Physical Activity and its Relation to Academic Performance among University Students

by Agus Hariyanto

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Abstract. The benefits of physical activity (PA) are widely known. However, the correlation between physical activity and academic performance needs further investigation. Thus, this study aims to evaluate the association between those variables in university students. The data for this cross-sectional study were gathered from a convenience sample of students from Universitas Negeri Surabaya aged between 18 and 22 years. Socio-demographic characteristic (anthropometric, parental factor, health-related behaviour) was obtained using an online self-administered questionnaire. Physical activity levels were self-reported with the International Physical Activity Questionnaire (IPAQ), and academic performance was assessed using Grade Point Average (GPA) from the last final semester exam. The finding reveals that age (p=0.072, r=0.142), weight (p=0.840, r=-0.026), height (p=0.799, r=0.244), and body mass index (p=0.154, r=-0.251) do not significantly correlate with academic performance measured using GPA. The positive correlation is only found between physical activity and academic performance (p=0.032, r=0.450). Most of students in this study practiced physical activity in moderate level (600 – 3000 METs/min/week) and achieved good academic performance (n=124, 64.6%). Further cross tabulation analysis using Chi Square shows that level of PA associates with academic performance in general (p=0.044). This finding supports the previous literatures with evidence that regular physical activity may relate to academic performance in university students.

Keywords: academic performance, exercise, GPA, health-related behavior, physical activity, university, student

INTRODUCTION

Physical activity (PA) refers to any movement generated by the contraction of skeletal muscles that increase energy expenditure beyond the basal level (Muntaner-Mas et al., 2022; Piggin, 2020). World Health Organization (WHO) (2020) recommends adults aged between 18 and 64 to participate in 75-150 minutes of moderate to vigorous intensity of physical activity (MVPA) throughout the week. The duration of PA can be increased up to 300 and 150 minutes in week for additional health benefits. On top of that, US Department of Health and Human Services (2018) adds that adults should also engage in any muscle-strengthening activities that involve major muscle groups for at least two or more days in their weekly repertoire. Previous studies have been documented the health benefits of physical activity over the life span (Muntaner-Mas et al., 2022), such as reducing risk for non-communicable diseases including type 2 diabetes, hypertension, dyslipidemia, metabolic syndrome, and some cancers (Asigbee et al., 2018; F. W. Booth et al., 2012; Elmagd, 2016). Additional health benefits of PA include maintaining healthy bodyweight (Chaput et al., 2011), boosting mood and mental health (Ai et al., 2021), as well as improving muscle and bone strength that prevent falls

and improves ability to run daily life activities (Asigbee et al., 2018). Regular physical activity is also associated with a healthier and longer life, thus it could affect quality of life and increase life expectancy (Reimers et al., 2012).

With those all health benefits, promoting physical activity has been a global health priority (Vuori, 2018) as almost one-third of the world's population failed to meet the recommended physical activity (González et al., 2017). In Indonesia, about one in three people aged ten years or more are physically inactive (Sitohang & Ghani, 2021). These age groups include university or college students, who are prone to practice sedentarism and physical inactivity (Small et al., 2013). Recent survey showed that about 50% of the adults aged 18-24 including those who graduated from university failed to meet the WHO's physical activity guideline (Choi et al., 2021). Previous studies over the last two decades reported that one of three college students tend to become more physically inactive throughout their college years (Huang et al., 2003; Kolodinsky et al., 2007; Vella-Zarb & Elgar, 2009). Several reasons that might explain the findings are due to rapid technology development (Ráthonyi et al., 2021), lack of motivation (Eichorn et al., 2018), and academic pressures (Hakim et al., 2020). Students often do not have time to do physical activities or any kind of sport because they are busy with lectures and assignments (Supriyanto et al., 2021). This situation is worsen by the fact that many universities in Indonesia do not provide sport facilities or even sport courses to their students, unlike in school level where students can learn and get to play sport for 120 minutes every week (Sunadi et al., 2016). In addition to that, the transition from senior high school to university can be very stressful for many, and students' beliefs about their fate during this transition can become a source of stress

The aforementioned situation is very unfortunate, as a growing finding states that physical activity has been positively affected academic and cognitive performance (Álvarez-Bueno et al., 2017; Donnelly et al., 2016). The benefits of physical activity in increasing cognitive function and learning indicate the potential effect of PA to improve academic achievement in children and adolescents (Bueno et al., 2021; Donnelly et al., 2016). Previous observational studies that investigated the association between moderate-to-vigorous physical activity (MVPA) and academic performance in adolescents have found various results, range from positive (J. N. Booth et al., 2014; Maher et al., 2016), null (Domazet et al., 2016; Syväoja et al., 2018), and even inverse associations (Dijk et al., 2014; Esteban-Cornejo et al., 2014) between the two.

