used exercise as a stress management technique. University officials should recognize gender differences in stress among their students when creating programs/interventions to prevent and treat student psychological stress.

KEY WORDS: Mental health, student health, physical activity, health promotion

INTRODUCTION

People experience psychological stressors over their lifetime for a variety of reasons, including life events (e.g. divorce of parents), environmental (e.g. neighborhood safety, traffic), social (e.g. injustice, assault), behavior (e.g. physical inactivity, alcohol use), and many others (14, 15, 17, 21). These stressors can lead to negative health consequences amongst all populations (43), making stress management a major public health importance. Psychological stress can cause acute physiological effects of the body, such as increased heart rate and blood pressure, which can lead to future health consequences, including increasing the risk of many non-communicable diseases (49). Psychological stress has also showed to have negative effects on the brain, increasing the risk of major mental disorders, such as major depressive disorder (18)

and anxiety (39). Early studies on stress and mental health suggested that the number of negative stressors (e.g. physical, environmental, and financial factors) in children predicted the risk of negative mental health, rather than the pattern of such factors (31). Understanding the mechanisms of stress and need for proper stress-management is important to future mental health research.

Although stress is inevitable, literature suggests college-aged individuals are at a higher risk for daily life stressors compared to other age groups, due to the increased daily stressors (2). Leaving home for the first time, making friends, and understanding personal identity are examples of stressors a college student uniquely endures. Academic performance, often indicated by grade point average (GPA), and the pressure to succeed are also major concerns that lead to stress among college students (7). Specific demographic characteristics such as race/ethnicity and sexual orientation have also been shown to increase psychological distress. Racial discrimination and underappreciation and/or underrepresentation of minority individuals cause profound negative effects on mental health of children and adults (11, 35, 51). Similarly, non-heterosexual individuals tend to have higher levels of perceived psychological stress, compared to their heterosexual counterparts (9, 10, 27, 45, 46).

Along with academic pressures, race/ethnicity, and sexual orientation, studies have suggested that there are gender disparities in psychological stress. Female college students experience higher perceived levels of stress compared to their male counterparts (25), making it essential to understand the gender differences between stress factor effects. Stressful life events may also have different effects on an individual, based on gender. In their study on gender differences and coping styles, Matud (2004) found that despite experiencing similar amounts of stressful life events, women were more likely to be negatively impacted by stressors than men (34). Physiological and neurological differences in the body suggest that the female hormonal and immune systems react differently to psychological stressors compared to men (8). Differences in long-term effects of daily life stressors between men and women may also be due to different coping styles. While women are more likely to use emotional and avoidance tactics of coping, men showed an increase in using rational and detachment coping styles (34).

Perceived stress, or how the individual witnesses their psychological stress, is one of the many subjective ways that researchers measure stress. Tools that assess perceived stress (19) typically measure perceived response to life events in a given time frame. Perception of stress is important for psychological research, due to the different effects stressors can have on different individuals. Although stress is a natural part of one's life, it is important for one to find ways to cope, prevent, and alleviate negative psychological stress. Coping can lower the risk of future negative health consequences seen from longitudinal stress (30). Stress management and coping can have very individualized effects, but there are many behavior changes that have shown to significantly promote healthy psychological health. Stress management techniques such as meditation (40), social support of family/friends/peers (16) and restful sleep (13) have significantly lowered stress levels amongst college students.

A major contributor to stress levels in all populations, including college students, is participation in physical activity (PA) (6, 44). Individuals who participate in PA report lower levels of perceived stress (20, 22). PA is a long-term lifestyle behavior that should be introduced at some capacity to all able children, adolescents, and adults. Using exercise as a stress management technique has shown to have preventative and treatment effects on perceived stress (26, 32). Other than promoting positive mental health in college students (36), using PA to manage stress will also promote physical health, by decreasing the risk of many long term non-communicable diseases (3). In college students, studies have also showed that students who participated in vigorous PA were likely to report positive mental health and lower levels of perceived stress (50).

