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Physical activity and sedentary behaviors and the impact on college student's stress, depression, and anxiety

Abstract

University students are at a significant risk for mental health issues, including stress and depression. Negative mental health among college-aged adults continues to rise, impacting students' cognitive function, academic performance, social development, and overall well-being. Rather than offering support through medication, physical activity has demonstrated a potential behavioral approach to reduce students' stress and anxiety. The current study examined the influence of young adults' physical activity and sedentary behavior levels and their self-reported stress, depression, and psychological well-being. Participants were undergraduate and graduate students recruited from a Midwestern university and a Mid-Southern university. Multiple linear regressions estimated mean differences in participants' self-reported stress, depression, and psychological well-being based on their physical activity levels and sitting minutes. Moderate levels of physical activity improved participants' growth psychological well-being ($p = .01$). Vigorous physical activity had an effect on participants' relations, purpose, and self-acceptance ($p<0.05$). Daily sitting minutes significantly affected participants' stress, perceived stress, depression, and environmental psychological wellness ($p<0.05$). Results demonstrate how physical activity can be a natural medicine for symptoms of stress and depression. Current outcomes support the development of future programs to prevent and react to mental health via physical activity.

Keywords: physical activity, sedentary behavior, young adults, psychological well-being

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Introduction

Depression is a significant problem among college students in the United States (US). As the current leading cause of disability worldwide, depression impacts mood and cognitive function, and affects roughly 300 million people from all populations.[1] According to the National Institute of Mental Health (NIMH), over 8% of adults in the United States suffered from depression in 2020.[2] College students in the US suffer from depression at much higher rates. The prevalence of depressive disorder symptoms among US college-aged students is approximately 33%, attributing to academic pressure, life responsibility, social life stress, financial difficulties, and alcohol intake among numerous others.[3–6] When suffering from depression, it is common to experience deficits in cognitive control, such as lack of concentration and inhibited memory.[7] Research done on cognitive control has found that deficient levels can impact a young adult's management of depression and stress levels which can cycle back and impact their college experience.[8] Cognitive deficits also impact the ability to adjust and adapt to new experiences and environments and utilize coping skills to manage psychological distress.[7] These deficits in brain functioning are a serious threat to college students, as the academic and personal demands of college cause up to 45% of students having reported experiencing higher than average stress.[9]

Accumulated stress is a common contributor to the development of depression, with a strong relationship between heightened levels of stress and increased levels of depression.[10–12] According to Acharya and colleagues, college students are especially vulnerable to a variety of stressors, many related to the transition from high school to college. The transition from dependent living during high school to the demands of independent living in college increases the risk of developing depression.[13] During this transition students experience developmental changes socially, academically, and personally.[14] Examples of these changes include experiencing reduced social support, having to adjust to new academic expectations and responsibilities, and becoming autonomous for the first time.[14] In addition, many first-year university students struggle academically due to a gap in academic preparation from high school to college, and the conformity to a dominant culture that may be different from their own.[15] Common stressors related to the college transition and experience that contribute to depression are loneliness, separation from family and friends, relationship problems, academic and financial stress, and concerns for personal health such as sleep.[13] According to the annual National College Health Assessment, 52% of college students experienced loneliness, 53% experienced challenges with their personal appearance, 47% experienced financial difficulties, and 76% reported not feeling well-rested for three or more days of the week.[16] These stressors account for the 79% of college students who experienced moderate to high levels of stress within the past 30 days, with 30% reporting high stress.[16] All these stressors are directly related to the six subscales of psychological wellness: autonomy, environmental mastery, personal growth, relationships with others, purpose in life, and self-acceptance.[17,18]

