A CORRELATIONAL STUDY ON PHYSICAL ACTIVITY AND GPA AMONG COLLEGE STUDENTS

Tobias Whitford

Tobias Whitford is currently lead sixth grade science teacher at Harlem North Central, Success Academy in New York City. Tobias graduated from Florida State University in 2020 with a Bachelor of Science in Biological Sciences. He enjoys weightlifting, hanging out with friends (pre-pandemic), and spending time with his family. Tobias is currently applying to medical school where he hopes to study Oncology or Geriatrics.

Abstract

Studies have documented positive effects of physical activity on a variety of outcomes, including academic performance. However, other studies report mixed or null results, mostly based on samples of high school students or post-graduates. The current, novel study examined physical activity and grade point average (GPA) in a sample of undergraduate students at the Florida State University. This association was tested using a survey distributed to students online. Respondents (n=200) reported on their GPA and answered questions on engagement in physical activity and other health behaviors (i.e., cigarette smoking, alcohol use, etc.) and variables (i.e. personality and psychological symptoms) potentially associated with both GPA and physical exercise. They also completed a cognitive test. Contrary to what expected, the analyses indicated a non-significant correlation between time spent in vigorous or moderate physical activities and GPA, when controlling for age, sex, race/ethnicity and years in college. GPA was also unrelated to cognitive performance and other health behaviors. Further studies are needed to confirm these results and explore associations between study variables longitudinally, over the course of the four years of college.

Keywords: physical activity, GPA, college, health behaviors, correlations.

Current scientific literature has widely demonstrated that regular physical activity benefits health, decreasing risk of diseases (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis) and premature death (Warburton et al., 2006). These benefits start at young age and extend across the lifespan. At young age, physical activity appears as important in attaining higher academic achievement and a healthy lifestyle. For example, studies correlated physical activity with both academic and cognitive performance, from high school to undergraduate and specialized upper-level graduate programs (Al-Drees, 2016; Wald et al., 2014; Weston et al., 2020). Yet, the transition into college could be particularly challenging. For students to maintain their academic performance, it may come at the cost of reducing time spent on extracurricular activities, including physical activity. Further, with increased autonomy, students often engage in health-risky behaviors (i.e. poor diet, alcohol drinking and substance use; DiBello et al., 2018). This study could suggest exercise as interventionist techniques for combatting low academic performance.

One common method to assess academic performance among college students is evaluating self-reports of their grade point average (GPA; Kuncel et al., 2005). To date, studies that examined the association between physical activity and GPA reported mixed results. While some studies found a positive association (Wald et al., 2014; Weston et al., 2020), other do not observe a significant correlation between these two variables (Khan et al., 2017; Xu & Sansgiry, 2018). Using data from a national survey of college students, Wald et al. (2014) found grade average was higher in students meeting moderate-vigorous physical activity, and engaging in a healthier lifestyle, following fruit and vegetable intake, and sleep recommendations. Xu and Sansgiry (2018), on the contrary, did not found an association between physical activity and GPA, but observed that students with lower body mass index (BMI) had higher GPAs than students with higher BMI. In another study, Khan et al. (2017) evaluated stress levels and GPAs of medical students in relation to their physical activity. The authors found physical activity to be correlated with reduced stress levels, but the correlation between physical activity and academic performance was not significant (Khan et al., 2017). To note that most of extant literature has been conducted either on adolescents or graduates in physical and medical training, but few studies have focused on traditional undergraduate students.

The aim of the current, novel study was to explore the correlation between physical activity and self-reported GPA in a sample of undergraduate college students at the Florida State University. The study further assessed health-related habits and psychosocial variables that could potentially be related to physical

activity and GPA—i.e. personality and psychological symptoms (i.e. depressive symptoms). Cognitive performance was also assessed as consistently associated with physical activity and academic performance in young populations to increase the validity of the data (Bergol & Steinmayr, 2018; Phan et al., 2018).

Methods

Participants and Procedure

This study consisted of an anonymous Qualtrics survey distributed to college students at the Florida State University. The survey was advertised as an online study on academic performance and health behaviors. Recruitments was carried out through the distribution of flyers at the main campus in Tallahassee and ads on university-related Facebook groups and/or webpages. Ads and flyers included a link/QR code that participants could use to access the survey online. Students were not given credit or remuneration. Data collection was completed in the Spring Semester of 2019.