College students are in the midst of an important developmental transition from young adulthood to adulthood, which can lead to increased stress and major effects in the future (5). This makes college students an important population to study. This transitionary time-period is also very critical for introducing healthy habits, because many of these habits made in this time-period are likely to last a lifetime (53). The United States' college population was struck with major life changes in the Spring of 2020 due to the COVID-19 pandemic. Students were sent home from their institutions to completely change their way of living. In-person classes were changed to online classes, and quarantines with stay-at-home orders decreased the amount of time spent with peers. Although many US students had increased stress pertaining to their fear of family member's health, they also showed increased levels of academic and social stressors, such as difficulty concentrating, concern of academic performance, and lower amounts of social interactions from peers (48). Although stressful life events have increased during the COVID-19 pandemic, PA was still associated with positive affect in college students (33). This association makes it important for us to understand more about how exercise plays a role in an individual's mental health.

The current study aims to understand the gender differences between how using exercise as a stress management technique predicted overall perceived stress during the COVID-19 pandemic. We also aim to detect gender differences between how perceived stress factors are predicted by use of exercise as a stress management tool. Understanding these concepts is important for colleges to manage student mental and physical health while they complete their courses virtually under pandemic conditions, creating and implementing prevention strategies for overall mental health.

METHODS

Participants

Study Design - This cross-sectional study was performed from the results of an online survey (Qualtrics, Provo, UT). This survey was sent to individuals at a large Northeastern university. Participants were enrolled in general health and wellness courses. The survey was sent in the month of April 2020, and approximately four weeks after the institution switched to remote learning due to the pandemic and many state governments had issued stay-at-home orders. For the survey, response rate was 30.69% (n = 519) and completion rate was 94.61% (n = 491).

Volunteers who completed the survey had an opportunity to enter a drawing to win a $50 gift card as incentive. Contact information for the drawing was collected separately from the survey data to ensure anonymity was protected. Before starting the survey, informed consent was presented when opening the link, along with a statement saying only individuals 18 or older can participate. Participants with incomplete survey data (n = 98) were discarded. Individuals who completed the survey but were not currently students were excluded from analyses (n = 9). The Pennsylvania State University Institutional Review Board approved this study and all methods followed ethical consideration for exercise psychology (38).

Protocol

Demographics - Participants self-reported age, race/ethnicity, semester standing, gender identity (male, female, non-binary), and sexual orientation. Race/ethnicity, gender identity, and sexual orientation were dummy-coded based on answer choice to allow for proper statistical analyses. Non-Hispanic white and straight (heterosexual) were used as referent groups (dummy coded = 1) for race/ethnicity and sexual orientation, respectively.

Perceived Stress - Stress was assessed using the 10-item Perceived Stress Scale (PSS-10) (19), which measures perceived stress on a five-point scale ranging from 0 (never) to 4 (very often). Participants rated how often they have felt in the past month to 10 different responses that focused on different areas of perceived psychological stress. These points were summed to create a continuous overall perceived-stress level score from 0-40. In previous literature, this scale has shown positive validity in measuring proper psychometric stress properties in the college-student population (41, 47). In the current study, the PSS-10 scale showed good reliability (a = 0.869).

Physical Activity Behaviors - Self-reported moderate (MPA) and vigorous (VPA) leisure time physical activity (4) was assessed using the validated Global Physical Activity Questionnaire (GPAQ) (12). Muscle-strengthening (strength-training - ST) activity was measured similarly to the GPAQ (52), using items that assessed the frequency (days per week) and duration (minutes per ST bout) throughout the week of moderate or high-intensity muscle strengthening (for at least 10 minutes to gain a minutes/week outcome).

Stress Management Techniques - Participants rank ordered their most used stress management techniques during the COVID-19 stay at home order. Stress management techniques included: using medication, eating, relaxation techniques (e.g. breathing, meditating), exercising, talking to someone, drinking alcohol, sleeping, creative crafting, watching TV, cooking, and/or organizing. Participants were then dichotomized into groups based on whether they selected exercise as a technique to manage stress or not.

Grade Point Average (GPA) - Participants were asked to self-report their collegiate cumulative GPA on a four-point scale (0.0 – 4.0).