Physical activity is a well-researched, low-cost form of treatment that aids in the management of stress and depression. Regular physical activity can have similar antidepressant effects as psychotherapeutic and pharmacotherapeutic interventions.[19] Physical activity, if performed to the standard recommendation for healthy individuals, can moderate high levels of stress.[19] The recommendation for healthy individuals is 150 minutes of moderate to vigorous aerobic or resistance exercise 3-5 days per week.[20] Regular physical activity for individuals experiencing depression is 20–45 minute bouts of moderate to vigorous aerobic or resistance exercise 3-5 days per week.[20] For long lasting antidepressant effects, physical activity should be gradually progressed to meet the ACSM recommendations for healthy individuals.[20] In support of these recommendations, it was found that college students who engaged in lower levels of physical

activity than recommended experienced increased severity and prevalence of depressive symptoms.[21] Conversely, college students who engaged in sufficient physical activity were less likely to suffer from depression across the board.[22]

While physical activity is known to reduce depression severity, cognitive deficits inherent to depression make initial adherence to physical activity programs exceedingly difficult.[23] One of the most prevalent symptoms and cognitive deficits of depression is anhedonia, which can be defined as a loss of interest in and pleasure from once enjoyed activities.[24] It also encompasses decreased reward learning and processing, reinforcement conditioning, positive emotional expression and reactivity, and appetitive motivation.[24] While healthy individuals may be able to feel the positive effects of physical activity, those experiencing depression have a stunted sensitivity to rewards and may not believe they are benefiting from physical activity participation.[23] This can cause complications for long term dedication to physical activity.[23]

As physical activity is an extensively studied method to reduce levels of stress and depression, it is important to continuously investigate the relationship between physical activity, stress, depression, and psychological well-being. The purpose of this study was to examine the influence of young adult college students' physical activity levels and their self-reported stress, depression, and psychological well-being. Based on previous research, expectations were that increased levels of physical activity would result in decreased levels of stress and depression and higher levels of psychological well-being.

Methods

Participants

Undergraduate and graduate students were recruited via email. School and teacher partnerships were used to recruit students from an Ohio university and a Virginia university. Social media (i.e., Facebook) was also used to invite potential participants. The University's Institutional Review Board approved the study, and all participants provided informed consent. Data were collected anonymously via the Qualtrics online survey platform.

Measurement

Participants were asked to provide information on certain demographic, behavioral, and mental health variables. Participants reported their gender, age, ethnicity, perceived health via a 5-point Likert scale (1 = "poor", 2 = "fair", 3 = "good", 4 = "very good", 5 = "excellent"), and the state that they are currently attending college. Due to minimal data from certain ethnic groups, two categories were created (white or non-white). Participants also reported their physical activity, sedentary behavior, and mental health.

International physical activity questionnaire-short form (IPAQ-SF)

Physical Activity was measured with the International Physical Activity Questionnaire- Short Form (IPAQ-SF),[25] which has previously demonstrated appropriate reliability and validity.[26,27] Participants reported the number of days and minutes they walked and performed moderate and vigorous physical activity each day. These data were then calculated into weekly minutes of walking, moderate physical activity, and vigorous physical activity for each participant.

Daily sitting minutes

Sedentary behavior was measured by asking participants the time they spent sitting on weekdays during the last seven days. Participants were asked to "include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television". Participants report of hours and minutes were calculated to total minutes per day.

Stress

To measure the stress experienced by the students, the Student Stress Scale and Perceived Stress Scale were used. The Student Stress Scale is a 31-item measure that presents participants with stressful life events. Each question is weighted depending on the level of the stressful event that participants report occurred within the last year. For example, "Death of a close friend" = 73, "Increased workload at school" = 37, and "Change in social activities" = 29.[28] The maximum score participants could report is 1,276. Scores were interpreted with the following ranges: 0-149 = "very little stress", 150-199 = "mild stress", 200-249 = "moderate stress", 250-299 = "serious stress", and 300+ = "major stress"). This measurement has previously demonstrated appropriate levels of validity and reliability.[29] The second measure of stress used was the Perceived Stress Scale. The Perceived Stress Scale is a 10-item questionnaire, asking participants to respond on a 5-point Likert scale (0 = "Never", 1 = "Almost never", 2 = "Sometimes", 3 = "Fairly often", 4 = "Very often").[30] Scores were averaged across participants. The validity and reliability of this measure has been previously demonstrated.[31]