The survey consisted of four blocks of questions: Block 1 included questions on socio-demographics and self-reported GPA; Block 2 included questions on health-related behaviors, such as physical activity; Block 3 included self-report questionnaires on depression and personality; and Block 4 consisted of a series of computer-based cognitive tasks. Of 246 students who initiated the survey, 200 (81.3%) reported on GPA and answered questions on physical activity. Of these, about 85% (up to 174/200 respondents) participants reported on other health behaviors (i.e., sleep hours per night, alcohol use, etc.); 82% (n=165) reported on depression symptoms and 80% (n=161) on personality. Fewer participants (less than 70%) completed the last block of the cognitive tasks and the whole survey.

On average, participants took 12 minutes to complete the survey. For the focus of this article, we analyzed data on self-reported GPA and physical activity, and explore correlations among health-related and personality variables. The analytic sample (n=200) was between 18 and 25 years of age, mostly female (69.0%) and white (69.5%); 22.6% were freshmen, 22.6% sophomores, 40.2% juniors, and 16.6% seniors (see Table 1 details).

All materials and procedures were approved by the Institutional Review Board of the Florida State University.

Measures

Self-reported Grade Point Average

Because we had no access to official academic records, we asked participants to report their cumulative GPA. Specifically, we asked, "Please indicate your current cumulative Grade Point Average (GPA)?" Response options were on a

scale from 0.00 to 4.00. Self-reports of GPA are commonly used as indicator of academic performance (Sticca et al., 2017) and would be accurate representations of the sampled population, though measure errors occur (Kuncel et al., 2005; Rosen et al., 2017).

Health Behaviors

Physical Activity. Questions used to investigate students' physical activity were adapted from other surveys (Sylvia et al., 2014). Participants were asked whether they engaged in any vigorous or moderate physical activity in the last month (response: yes/no) and the type of physical activity (i.e., football, soccer, swimming, etc.) they typically engaged in. For each type of activity separately (vigorous and moderate), they reported the number of days a week and the hours a day spent exercising. The time spend exercising was calculated multiplying days a week and hours/day spent in each activity, vigorous and moderate. For the analyses, we computed an average scores of time spent exercising across vigorous and moderate activity.

Cigarette Smoking. Participants were asked whether they currently smoked cigarettes (response: yes/no), and if not, whether they ever smoked a cigarette in the past (yes/no). Those who reported to smoke were asked to indicate the number of cigarettes smoked per day.

Alcohol Drinking. Participants were asked whether they currently drank alcohol (response: yes/no), and if not, whether they ever consumed alcohol beverages (yes/no). Those who currently drank also reported on the numbers of days they drank in the past month (possible range = 0-31) and number of drinks had on the days they drank (range = 0-90). The total number of drinks had in the last month was computed multiplying the number of days per number of drinks a day.

Other substance use. Participants reported whether they currently used marijuana (response: yes/no), and if not, whether they ever used marijuana in the past (yes/no).

Body Mass Index (BMI). Participants reported on their weight and height. BMI was calculated by dividing weight (lbs) by height in inches (in) squared and multiplying by a conversion factor of 703.

Hours of sleep per night. Participants were asked how many hours of sleep they had, on average, per night during the last week (possible range = 0-24).

Depression Symptoms

Participants completed the 8-item version of the Patient Health Questionnaire, depressive module (Kroenke et al., 2010). They reported the frequency of

depressive symptoms (e.g., "Feeling down, depressed, or hopeless") over the past 2 weeks, on a scale from 0 (not at all) to 3 (nearly every day). Scores ranged from 0 to 24, with higher scores indicating more depressive symptoms (alpha reliability =.71)

Personality Traits

Neuroticism, extraversion, openness, agreeableness and conscientiousness were measured with the 20-item form of the International Personality Item (Donnellan et al., 2006). Participants were asked to rate each item, e.g. "I sympathize with others' feelings." on a 5-point scale, from *strongly disagree* (1) to *strongly agree* (5). Alpha reliabilities ranged from .62 for neuroticism to .83 for extraversion.

Cognitive Measure: Mental Rotation

We used an adapted short mental rotation task to measure cognitive performance (Shepard & Metzler, 1971; Ganis & Kievit, 2015). Participants were presented a set of paired 3D cube images. For each pair, respondents were asked whether the target image on the left was the same (a rotated version) or different from the image on the right. After two practice trials, respondents were presented with 10 paired images. This cognitive test was used to explore possible correlations between cognitive performance and GPA and other self-reported variables.

Data Analysis

Descriptive statistics and correlation analyses were conducted using SPSS software, version 25. To identify correlations between self-reported GPA, physical activity and other health behaviors, personality, depression, and cognitive performance, we used non-parametric rank-order (Spearman's rho) correlations that controlled for age, sex, race/ethnicity and years in college to establish a clear link between physical activity and academic performance.