Statistical Analysis

Frequencies and descriptive statistics were computed to summarize the data. All data were analyzed using the SPSS Version 26.0 (IBM, Armonk, NY). Independent samples t-tests were performed separately for men and women to test the differences for each PSS-10 question item between those who use exercise as a stress management technique and those who do not. After initial linear regression modeling showed significant ($p < 0.05$) differences between PSS-10 score and using exercise as a stress management tool, two separate independent linear regression models for both men and women were performed. Each were conducted to show the individual significance of using exercise as a stress management technique to predict stress level variance. Due to previous literature showing differences in stress levels amongst specific demographics; race/ethnicity, sexual orientation and GPA were used as covariates in linear regression models. A *p*-value of 0.05 was used for all analyses. A post-hoc power analysis using G*Power version 3.1.9.7 (University of California – Los Angeles, CA, U.S.A) was completed and determined that the sample size was adequate for analyses.

RESULTS

Demographics - The sample ($n = 384$) consisted of college students (20.45 ± 1.40 years), with the majority identifying as women ($n = 282$, 73.4%) and Non-Hispanic White ($n = 294$, 76.7%). In the sample, 78.4% of men and 84.0% of women reported using exercise as a stress management tool. Table 1 shows a complete description of participant socio-demographic frequencies with mean stress scores and percentage of those who used exercise as a stress management tool.

Table 1. Demographics and PSS-10 scores for those who used exercise as a stress management tool.

				PSS-10	Used exercise as stress tool	
		n	%	Mean (SD)	*n*	%
Gender	Men	102	26.6	17.7 (6.7)	80	78.4
	Women	282	73.4	21.1 (7.4)	237	84.0
Race/Ethnicity	NH White	294	76.7	20.6 (7.4)	248	84.4
	NH African American	6	1.5	20.7 (6.1)	3	50.0
	Hispanic or Latinx	10	2.8	21.9 (6.1)	9	90.0
	NH Asian American	37	9.6	18.0 (6.0)	28	75.7
	NH Other	14	3.5	19.1 (6.3)	9	64.3
	NH Multiracial	23	5.8	18.3 (9.1)	20	87.0
Sexual orientation	Asexual	1	0.3	10.0 (NA)	1	100
	Bisexual	16	4.2	24.0 (6.6)	14	87.5
	Gay	5	1.3	17.8 (9.2)	5	100
	Straight (heterosexual)	345	90.1	19.9 (7.2)	285	82.6
	Lesbian	5	1.3	17.2 (11.3)	5	100
	Pansexual	4	1.0	27.8 (3.3)	3	75.0
	Queer	1	0.3	26.0 (NA)	1	100
	Questioning or unsure	3	0.8	29.7 (1.5)	1	33.3
	Prefer not to disclose	3	0.8	17 (1.0)	3	100

Note: NH = non-Hispanic

Weekly Physical Activity Levels - Table 2 shows the results from independent samples t-tests testing the differences between weekly minutes of MPA, VPA and ST.

Table 2. Differences in weekly PA levels in those who use exercise as a stress management technique and those who do not.

		Use exercise as a stress management technique	Do not use exercise as a stress management technique			
	PA Weekly Minutes	Mean (SD)	Mean (SD)	*t*	95% CI	*p*
Women	MPA	160.09 (152.73)	83.80 (159.41)	-2.958	(-127.87, -24.71)	0.004
	VPA	135.43 (154.80)	39.93 (97.42)	-3.944	(-143.17, -47.83)	< 0.001
	ST	58.97 (83.92)	12.22 (45.98)	-3.631	(-72.10, -21.40)	< 0.001
Men	MPA	123.10 (87.29)	87.29 (126.30)	-1.145	(-99.49, 27.85)	0.261
	VPA	140.44 (159.70)	32.75 (103.16)	-2.862	(-182.37, -33.02)	0.005
	ST	110.35 (137.88)	29.55 (90.01)	-2.594	(-142.61, -19.00)	0.011

Note: PA = Physical Activity, MPA = Moderate PA, VPA = Vigorous PA, ST = Strength Training

Women and PSS-10 Items - Four PSS-10 items were found to have a significant difference when compared to women who used exercise as a stress management technique and those who didn't. "Felt nervous or 'stressed'; been able to control irritations in your life; felt that you were on top of things; and felt difficulties were piling up so high that you could not overcome them" all had scores significantly lower in women who used exercise as a stress management technique versus those who did not (Table 3).

Men and PSS-10 Items - There were no PSS-10 items that had a significant difference depending on whether men used exercise as a stress management tool or did not (Table 3).