Depression

Depression was measured using Beck's Depression Inventory, which is a 21-item inventory to assess depression severity.[32] Participants rated statements on a 4-point Likert scale, ranging from 0 to 3. Each question had a unique participant response with lower scores indicating less depression. For example, one of the questions used the following Likert scale: 0 = "I do not feel sad", 1 = "I feel sad", 2 = "I am sad all the time and can't snap out of it", 3= "I am so sad and unhappy that I can't stand it". Scores were averaged across participants, with higher scores indicating increased depression. The Beck's Depression Inventory has demonstrated previous reliability and validity.[33]

Psychological wellness

Psychological wellness was recorded using the 42-item Psychological Wellness scale.[17,18] This measurement included six subscales of well-being, including autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Participants' responses were calculated as averages for each subscale. Lower scores demonstrated increased levels of well-being. Appropriate validity and reliability have been demonstrated with intercorrelations for subscales reported as ranging between 0.15 to 0.71.[34]

Statistical analysis

Data analyses were performed using IBM SPSS Statistics (Version 28). Descriptive statistics characterized the sample and described participants' physical activity and perceived stress, depression, and well-being. An analysis of variance (ANOVA) F-test was used to test for differences in mean weekly minutes of walking, moderate, vigorous physical activity, and daily sitting minutes between demographic groups. Demographic groups tested included gender, ethnicity, and perceived health. Similarly, differences in Student Stress Score, Perceived Stress, Beck's Depression Inventory, and Psychological Wellness subscales were measured. Multiple linear regression models were used to estimate mean differences in Student

Stress Score, Perceived Stress, Beck's Depression Inventory, and Psychological Wellness subscales based on participants' self-reported weekly minutes of walking, moderate physical activity, vigorous physical activity and daily sitting minutes. Models examined adjusted associations, controlling for covariates that were found to predict stress and depression variables and effect model estimates (e.g., gender, age, ethnicity, state of residency, and perceived health). Adjusted R square (R2adj) was used to calculate the proportion of variation in each stress/depression scale accounted for by the included physical activity levels, sedentary behavior, and significant covariates.

Results

Participants (n = 177) were predominantly female (85.1% female; 14.95% male) with a mean age of 20.60 (standard deviation (SD) = 2.56). Participants self-identified as Caucasian (85.6%), Asian (6.30%), Hispanic/Latino (4.60%), or mixed ethnicity (Caucasian and African American, 3.4%). Participants represented universities from seven states, including Ohio (141, 79.7%), Virginia (27, 15.3%), North Carolina (3, 1.7%), Pennsylvania (2, 1.1%), Indiana (2, 1.1%), Louisiana (1, 0.6%), and New York (1, 0.6%). Most participants perceived their general health as very good (46.6%), followed by good (35.6%), excellent (10.9%), and fair (6.9%). No participants reported poor health.

Table 1 depicts differences in weekly physical activity and daily sitting minutes based on participants' gender, ethnicity, and perceived health. Males reported higher vigorous physical activity than females (MD = 177.07, p = .02).

Table 2 shows differences between student stress, perceived stress, and depression based on participants' gender, ethnicity, and perceived health. Males reported significantly lower perceived stress than females (MD = 3.25, p = .04). Based on students' perceived health, significant differences were observed for student stress (p = .02) and depression (p = .01).

Table 3 shows differences between gender, ethnicity, and perceived health based on participants' psychological wellness. Significant differences were detected for perceived heath dependent on the environment, relations, purpose, and self-acceptance subscales (p < .05).