Many literatures investigate the relationship between physical activities and cognitive function or academic performance among populations such as adolescents, adults, and older groups (Langford et al., 2014). Studies conducted on youth and adolescents are extensive, although they may not be extrapolated to the college population. Despite a large number of evidences during other life stages, there is limited research examining how PA and academic performance relate to each other during college years. On top of that, study about physical activity of university students is quite interesting, as previously mentioned that physical education is no longer a compulsory course at tertiary level as it is in primary or secondary school in Indonesia. Thus, we conduct this study to investigate the association between physical activity and academic performance in university students.

METHODS

It was a descriptive study with cross-sectional design. Participants of this study were undergraduate students in year one to four, recruited using convenient sample method. Participants who belong to specific age range (between 18 and 22 years) were invited to participate in this study by completing an online self-administered questionnaire. The survey was distributed after they finished final semester exam. Each participant was provided with a brief written explanation about the detailed nature of this study before filling the survey. They were also assured of the confidentiality of their responses. A total of 377 respondents were completing self-reported survey.

The first part of the survey was a questionnaire that assessed baseline characteristic. The baseline information we gathered including age, gender, year in university, place of origin, living arrangement, financial education source, parent's education and educational status, sleep duration, screen time, and frequency of exercise.

The physical activity was measured using the short version of the validated International Physical Activity Questionnaire (IPAQ-SF). The questionnaire was translated into Indonesian without any modification. Respondents were then asked to calculate the time they spent (expressed in days per week, and minutes per day) over the last 7 days, on some different levels of physical intensity (walking, moderate, vigorous, and sitting/leisure activity). The overall physical activity was scored using metabolic equivalent task (METs) that was scored in minutes per week. The MET-min/week is the sum of minutes spent on activities at different levels of walking, moderate, vigorous, and sitting within the last 7 days that is multiplied by 8.0, 4.0, and 3.3, 1.0, respectively.

Academic achievement was a dependent variable of this study. It was assessed by Grade Point Average (GPA) during the last semester. GPA was computed as weighted averages of course grades in this specific semester, and it

was acquired from the faculty's academic office. GPA was measured by a 4.00 scale, where each course of the study was awarded a grade value between 0 and 4 based on the grade awarded for the course. Each grade value was multiplied by credit point of each course and these values were then summed. The summed values were then divided by the total number of credit point that each student took during the semester.

Descriptive statistics were used to present all variables in mean, standard deviation, frequency and percentages. In addition to descriptive statistic, follow up analyses using independent t-test or Mann-Whitney test and one way ANOVA were performed to analyze any significant differences between groups. Pearson Correlation, Spearman Rank test and Chi-Square were done to investigate the correlation between measured variables. P-value less than 0.05 was considered to be statistically significant. All statistical analysis were performed using SPSS 26 for Windows.

RESULTS

This study involved 377 students with an average age of 20.11 ± 1.14 years, weight 60.44 ± 9.71 kg, height 165.74 ± 7.58 cm, and who were mostly male (68.2%). Most of the respondents came from urban areas (54.9%), were registered as students in the first year (46.9%), having parent as the primary source of financial education (64.9%), and living with parents during school-from-home (92.0%). Regarding parental factors, the fathers' occupation of respondents mostly work as entrepreneurs (37.9%) and they have mothers who graduated from high-school (46.7%). As for health-related behavior, majority of students slept more than 6 hours a day (55.7%), spent more than 2 hours a day looking at screen, did exercise 3-4 times a week (48.0%), and practiced physical activity in moderate level (50.9%) (Table 1).

TABLE 1. Socio-demographic Characteristic of Participants

Socio-demographic Characteristic	Mean / Freq	GPA, mean ± SD	p-value
Gender, n (%)	257 (68.2%)	3.38 ± 0.35	0.000*
Male	120 (31.8%)	3.53 ± 0.32	
Female			
Age (year), mean ± SD	20.11 ± 1.14	-	
Weight (kg), mean ± SD	60.44 ± 9.71	-	
Height (cm), mean ± SD	165.74 ± 7.58	-	
Body mass index (kg/m^2), mean ± SD	21.93 ± 2.68	-	
Place of origin, n (%)			0.768
Rural	170 (45.1%)	3.43 ± 0.3	
Urban	207 (54.9%)	3.44 ± 0.35	
Year in university, n (%)			0.000**
First-year	177 (46.9%)	3.33 ± 0.39	
Second-year	145 (38.5%)	3.53 ± 0.28	
Third-year	44 (11.7%)	3.57 ± 0.20	
Fourth-year	11 (2.9%)	3.17 ± 0.45	
Financial education source, n (%)			0.181
Parent	245 (64.9%)	3.44 ± 0.36	
Self-financed	27 (7.2%)	3.45 ± 0.35	
Scholarship	105 (27.9%)	3.48 ± 0.38	
The living arrangement, n (%)			0.045**
Living alone	5 (1.3%)	3.45 ± 0.03	
Living with parent	347 (92.0%)	3.52 ± 0.36	
Dormitory/boarding house	25 (6.6%)	3.43 ± 0.23	
Father's occupation, n (%)			0.046**
Civil servant	100 (26.5%)	3.38 ± 0.42	
Entrepreneur	143 (37.9%)	3.50 ± 0.23	
SOE official	6 (1.6%)	3.47 ± 0.31	
POE official	71 (18.8%)	3.58 ± 0.12	
Unemployed	57 (15.1%)	3.42 ± 0.36	
Mother's education status, n (%)			0.009**
Uneducated	11 (2.9%)	3.48 ± 0.25	
Primary school	30 (8.0%)	3.43 ± 0.36	
Junior high school	55 (14.6%)	3.44 ± 0.26	
High school	176 (46.7%)	3.52 ± 0.37	
College/university	105 (27.9%)	3.54 ± 0.36	