Results

Frequencies, means and standard deviations for sample and study variables are reported in Table 1. We reported statistics for those who had valid data on GPA and who reported at least some information on physical activity. The smallest number of responses was for the mental rotation task (n=84/200; 42% of the analytic sample).

GPA values ranged from 2.50 to 4.00 with a mean of 3.48 (SD=0.36). Only 18 students reported a GPA lower than the 3.00. There were no differences in GPA across the four years of college (p<.05). Of note, the GPA score in the current sample was slightly higher than what reported by FSU Office of Institutional

Research (GPA Spring 2019, *M*=3.21; *SD*=0.57). Specifically, the present sample had 0.27 points higher GPA compared to the average undergraduate FSU population in Spring 2019 (Cohen's *d* = 0.56).

Respondents were highly active: About 80% (159/200) reported to have engaged in vigorous physical activities in the last month and 78% (156/174; 26 missing cases) reported to have engaged in moderate physical activities. Only 10/174 students reported to not have engaged in any vigorous or moderate activities. Most frequent vigorous activities were running (57%), weight lifting (45.5%), cycling (22%) and high-intensity aerobic exercises (28%). Most frequent moderate activities were brisk walking (54%) and weight lifting for fitness (47.5%). On average, respondents spent about 3 days a week and 5 hours per week engaging in vigorous or moderate exercises.

Table 2 shows non-parametric correlations between GPA, physical activity and other study variables, controlling for age, sex, race/ethnicity, and years of college. Contrary to expectations, correlation analysis showed no association between self-reported GPA and measures of physical activity, nor other health-related behaviors (*p*=-.10) Physical exercise was associated with lower depressive symptoms (*p*=-.36*) and neuroticism(*p*=-.30*), and higher extraversion (*p*=.28*). Students that were more extroverted and outdoing also reported higher alcohol drinking(*p*=.32*), use of marijuana (*p*=.36*) but less depressive symptoms (*p*=-.48*), and BMI (*p*=-.24*),. There was no correlation between GPA and mental rotation performance (*p*=.085) (see Table 2).

Table 1

Descriptive Statistics

Variables	Frequency (%) or Mean (SD)	Response Rate N (%)
Self-reported GPA	3.48 (0.36)	200 (100%)
Age (years)	20.00 (1.22)	200 (100%)
Female	138 (69.0%)	200 (100%)
White	139 (69.5%)	200 (100%)
College year		199 (99.5%)
First (Freshman) year	45 (22.5%)	
Second (Sophomore) year	41 (20.5%)	
Third (Junior) year	80 (40.0%)	
Forth (Senior) year	33 (16.5%)	
Vigorous Activities (yes)	159 (79.5%)	200 (100%)
Times spent in Vigorous Activities		200 (100%)
Days a week	2.85 (2.03)	
Hours a day	1.17 (1.23)	
Total hours/week	4.49 (6.71)	
Moderate Activity (yes)	156 (78.0%)	174 (87.0%)
Times spent in Vigorous Activities		166 (83.0%)
Days a week	3.11 (1.95)	
Hours a day	1.25 (1.62)	
Total hours/week	4.47 (6.91)	
Total time (hours/week) spent in exercising	4.46 (6.53)	200 (100%)
Average hours of sleep per night in the last month	6.93 (1.07)	174 (87.0%)
Ever drank alcohol (yes)	164 (82.0%)	171 (85.5%)
Average alcohol consumption		168 (84.0%)
Days when drank in the last month	5.41 (5.11)	
Drinks/day drank in the last month	3.79 (3.46)	
Total no. of drinks had in the last month	23.63 (34.33)	
Ever smoked cigarettes (yes)	44 (22.0%)	171 (85.5%)
Currently smoking (yes)	3 (1.5%)	
Ever used marijuana (yes)	115 (57.5%)	171 (85.5%)
Currently using marijuana (yes)	57 (28.5%)	
BMI	23.58 (4.00)	163 (81.5%)
BMI ≥ 30	9 (4.5%)	
Depressive symptoms (score = 0-24)	6.59 (4.63)	165 (82.5%)
Personality (score = 1-5)		161 (80.5%)
Neuroticism	2.89 (0.78)	
Extraversion	3.30 (0.99)	
Openness	3.67 (0.78)	
Agreeableness	4.04 (0.74)	
Conscientiousness	3.62 (0.84)	
Mental Rotation (score = 0-10)	8.64 (1.78)	84 (42.0%)