Table 4 shows results relative to the purpose of the current study, including relationships between physical and sedentary behavior on students' self-reported stress, perceived stress, and depression. Daily sitting minutes significantly affected participants' stress (p = .03), perceived stress (p = .01), and depression (p = .04). No relationships for physical activity influence were detected.

Table 5 shows the relationships between physical activity levels and sedentary behavior on the multiple psychological wellness variables. Moderate levels of physical activity had a significantly negative impact on growth (β = -.24, p = .01), meaning an increase in physical activity led to improved growth psychological wellness. This similar relationship was also observed between vigorous physical activity and relations (β = -.18, p = .04), purpose (β = -.22, p = .01), and self-acceptance (β = -.20, p < .001). Minutes participants reported sitting was negatively related to their environmental psychological wellness (β = -.23, p = .01).

Table 1 Descriptive statistics and weekly minutes of walking, moderate physical activity, vigorous physical activity, and daily sitting minutes

Sample Characteristics			Physical Activity Weekly Minutes and Daily Sitting Minutes											
		%	Walking		p-value	Moderate		p-value	Vigorous		p-value	Sitting		p-value
			Mean	SD		Mean	SD		Mean	SD		Mean	SD	
Total	N=177	100	669.60	568.07		343.40	558.75		1680.00	350.13		362.21	170.23	
Gender Missing data = 3	Females	85.10	687.09	600.31	0.47	361.05	596.07	0.49	338.31	596.07	**0.02**	366.35	174.60	0.45
	Males	14.90	619.04	351.28		279.04	300.86		515.38	389.20		338.65	143.51	
Ethnicity	White	85.6	667.34	573.63	0.59	339.75	548.82	0.61	370.05	349.24	0.63	354.32	169.97	0.14
	Non-White	14.4	734.08	554.04		402.76	644.79		333.44	366.19		409.28	167.39	
Health	Fair	6.90	538.75	379.16	0.76	87.50	99.46	0.43	250.00	406.00	0.90	398.75	207.30	0.72
	Good	35.60	665.69	673.32		375.63	552.00		302.42	358.20		368.74	156.41	
	Very Good	46.60	700.58	541.16		362.74	614.62		400.28	292.68		359.36	185.70	
	Excellent	10.90	700.00	421.95		366.84	518.48		497.47	471.92		330.00	117.90	

Significant results (p < 0.05) are bolded.

Table 2 Descriptive statistics and student stress, perceived stress and beck's depression inventory

Sample Characteristics			Student Stress			Perceived Stress			Beck's Depression Inventory		
		%	Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value
Total	N=174	100	227.76	129.68		20.98	5.67		10.34	9.03	
Gender Missing data = 3	Females	85.10	232.47	131.79	0.25	21.32	5.67	0.04	10.72	9.34	0.19
	Males	14.90	200.92	115.62		18.07	5.05		8.19	6.70	
Ethnicity	White	85.6	227.94	126.22	0.96	21.16	5.91	0.38	10.11	9.23	0.40
	Non-White	14.4	226.68	151.56		19.95	4.06		11.76	7.74	
Health	Fair	6.90	320.08	117.70	0.02	24.50	6.64	0.12	17.58	11.91	**0.01**
	Good	35.60	231.45	133.64		21.45	5.61		11.56	9.64	
	Very Good	46.60	225.46	125.88		20.21	5.49		9.07	7.78	
	Excellent	10.90	167.21	112.20		19.75	5.28		7.21	7.38	

Stress was summed across 31 potential stressors with a maximum score of 1,276. Perceived Stress was measured on a 5 point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often. Beck's Depression Inventory was summed across 21 questions (0, 1, 2, or 3 for each question) with a potential score of 0 (no depression) to 63 (highest depression). Significant results (p < 0.05) are bolded.

