



*Original Research*

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## **College Student Work Habits are Related to Physical Activity and Fitness**

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### ABSTRACT

*International Journal of Exercise Science 10(7): 1009-1017, 2017.* Despite the known benefits of regular physical activity, research shows a significant decline in physical activity participation and an increase in sedentary behavior during young adulthood during the college years. Studies examining the relationship between academic outcomes and fitness/physical activity have not extensively examined this among college students. Therefore, the purpose of this study was to examine the relationship between fitness measures (cardiovascular endurance, muscular endurance, flexibility and body composition), physical activity, and academic outcomes in college students. This cross-sectional study had college students complete a one-time fitness assessment and survey examining their physical activity and academic factors (GPA, study habits, course load). Correlations examined relationships between fitness, physical activity and academic outcomes, t-tests compared differences for fitness and behavioral outcomes between groups by academic factors. The final sample (n=512) was 50.4% male, 78% Non-Hispanic White, and 67% upperclassmen. The majority (76%) of participants reported meeting current PA guidelines. Hours of studying and social media use were both positively associated with body fat. Course load was negatively associated with vigorous activity. Study time was negatively associated with cardiovascular endurance, positively associated with hip flexibility and sedentary behavior. Higher GPA was associated with a higher BMI and a higher credit load was associated with less vigorous physical activity. These findings indicated that academic outcomes and physical activity may have a different relationship among college students compared with younger age groups. This study provides insight for the development of future campus-based health initiatives to have a shared focus of academic outcomes and physical activity.

**KEY WORDS:** College student, fitness, academic outcomes

### INTRODUCTION

Physical activity is associated with decreased risk of heart disease, stroke, type-2 diabetes, metabolic syndrome and lower all-cause mortality rate (17). The prevalence of chronic disease is a significant issue in public health. Despite the known benefits, research shows a significant

decline in physical activity participation and an increase in sedentary behavior during young adulthood during the college years (20). There is significant evidence documenting the decline in activity levels through adolescence, and this trend continues with increasing age throughout adulthood. A study of 233 undergraduate students reported physical activity levels decreased during the transition from high school to college years; 65% of students reported engagement in regular vigorous and 26% in regular moderate physical activity during high school. Upon follow-up however, during their college years 38% of students participated in regular vigorous and 20% moderate PA(6).

This decline in activity can be related to a variety of factors. As students transition from high school to college they gain greater autonomy relative to their daily lives. Epidemiological findings have reported a decrease in physical activity as autonomy increases throughout middle and high school (13). One longitudinal study of college students demonstrated that psychosocial and residency (location, i.e. on or off campus housing) influences student physical activity levels as well as related mediators (e.g. self-efficacy, perceived benefits)(21). Other factors could include greater time demands (e.g. work, class time) as well as different access to places to be active.

There is a significant amount of literature examining the relationship between physical activity, cardiorespiratory fitness and cognitive/academic outcomes among adolescent, adult and senior citizen populations (16). Studies conducted with adolescents are extensive, though may not extrapolate to a college population. One study compared academic outcomes and physical fitness levels (cardiorespiratory fitness, body composition) for 6th and 7th graders. Analyses revealed that normal weight students had, on average, 11% higher GPA when compared with overweight students. Overweight students had lower reading comprehension scores and aerobic endurance levels were positively correlated with academic outcomes (18). In addition to these findings, a meta-analysis looking at data across 59 studies resulted that PA had a positive effect on children's achievement and cognitive outcomes, and the greatest correlation was with aerobic exercise (13). Despite this abundance of evidence during other life stages, there is limited research examining how physical activity, fitness, and academic outcomes are related during the college years.

The evidence presented reinforces the importance of policies and programs including physical activity in K-12 school settings for both health and academic outcomes. The relationship between physical activity and academic outcomes among college students is less clear, and therein there is a lack of evidence informing college health and wellness programs and policies for physical activity. Therefore, the purpose of this study was to examine the relationship between objectively measured physical fitness (cardiovascular endurance, muscular endurance, flexibility and body composition), physical activity, sedentary behavior, and academic outcomes in a sample of college students. Based on previous research with other age groups, we hypothesized that there would be a positive relationship between fitness and academic outcomes for college students.