Table 2

Non-parametric partial correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	Mental Rotation
GPA	-.10	.22	-.16	-.11	-.04	-.08	-.05	.06	-.08	-.14	-.01	.03	.085
1. Physical Exercise (tot. hours/week)	1	-.01	-.01	.08	.18	.09	-.36*	-.30*	.28*	.15	.21	.14	-.09
2. Hours of sleep per night		1	-.22	-.19	-.26*	-.12	-.16	-.22	-.20	-.19	.03	.08	.12
3. Drinks drank in the last month			1	.16	.34*	-.06	.05	-.01	.36*	.18	-.05	-.09	.11
4. Ever smoked				1	.25*	-.12	.13	.29*	-.02	-.16	-.27*	-.03	-.09
5. Ever used marijuana					1	-.10	-.15	.04	.32*	-.08	-.05	-.03	-.07
6. BMI						1	.07	-.03	-.24*	-.02	-.24*	-.14	-.04
7. Depressive symptoms							1	.44*	-.48*	-.20	-.19	-.36*	.02
8. Neuroticism								1	-.32*	-.32*	-.01	-.17	-.13
9. Extraversion									1	.33*	.41*	.15	-.10
10. Openness										1	.147	.18	-.08
11. Agreeableness											1	.29*	-.02
12. Conscientiousness												1	-.06

Note. N size varies base on missing values. The smallest number of responses was for the mental rotation task (*n*=84/200; 42% of the analytic sample). The analyses controlled for age, sex, race/ethnicity and years in college.

* *p*<.05

Discussion

With the current sample, no statistically significant correlation between physical activity and GPA was observed. This stands in contrast with some of the studies that found a positive association between these variables (Wald et al., 2014), but align with those finding a non-significant correlation (Gonzalez et al., 2014; Xu & Sansgiry, 2018; Khan et al., 2017).

One possible explanation for this null result is that students entering college may have reduced time for and resources spend on extracurricular activity such exercise (as suggested by Gonzalez et al., 2014). That is, students would rather spend time studying and focusing on their study program that engaging in physical activity. GPA was also not associated with other health-related behaviors, contrasting previous results of alcohol drinking, smoking and sleep deprivation associated with poor academic performance (Ansari et al., 2013; Smith, 2019; Taylor et al., 2013). GPA was as well unrelated to performance on the mental rotation test.

One important limitation to point out is that the current sample reported high GPA values. The GPA of the sample was higher compared to the average GPA of the Florida State undergraduate population in Spring 2019 (+.27 points). Given this, it is possible that limited variability in GPA scores would not allow to detect significant association with other study variables. Further, GPA is only one index of academic performance and success. This study did not assess other important aspects, such as actual grades, but also attainment of learning objectives, satisfaction, and acquisition of specific competence. Self-reported

GPA could have been artificially inflated by the respondents, further affecting the correlation. In addition, the sampled population gender demographics did not accurately represent the Florida State University population (57% Female actual vs. 69% Female sampled).

The results did support the known associations between personality, health-behaviors and depressive symptoms. For example, the trait of extraversion (i.e. tendency to be sociable and outgoing) was associated with physical activity, as well as with lower BMI and depression, but also more substance use. Neuroticism and depressive symptoms in contrast were associated with lower physical activity. These associations are in line with those observed in prior studies of personality and health behaviors among college students and general population (Aherthon et al., 2014; Raynor & Levine, 2009).

This study adds to the literature on physical activity and GPA assessing a convenience cross-sectional sample. Further studies are needed to confirm the null association of physical activity with GPA. It is also important to explore associations between study variables longitudinally, over the course of the four years of college.

References

Al-Drees, A., Abdulghani, H., Irshad, M., Baqays, A. A., Al-Zhrani, A. A., Alshammari, S. A., & Alturki, N. I. (2016). Physical activity and academic achievement among the medical students: A cross-sectional study. *Medical Teacher, 38*(sup1), S66-S72. https://doi.org/10.3109/0142159X.2016.1142516

Atherton, O. E., Robins, R. W., Rentfrow, P. J., & Lamb, M. E. (2014). Personality correlates of risky health outcomes: Findings from a large Internet study. *Journal of Research in Personality, 50,* 56-60. https://doi.org/10.1016/j.jrp.2014.03.002

Bergold, S., & Steinmayr, R. (2018). Personality and intelligence interact in the prediction of academic achievement. *Journal of Intelligence, 6*(2), Article 27. https://doi.org/10.3390/jintelligence6020027

DiBello, A. M., Benz, M. B., Miller, M. B., Merrill, J. E., & Carey, K. B. (2018). Examining residence status as a risk factor for health risk behaviors among college students. *Journal of American College Health, 66*(3), 187-193. https://doi.org/10.1080/07448481.2017.1406945

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The mini-IPIP scales: Tiny-yet-effective measures of the Big Five factors of personality. *Psychological assessment, 18*(2), 192- 203. https://doi.org/10.1037/1040-3590.18.2.192

El Ansari, W., Stock, C., & Mills, C. (2013). Is alcohol consumption associated with poor academic achievement in university students? International *Journal of Preventive Medicine, 4*(10), 1175-1188.