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Table 3 Descriptive statistics and psychological wellness subscales

Sample Characteristics			Autonomy N=129			Growth N=130			Environmental N=130			Relations N=129			Purpose N=129			Self-Acceptance N=131		
		%	Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value	Mean	SD	P-value	Mean	SD	p-value	Mean	SD	p-value
Total	N=177	100	3.76	0.83		4.84	0.69		3.86	0.85		4.74	0.86		4.58	0.82		3.99	0.91	
Gender Missing data = 3	Females	85.10	3.71	0.83	0.05	4.81	0.70	0.20	3.85	0.87	0.59	4.74	0.89	0.96	4.59	0.83	0.73	3.98	0.93	0.68
	Males	14.90	4.16	0.76		5.06	0.50		3.98	0.69		4.72	0.18		4.51	0.79		4.08	0.73	
Ethnicity	White	85.6	3.77	0.85	0.80	4.85	0.68	0.75	3.86	0.87	0.87	4.77	0.89	0.29	4.59	0.80	0.89	4.02	0.93	0.27
	Non-White	14.4	3.71	0.75		4.79	0.72		3.89	0.80		4.54	0.68		4.56	0.97		3.78	0.81	
Health	Fair	6.90	3.70	0.71	0.79	4.56	0.49	0.40	3.06	0.87	0.01	3.93	1.12	0.04	3.89	0.84	0.02	3.36	1.10	**0.03**
	Good	35.60	3.78	0.73		4.79	0.68		3.80	0.73		4.66	0.80		4.55	0.80		3.87	0.83	
	Very Good	46.60	3.80	0.88		4.89	0.74		4.02	0.82		4.86	0.83		4,74	0.78		4.12	0.88	
	Excellent	10.90	3.54	1.13		5.00	0.58		4.07	1.09		5.15	0.62		4.55	0.91		4.33	1.02	

Psychological Wellness subscales were measured on a 5 point Likert scale (1=strongly agree, 2 = somewhat agree, 3 = a little agree, 4 = neither agree nor disagree, 5 = strongly disagree. Higher scores indicate better psychological wellness for each subscale. Significant results ($p < 0.05$) are bolded.

Table 4 Weekly minutes of physical activity and daily sedentary behavior on student stress, perceived stress, and beck's depression inventory

Independent Variable	Student Stress[a]		Perceived Stress[b]		Beck's Depression Inventory[c]	
	β (SEM)	*P* value	*β* (SEM)	*P* value	*β* (SEM)	*P* value
Weekly Walking Minutes	0.11 (0.02)	0.14	-0.05 (0.00)	0.56	-0.06 (0.00)	0.42
Weekly Moderate Minutes	0.01 (0.02)	0.94	-0.01 (0.00)	0.96	-1.00 (0.00)	0.16
Weekly Vigorous Minutes	0.06 (0.03)	0.47	0.09 (0.00)	0.34	1.11 (0.00)	0.15
Daily Sitting Minutes	0.17 (0.06)	0.03	0.21 (0.00)	0.01	0.15 (0.00)	0.04

β = standardized coefficients; SEM = standard error of the mean. Student Stress was summed across 31 potential stressors with a maximum score of 31. Perceived Stress was measured on a 5 point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often; Beck's Depression Inventory was summed across 21 questions (0, 1, 2, or 3 for each question) with a potential score of 0 (no depression) to 63 (highest depression). Statistically significant results are bolded ($p<0.5$). [a]Perceived health included as a significant covariate. [b]Gender and perceived health included as significant covariates. [c]Gender, state of residency, and perceived health included as significant covariates.