Women and Exercise Stress Management - Using exercise as a stress management tool significantly predicted (p = 0.022, β = -2.796) the variance of perceived stress levels for women. Women who used exercise as a stress management tool were more likely to have lower perceived stress scores. Race/ethnicity and sexual orientation also significantly predicted the variance of an individual's stress levels. GPA did not predict stress level variance. The model for women explained 5.3% of the total variance (Table 4).

Men and Exercise Stress Management - Using exercise as a stress management tool did not significantly (p = 0.343, β = -1.662) predict the variance of total stress levels for men. The covariates did not predict the variance of stress levels for men (race/ethnicity, p = 0.998; GPA, p = 0.155; sexual orientation, p = 0.696). The model for men explained 3.2% of variance in total stress levels (Table 4).

Table 3. Difference in individual PSS-10 item scores between those who use exercise as a stress management tool or not.

	Men						Women					
PSS-10 Items	*F*	*t*	MD	SE	95% CI	*p*	*F*	*t*	MD	SE	95% CI	*p*
1. Been upset because of something that happened unexpectedly?	0.06	0.57	0.14	0.25	(-0.35, 0.63)	0.567	0.62	0.93	0.16	0.17	(-0.18, 0.50)	0.351
2. Felt that you were unable to control the important things in your life?	0.05	0.82	0.24	0.30	(-0.34, 0.83)	0.412	0.28	0.82	0.17	0.21	(-0.24, 0.57)	0.413
3. Felt nervous and "stressed"?	3.45	0.46	0.11	0.25	(-0.61, 0.38)	0.648	0.05	1.98	0.34	0.17	(0.002, 0.67)	0.049
4. Felt confident about your ability to handle your personal problems?	1.09	0.07	0.02	0.25	(-0.48, 0.52)	0.942	0.32	1.61	0.22	0.14	(-0.05, 0.50)	0.109
5. Felt that things were going your way?	2.94	0.94	0.21	0.22	(-0.23, 0.64)	0.350	1.63	0.97	0.15	0.15	(-0.15,0.45)	0.331
6. Found that you could not cope with all the things that you had to do?	3.38	0.12	0.03	0.26	(-0.49, 0.55)	0.909	0.21	1.80	0.32	0.18	(-0.03, 0.67)	0.073
7. Been able to control irritations in your life?	0.08	0.54	0.14	0.26	(-0.37, 0.64)	0.588	0.41	2.35	0.33	0.14	(0.05, 0.60)	0.020
8. Felt that you were on top of things?	0.08	0.77	0.18	0.24	(-0.29, 0.65)	0.445	0.60	2.10	0.33	0.16	(0.02, 0.64)	0.036
9. Been angered because of things that were outside of your control?	0.73	1.29	0.37	0.28	(-0.20, 0.93)	0.199	2.22	1.41	0.26	0.19	(-0.10, 0.63)	0.159
10.Felt difficulties were piling up so high that you could not overcome them?	4.68	1.01	0.23	0.23	(-0.23, 0.68)	0.318	1.00	3.08	0.61	0.20	(0.22, 0.99)	0.002

Table 4. Models predicting PSS-10 score based on individual use of exercise as a stress management tool.

Gender		*B*	SE	Beta	*t*	95% CI	*p*
Men	(R^2 = 0.032, p = 0.557)						
	Exercise as Stress Management Tech.	-1.662	1.744	-0.098	0.002	(12.68, 41.76)	0.343
	Race/ethnicity	0.001	1.744	0.000	0.002	(-5.13, 1.80)	0.998
	GPA	-2.569	1.791	-0.148	-1.435	(-6.13, 0.99)	0.155
	Sexual orientation	1.128	2.882	0.040	0.391	(-4.60, 6.85)	0.696
Women	(R^2 = 0.053, p = 0.006)						
	Exercise as Stress Management Tech.	-2.796	1.213	-0.139	-2.312	(-5.18, -0.41)	0.022
	Race/ethnicity	-0.486	0.210	-0.139	-2.312	(-0.90, -0.07)	0.022
	GPA	-0.111	0.992	-0.007	-0.112	(-2.07, 1.84)	0.911
	Sexual orientation	-3.083	1.388	-0.133	-2.221	(-5.82, -0.35)	0.027

Note: GPA = Grade Point Average
Tech. = technique

DISCUSSION

Stress management is important for all individuals but became more of a priority during the COVID-19 pandemic due to the increased stress levels college students are feeling from the pandemic (48). It is important to find ways to properly manage stress. One way that this can be done is through exercise (44). The findings from this study revealed gender differences in how using exercise as a stress management tool during the COVID-19 pandemic predicted perceived stress level variance in college students. Women who used exercise as stress management technique reported significantly lower perceived stress scores compared to their peers who did not. For men, there were no differences between perceived stress scores among those who used exercise as stress management and those who did not.