## METHODS

### *Participants*

Participants were volunteers (n=512) enrolled in for-credit physical activity and nutrition classes that required a fitness assessment as a part of their course requirements. Courses drew from all colleges across the universities and were a part of a student general education requirement. Students were invited to take part in the survey between September and December 2013 and provided written consent to use their data. This study was approved by the Institutional Review Board at Pennsylvania State University.

### *Protocol*

**Cardiovascular Fitness** - All subjects completed the YMCA cycle ergometer protocol (2). This test consisted of four, 3-minute stages of submaximal exercise. Workrates for stages 2-4 were determined by the heart rate response to the initial workrate of 150 kg·m/min. Heart rate was recorded each minute using an ePulse2 Heart Rate Monitor Armband (Impact Sports Technologies, San Diego, CA). Workrate and heart rate data from each test was entered into The Fitness Analyst software package (BSDI, Califon, New Jersey) and an estimate of maximal oxygen consumption (VO<sub>2</sub>max) was calculated via direct heart rate plotting.

**Muscular Endurance** - Assessments included two tests; a one-minute maximum repetition push-up test and modified curl-up test. Modified curl-up's are performed under a 40bpm cadence (max number possible to perform is 75 repetitions) (2).

**Body Composition** - Height, weight, waist girth, Body Mass Index (BMI), and body fat percentage via bioelectrical impedance (Omron BF306, Omron Global, Lake Forest, IL) were used to assess subject's body composition and weight status.

**Flexibility** - Trunk flexion was assessed with a standard sit-and-reach box, with total distance recorded in centimeters (2).

Following the objective fitness measurements, subjects were asked to complete a brief survey. An identifying code number generated during the fitness assessment linked the participant's fitness outcomes with their survey responses.

**Demographics** - Students self-reported their current academic year, age, sex, and race/ethnicity.

**Behavioral Outcomes** - The International Physical Activity Questionnaire (short-form) was used to assess moderate and vigorous leisure, occupational and transportation related physical activity (8). Minutes per week of moderate and vigorous physical activity were used in analyses. Students were asked to report number of hours/day spent sitting or reclining on a typical weekday to examine sedentary behavior. Participants also reported how many hours per day they spent using social media using a continuous scale of 0-24 hours. The distribution

for social media was examined and the median was 2 hours per day, then social media use was dichotomized as less than or greater than 2 hours per day.

Academic Factors - Individuals reported their current grade point average (GPA) using a continuous scale. The distribution was then examined and the median was 3.2. GPA was then dichotomized into less than/equal to or greater than 3.2 (all values rounded to the nearest tenth). Participants also indicated how many credits they were currently enrolled in using a continuous scale (dichotomized as normal ( $\leq 15$ ) and overload (16 or greater) based on college norms) and the hours per day they spent studying and doing academic work (dichotomized as less than/greater than 2 hours, based on the median reported time).

#### *Statistical Analysis*

Basic descriptive statistics described the sample. Pearson correlations examined the relationships between the fitness, behavioral and academic outcomes. Independent t-tests were conducted to compare the differences for high/low social media use, study time and GPA for behavioral and fitness outcomes. Significance levels were set at  $p < .05$  and all analyses were run using SPSS 22.0 (IBM, Armonk, NY).

## **RESULTS**

Table 1 shows the demographics of the sample ( $n=512$ ) of students. The majority of the population was white (76%) and upperclassmen (67%). For overall physical activity levels, 76% of the population met current physical activity guidelines (17). A majority (55%) of students reported studying more than 2 hours/day, 51.8% were taking 16 or more credits in the current semester, 61% reported using more than two hours of social media per day, and 59% of the sample had a GPA equal to or greater than a 3.3.

The correlational analyses of fitness variables with academic outcomes study variables are shown in Table 2. Hours of studying was positively associated with body fat ( $r=0.13$ ,  $p < .001$ ) and negatively associated with predicted  $VO_2\max$  ( $r=-.011$ ,  $p=.02$ ). Social media use was positively associated with body fat ( $r=.09$ ,  $p=.04$ ). Number of credits was negatively associated with vigorous physical activity ( $r=-.09$ ,  $p=.05$ ).