Table 5 Weekly minutes of walking, moderate physical activity, and vigorous physical activity on psychological wellness subscales

Physical Activity Weekly Minutes	Autonomy		Growth		[a]Environmental		[a]Relations		[a]Purpose		[a]Self-Acceptance	
	β (SEM)	*P* value	*β* (SEM)	*P* value	*β* (SEM)	*P* value	*β* (SEM)	*P* value	*β* (SEM)	*P* value	*β* (SEM)	*P* value
Walking Weekly Minutes	-0.06 (0.00)	0.53	0.12 (0.00)	0.18	0.06 (0.00)	0.52	0.08 (0.00)	0.34	-0.04 (0.00)	0.68	0.01 (0.00)	0.53
Moderate Physical Activity Weekly Minutes	0.04 (0.00)	0.69	-0.24 (0.00)	0.01	-0.04 (0.00)	0.62	-0.16 (0.00)	0.06	-0.07 (0.00)	0.42	0.03 (0.00)	0.73
Vigorous Physical Activity Weekly Minutes	-0.04 (0.00)	0.66	-0.08 (0.00)	0.33	-0.10 (0.00)	0.25	-0.18 (0.00)	0.04	-0.22	0.01	-0.20 (0.00)	0.00
Sitting Daily Minutes	0.05 (0.00)	0.57	-0.08 (0.00)	0.38	-0.23 (0.00)	0.01	-0.08 (0.00)	0.36	0.01 (0.00)	0.93	-0.13 (0.00)	0.12

B = standardized coefficients; SEM = standard error of the mean; Psychological Wellness subscales were measured on a 5 point Likert scale (1=strongly agree, 2 = somewhat agree, 3 = a little agree, 4 = neither agree or disagree, 5 = strongly disagree. Lower scores indicate better psychological wellness for each subscale. Significant results are bolded ($p<0.5$). [a]Perceived health included as a significant covariate.

Discussion

The current study aimed to identify the effect of physical activity levels and sitting behavior as it relates to young adults' stress, depression, and psychological wellness. Differences between physical activity, sitting behavior, stress, and depression between certain demographic groups showed significant differences. Expectations that increased physical activity levels and lower sitting behavior would lead to decreased stress, depression, and psychological wellness among participants were mixed. This uncertainty on whether sitting behavior and physical activity had an impact on stress levels and mental health among this population reflects a need for more outreach on psychological wellness and appropriate physical activity levels. The outcomes based on expectations and previous researches are provided in the following paragraphs.

In terms of demographics, results showed that males participated in vigorous physical activity at higher rates than females. This supports previous research by Azevedo and colleagues[35] that found since males are more likely to engage in physical activity, that physical activity health interventions should be considered. Females are more likely to experience higher levels of perceived stress compared to males by a significant margin. This aligns with recent research conducted by Graves and colleagues[36] which looked at stress and gender differences in undergraduate college students and found that females were more stressed on average than males. Researchers also found there were gender differences in both coping strategies that were utilized and coping dimensions.[36] Current research also discovered that among all reported ethnicities, walking was the level of physical activity that was engaged in the most by participants. This finding is supported by a study conducted by Katzmarzyk and colleagues.[37]

While data did not support the hypothesis that increased levels of physical activity correlated with decreased stress and depression, there was evidence to suggest improved psychological wellness in those who engaged in more activity. Sitting minutes were found to be significant across all three domains of student stress, perceived stress, and Beck's Depression Inventory. This supports previous research findings that the more sitting college students do can increase levels of stress and depression in this population.[38] This study indicated a negative relationship between increased physical activity and certain subscales of psychological wellness. Hence, as physical activity levels increased, certain subscales of psychological wellbeing decreased. Individuals who participated in higher levels of moderate physical activity scored higher on the personal growth subscale, indicating that moderate physical activity has influence on personal improvement, such as expanding horizons and making important life changes. This supports previous research that exercise has antidepressant effects that can increase both self-esteem and self-efficacy, decrease inflammation, and promote socialization.[1] Current outcomes also showed a negative relationship between increased vigorous physical activity and relationships with others, purpose in life, and self-acceptance subscales. Those who actively engaged in vigorous physical activity had better relationships and relationship skills, supporting previous research on the antidepressant effects of exercise.[1] Current participants also felt they had more direction in day-to-day life, and a better idea of their future goals (i.e., purpose). In terms of self-acceptance, participants who engaged in vigorous physical activity had more positive outlooks on their life, and more confidence in who they are as a person. These findings support results of prior research that showed weekly physical activity and physical activity in natural settings increased well-being and enhanced motivation levels.[39]