Ganis, G., & Kievit, R. (2015). A new set of three-dimensional shapes for investigating mental rotation processes: Validation data and stimulus set. *Journal of Open Psychology Data, 3,* Article 3a. http://dx.doi.org/10.5334/jopd.ai

Gonzalez, E. C., Hernandez, E. C., Coltrane, A. K., & Mancera, J. M. (2014). The correlation between physical activity and grade point average for health science graduate students. *OTJR: Occupation, Participation and Health, 34*(3), 160-167. https://doi.org/10.3928/15394492-20140714-01

Khan, M. A., Afzal, S., Ahmed, Z., Mishal, M., Manan, A., Cheema, A., ... & Sehole, M. (2017). Association of internet supported physical activity with academic performance of medical students. *Annals of King Edward Medical University, 23*(1), 67-72. https://doi.org/10.21649/akemu.v23i1.1508

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The patient health questionnaire somatic, anxiety, and depressive symptom scales: A

systematic review. *General hospital psychiatry, 32*(4), 345-359. https://doi.org/10.1016/j.genhosppsych.2010.03.006

Kuncel, N. R., Credé, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*(1), 63-82. https://doi.org/10.3102/00346543075001063

Phan, D. V., Chan, C. L., Pan, R. H., Yang, N. P., Hsu, H. C., Ting, H. W., & Lai, K. R. (2018). A study of the effects of daily physical activity on memory and attention capacities in college students. *Journal of Healthcare Engineering, 2018*, Article 2942930. https://doi.org/10.1155/2018/2942930

Raynor, D. A., & Levine, H. (2009). Associations between the five-factor model of personality and health behaviors among college students. *Journal of American College Health, 58*(1), 73-82.

Rosen, J. A., Porter, S. R., & Rogers, J. (2017). Understanding student self-reports of academic performance and course-taking behavior. *AERA Open, 3*(2). https://doi.org/10.1177/2332858417711427

Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science, 171*(3972), 701-703. https://doi.org/10.1126/science.171.3972.701

Smith, A. (2019). Smoking, wellbeing and academic attainment. *Journal of Health and Medical Sciences, 2*(3). https://ssrn.com/abstract=3426983

Sticca, F., Goetz, T., Bieg, M., Hall, N. C., Eberle, F., & Haag, L. (2017). Examining the accuracy of students' self-reported academic grades from a correlational and a discrepancy perspective: Evidence from a longitudinal study. *PloS ONE, 12*(11), Article e0187367. https://doi.org/10.1371/journal.pone.0187367

Sylvia, L. G., Bernstein, E. E., Hubbard, J. L., Keating, L., & Anderson, E. J. (2014). Practical guide to measuring physical activity. J*ournal of the Academy of Nutrition and Dietetics, 114*(2), 199-208. ttps://doi.org/10.1016/j.jand.2013.09.018

Taylor, D. J., Vatthauer, K. E., Bramoweth, A. D., Ruggero, C., & Roane, B. (2013). The role of sleep in predicting college academic performance: is it a unique predictor? *Behavioral Sleep Medicine, 11*(3), 159-172. https://doi.org/10.1080/15402002.2011.602776

Wald, A., Muennig, P. A., O'Connell, K. A., & Garber, C. E. (2014). Associations between healthy lifestyle behaviors and academic performance in US undergraduates: A secondary analysis of the American College Health Association's National College Health Assessment II. *American Journal*

of Health Promotion, 28(5), 298-305. https://doi.org/10.4278/ajhp.120518-QUAN-265

Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174*(6), 801-809. https://doi.org/10.1503/cmaj.051351

Weston, R. E., Zeng, H., & Battle, J. (2020). Physical activity and GPA: Results from a national sample of Black students. *Journal of Human Behavior in the Social Environment, 30*(4), 383-398. https://doi.org/10.1080/10911359 .2019.1687387

Xu, Q., & Sansgiry, S. S. (2018). Association between physical activity and grade point average among a cohort of pharmacy students in didactic years. *Currents in Pharmacy Teaching and Learning, 10*(3), 333–339. https://doi.org/10.1016/j.cptl.2017.11.007