The results of t-test analyses comparing academic outcomes (high/low study time, social media use, GPA and number of credits) with fitness outcomes are found in Table 3. Higher social media use was associated with greater body fat, lower BMI, less vigorous activity and more sedentary behavior compared with low social media use. Greater study time was associated with a lower predicted  $VO_2\max$ , greater hip flexibility, and more sedentary behavior than low study time. Higher GPA was associated with a higher BMI and taking a higher credit load was associated with less vigorous physical activity.

**Table 1.** Demographic characteristics of the sample (n=512).

Demographic Variable	n (%)	Mean (SD)
Gender		
Male	261 (50.4)	
Female	256 (49.6)	
Academic Class		
Lower classmen	171 (33)	
Upper classmen	346 (67)	
Race/Ethnicity		
Non-Hispanic White	408 (78)	
Non-Hispanic Black	30 (6)	
Hispanic	29 (6)	
Asian American/Pacific Islander	43 (8)	
Other	8 (2)	
Behavioral outcomes		
Moderate physical activity minutes/week		290.38 (310.55)
Vigorous physical activity minutes/week		259.23 (245.13)
Sedentary behavior (hours/weekday)		3.00 (1.79)
Fitness Outcomes		
Predicted VO <sub>2</sub> max (ml/kg/min)		37.35 (8.81)
% Body Fat		20.59 (13.09)
Body Mass Index (kg/m <sup>2</sup> )		24.60 (4.08)
Curl ups (per minute)		46.50 (23.46)
Push-ups (per minute)		31.41 (14.07)
Trunk Flexion (cm)		18.50 (4.26)
Academic Outcomes		
Grade point average		3.31 (1.47)
Hours studying/day		3.91 (1.41)
Number of credits in current semester		15.40 (2.47)
Social media use hours/day		3.88 (1.51)

**Table 2.** Correlations between fitness, behavioral and academic outcomes.

Academic Outcomes	Fitness and Behavioral Outcomes									
		Body Fat	BMI	Predicted VO <sub>2</sub> max	Curl Ups	Push Ups	Trunk Flexion	VPA min/week	MPA min/week	Sitting time hrs/weekday
GPA	R	0.06	-0.08	-0.04	0.01	-0.02	0.06	-0.07	-0.02	0.03
	p	0.22	0.11	0.36	0.84	0.70	0.19	0.14	0.62	0.55
Hrs Studying/Day	R	<b>0.13</b>	0.01	<b>-0.11</b>	-0.04	-0.03	0.08	-0.06	-0.06	<b>0.16</b>
	p	0.00	0.85	0.02	0.36	0.56	0.07	0.16	0.19	0.00
Social Media Use hrs/day	R	<b>0.09</b>	-0.08	-0.05	0.01	-0.08	-0.01	-0.08	-0.04	0.08
	p	0.04	0.06	0.23	0.91	0.09	0.82	0.07	0.35	0.09
Number of credits	R	-0.06	-0.02	-0.05	-0.01	-0.01	0.01	<b>-0.09</b>	-0.04	0.01
	p	0.36	0.71	0.34	0.93	0.95	0.85	0.05	0.39	0.87

Note: Boldface indicates significance, GPA-Grade point average, BMI- body mass index, VPA- vigorous physical activity, MPA- moderate physical activity

## DISCUSSION

This study of college students outlines a possible relationship between behavior, fitness and academic variables. During college years, there are a number of personal habits that have the potential to impact health behaviors, including time management, academic activities, leisure activities and social media use. This study attempted to examine how lifestyle health behaviors in college student populations are related to academic factors and physical health outcomes. The implications of this study are relevant for college student healthcare providers, campus health and fitness departments and college administrators for informing preventative health interventions to impact lifelong health and fitness.

The sample in the current study reported that a majority of students both studied for more than two hours and used more than two hours of social media per day. These findings also found that hours of studying were positively associated with body fat and that high levels of social media use were correlated with higher body fat. Despite the findings with study time, no relationship with GPA and fitness was found. There is significant evidence among youth that indicates academic outcomes are positively related to better health outcomes (5, 10), though it appears that, among college students, the evidence is much less clear. Similar to our findings, one study of medical students found no relationship between BMI and academic performance (1). A prospective study of 12-18 year olds found that physical activity was

related to greater cognitive performance in early adolescence, but by 18 years the most active youth had lower cognitive performance. This indicates a possible shift in this relationship during the adolescent years (12). Furthermore, a study with college freshmen by Economos and colleagues (11) found that weight gain was associated with increased academic workload.