Perceived health had a significant relation to depression levels, student stress, and psychological wellness. Individuals reporting excellent health experienced significantly lower levels of depression than those who reported having fair health, which has been found in prior research.[40] Lower levels of perceived health were associated with decreased psychological wellness subscales of environmental mastery, relationships with others, purpose in life, and self-acceptance, supported by a study conducted by Lukács.[41] Surprisingly, there was no significant relationship between weekly physical activity minutes and levels of stress and depression. While data were trending in the correct direction, findings were insignificant. This is contradictory to previous research which suggests a strong relationship between physical activity and reduced levels of stress and depression.[1] The American College of Sports Medicine (ACSM) has also found evidence that physical activity positively impacts moderate symptoms and severity of depression and severe stress.[42]

Limitations of this study were related to sample size, diversity, and measurement. Firstly, there was a lack of diversity as 86% of participants were Caucasian, and there was no Black/African American representation. This is likely due to the limited diversity found in the Midwestern University where most of the data was sourced. There were also a low number of males, with 85% of participants being female. The department where the survey was distributed is mostly female, which accounts for this limitation. It was also found that some participants did not complete the full survey. It could have benefited the study if the number of measurements used was limited to decrease the length of the survey. Future research should aim to identify the most relevant stressors specific to college students after the COVID-19 pandemic.

Conclusion

The descriptives comparisons indicated that only vigorous activity levels were significant in both males and females. This concludes that only vigorous activity was significant across gender among a predominantly female sample. Future research is needed with data that better represents all genders. Additionally, perceived stress was significant across gender, which is supported by previous research.[36] This demonstrates that one's gender can have an impact on the stress levels they face in college and beyond and helps conclude that mental health interventions need to consider gender differences. Another trend found was that perceived health status was significant across the student stress and Beck's Depression Inventory domains. This demonstrates that how one views themselves and their health can have an impact on their stress while in college as a student. Also true is how one perceives their health can indicate depression symptoms to help professionals determine whether one has a depressive disorder or not. Perceived health status was also significant across the environmental, relations, purpose, and self-acceptance psychological wellness subscales. This suggests that how one view their health can have an impact on how they view the environment around them, how they view their relationships and socialize with others, how they view their purpose in life, and whether they can accept themselves for who they are.

Daily sitting minutes were significant across the three domains of student stress, perceived stress, and Beck's Depression Inventory. This shows that sitting behavior can cause stress levels to increase, as well as lead to increased risk for developing a depressive disorder. Relative to physical activity, weekly moderate levels significantly predicted improved psychological wellness growth subscale. Therefore, appropriate levels of moderate physical activity per week improved one's view of themselves as growing as a person. Weekly vigorous physical activity was also significant across the relations, purpose, and self-acceptance psychological wellness subscales. This concludes that having higher physical activity levels can increase one's self-efficacy and increase positive views of their relationships, as well as increase positive views of their purpose in life, and finally increase one's acceptance of themselves as a person. Daily sitting minutes significantly impacted the psychological wellness environmental subscale; hence sitting behavior can make one negatively view their environment.

To conclude, physical activity was found to be a positive influence across many domains of stress, depression, and psychological wellness domains. Also, increased sitting behavior was found to be a negative influence across several domains which can cause one to have a negative view of themselves and their environment. Overall, physical activity and less sitting time can be natural interventions to prevent and relieve mental health symptoms and promote positive

mental health and wellness. Current results will help inform future research in the development of interventions tailored to college students who are suffering from mental illness, increased levels of stress, and decreased wellness.

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Conflict of interest statement

The authors report no conflict of interest.

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