The COVID-19 pandemic created much change for all individuals throughout the world. Lockdowns and stay-at-home orders were implemented, which had negative health effects on all individuals (29), including college students (48). Adolescents participating in social distancing were shown to have a decrease in PA along with well-being (37). Even though increases of negative mental health were seen through individuals, those who participated in PA continued to show higher levels of psychological affect than those who did not participate in PA (33).

Women who used exercise as a technique to manage stress showed differences in specific items of the PSS-10. Four items were shown to have lower scores (less perceived stress) in those who used exercise as a stress management technique. These four items asked questions about 'being nervous or stressed', 'being able to control irritations', 'felt on top of things', and 'not being able to overcome difficulties' in their lives. Participating in exercise as a stress management tool may help to create a sense of control in college women's lives, especially under extraordinary circumstances (24, 42). There are many studies that have shown the positive effects exercise has on decreasing perceived stress (41, 47), but the findings from the current study fill the gaps in reference to college students during the COVID-19 pandemic.

Gender differences in perceived stress and exercise is an important realm to study. As this study suggests, men and women's participation in exercise as a stress management tool predicted perceived stress in different ways. We believe that this difference may be due to the physiological/biological effects PA has on men and women, which has been shown in previous studies (1). In the realm of public health and PA interventions, different strategies may be needed to engage different genders. Classes may be promoted specifically engaging women, while other types of stress management techniques may be important to look into for men.

Although the current study did not have a large enough sample size to examine racial/ethnic differences, we know there are disparities in health outcomes and it is important to understand the role PA plays in diverse populations (28, 51). The increases in perceived stress level with underrepresented populations may contribute to negative mental health consequences (18, 39), physical health consequences (49), and even death by suicide (23). University officials should focus on increasing education and funding towards initiatives and programs that attempt to treat or prevent negative health effects in these populations.

This study has several limitations. The PSS-10, although reliable and validated, are self-reported and participants may have inaccurate recall. Furthermore, a student population from a large north-eastern university does not allow for generalizability to all college-aged individuals in the US, or in other countries. The convenience sampling method is also a limitation of this study. Weekly minutes of PA (VPA, MPA or ST) was not added to any regression model due to multicollinearity, after formative analyses revealed significant ($p < 0.01$) correlations between weekly PA minutes and stating individuals used exercise as a stress management tool. This limited the models, and future research should attempt to understand the role intention of exercise for stress, as well as actual PA participation plays on predicting perceived stress levels.

In the current study, underrepresented populations contributed to a much smaller proportion of the sample, making it difficult to generalize the study to the US college populations. Future research in this area should focus on understanding diverse population differences in stress and PA throughout the COVID-19 pandemic (i.e. gender, sexual orientation, race/ethnicity, religion, etc.). Future studies should also attempt to look into differences between intention of exercise versus actual amounts of exercise/PA in order to understand gender differences in perceived stress. Understanding the differences based on these demographics and how specific stress management tools work for certain populations will give public health and university officials an initial understanding of what types of programs will work for specifically targeted populations under these special circumstances.

It is also important that researchers develop an understanding for exercise's potential in affecting perceived stress. Future research into college student behavior during the COVID-19 pandemic should also look into different forms, intensity, and duration of PA in order to gain an understanding for what type of exercise is most important in stress management.

Conclusion: The findings of the study suggest that women using exercise as a stress management tool have lower perceived stress scores than those who do not use exercise as a

stress management tool. In their male counterparts, there were no significant difference in perceived stress levels between men using exercise as a stress management tool or not. These results should encourage universities and college administrators to advocate for more ways to lower perceived stress scores through exercise classes, exercise promotion, and/or other means to get people active. These efforts should be offered to all college students, with an emphasis and focus on women.

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