**Table 3.** Comparison of fitness and behavioral outcomes by academic factors.

Fitness outcomes		Academic factors											
		High Social Media Use ( $\geq$ 2 hr/day)	Low Social Media Use (< 2 hr/day)	T	High Study Time (> 2 Hr/day)	Low Study Time ( $\leq$ 2 Hr/day)	T	High GPA ( $\geq$ 3.2)	Low GPA (< 3.2)	T	Normal credit load ( $\leq$ 15)	Overload (>15)	T
Body Fat	M	21.93	18.51	2.88**	21.57	19.33	1.85	19.65	21.22	1.25	21.62	19.82	1.39
	SD	15.61	7.65		16.07	8.32		7.88	16.03		17.76	7.45	
BMI	M	24.69	27.02	2.67**	25.6	25.69	0.09	26.92	24.72	1.93*	26	25.55	0.39
	SD	6.25	17.01		13.27	9.89		15.23	9.07		14.3	9.8	
Predicted V0 <sub>2</sub> max	M	37.06	37.65	0.57	36.71	38.35	2.05*	37.85	36.81	1.22	37.49	37.06	0.49
	SD	8.86	9.12		9.18	7.93		10.11	8.25		9.58	8.39	
Curl Ups	M	45.89	24.27	0.38	46.81	45.96	0.39	45.39	47.04	0.74	46.08	46.61	0.83
	SD	22	22.35		23.89	23.16		23.75	23.38		22.71	23.94	
Push Ups	M	31.29	31.65	0.27	31.34	31.56	0.16	32.21	30.21	1.49	31.63	30.81	0.61
	SD	14.14	14.04		13.56	14.65		14.48	13.58		14.58	13.37	
Trunk Flexion	M	18.57	18.39	0.47	18.98	18.05	2.42*	18.02	4.51	1.70	18.29	18.53	0.59
	SD	4.27	4.29		4.13	4.2		18.72	4.22		4.11	4.41	
VPA min/ week	M	242.55	290.73	2.11*	255.88	255.22	0.49	244	282.78	1.68	364.19	273.55	2.47*
	SD	238.69	253.19		236.7	299		233.57	258.45		436.71	338.72	
MPA min/ week	M	281.11	313.08	1.08	266.83	317.41	1.76	288.09	299.31	0.37	293.97	273.16	0.69
	SD	301.31	324.82		298.63	236.71		322.26	233.57		297.2	311.81	
SB hr/ week day	M	3.12	2.79	1.99*	3.21	2.77	2.71**	3.07	2.96	0.65	2.98	3.01	0.38
	SD	1.74	1.81		1.94	1.56		1.78	1.79		1.82	1.8	

Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ , GPA-Grade point average, BMI- body mass index, VPA- vigorous physical activity, MPA-moderate physical activity, SB - sedentary behavior.

In regards to our findings on social media, limited research has examined how health behaviors and outcomes are related to social media use. Meta-analyses of weight management and social media use found inconclusive evidence for a relationship between BMI and social media use, though the majority of this research involved older populations than those in the current study (3, 7). Our findings provide a foundation for further investigation, including examining daily time use.

Correlational analyses indicated that there was a significant relationship between study time compared to physical activity and fitness outcomes. Reported study hours were negatively associated with VO<sub>2</sub>max and vigorous physical activity. Further analyses revealed differences in vigorous activity between high (less active) and low social media use (more active) and credit load (lower load, higher activity). VO<sub>2</sub>max also differed between high (less fit) and low study time (more fit). A similar study involved 493 college students participating in 10 fitness conditioning activity classes (4). For men, computer use was negatively associated with vigorous exercise and participation in activity, and among women, television watching was negatively correlated with typical frequency of exercise, and history of vigorous physical activity. Time spent studying was positively correlated with days per week of strength training for females, and with minutes per week of exercise for both males and females (4). These differences suggest that further inquiry is necessary about the impact of social media and study time on physical activity behavior and related health outcomes. Future physical activity interventions targeting college students may need to consider the role of social media when developing intervention strategies or use social media as a behavior change strategy.

## **ACKNOWLEDGEMENTS**

The authors wish to acknowledge the Center for Fitness and Wellness interns who assisted with the data collection for this project.

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