Socio-demographic Characteristic	Mean / Freq	GPA, mean ± SD	p-value
Sleep duration, n (%)			0.026*
Less than 6 h/day	167 (44.3%)	3.35 ± 0.34	
More than 6 h/day	210 (55.7%)	3.51 ± 0.36	
Screen time, n (%)			0.006*
Less than 2 h/day	120 (31.8%)	3.52 ± 0.21	
More than 2 h/day	257 (68.2%)	3.32 ± 0.36	
Frequency of exercise, n (%)			0.983
Never	5 (1.3%)	3.43 ± 0.32	
Rarely (1-2 times/week)	99 (26.3%)	3.44 ± 0.36	
Sometimes (3-4 times/week)	181 (48.0%)	3.43 ± 0.35	
Often (> 5 times/week)	92 (24.4%)	3.43 ± 0.35	
Physical activity, (METs/min/week), mean ± SD	1692 ± 281	-	-
Level of physical activity, n (%)			0.044**
Low (< 600 METs/week)	99 (26.3%)	3.49 ± 0.34	
Moderate (600-3000 METs/min/week)	192 (50.9%)	3.52 ± 0.35	
High (> 3000 METs/min/week)	86 (22.8%)	3.54 ± 0.32	

*significant at 0.05 using independent t-test or Mann-Whitney test
**significant at 0.05 using one way ANOVA

Table 1 also presents the academic performance differences between groups. Statistical analysis shows that academic performance which is measured by GPA is significantly different by gender (p=0.000) with female students had higher GPA than male. Significant differences are also found in other socio-demographic factors which are years spent in university (p=0.000), living arrangement (p=0.045), father's occupation (p=0.046), and mother's education status (p=0.009), as well as in health-related behavior such as sleep duration (p=0.026), screen time (p=0.006), and level of physical activity (p=0.044).

TABLE 2. Association between Anthropometric Measurement and METs Value with Academic Performance

Variable	Mean ± SD	GPA	
		p-value	r
Age (year)	20.11 ± 1.14	0.072	0.142
Weight (kg)	60.44 ± 9.71	0.840	-0.026
Height (cm)	165.74 ± 7.58	0.794	0.244
Body mass index (kg/m^2)	21.93 ± 2.68	0.154	-0.251
Physical activity (METs/min/week)	1692 ± 281	0.032*	0.450

*significant at 0.05 using Spearman Rank test

Table 2 reveals that age (p=0.072, r=0.142), weight (p=0.840, r=-0.026), height (p=0.799, r=0.244), and body mass index (p=0.154, r=-0.251) do not significantly correlate with academic performance measured using GPA. The positive correlation is only found between PA and academic performance (p=0.032, r=0.450).

TABLE 3. Association between Physical Activity and Academic Performance

Level of Physical Activity	GPA				Total		p-value
	Average (≤ 3.25)		Good (> 3.25)				
	n	%	n	%	n	%	
Low (< 600 METs/min/week)	42	42.4	57	57.6	99	26.3	
Moderate (600-3000 METs/min/week)	68	35.4	124	64.6	192	50.9	0.044*
High (> 3000 METs/min/week)	46	53.5	40	46.5	86	22.8	

*significant at 0.05 using Chi-Square

Most of students in this study practiced physical activity in moderate level (600 – 3000 METs/min/week) and achieved good academic performance (n=124, 64.6%). Further cross tabulation analysis using Chi Square shows that level of physical activity associates with academic performance in general (p=0.044).

DISCUSSION

Many factors are considered as contributors to the academic performance of students, such as gender, living setting during university life, social environment, family income level, time spend for studying, etc. But, there is still lack of

studies about the determinants of students's GPA in Indonesia, thus this study is expected to fill the gap in the literatures for this research area. Present study reveals the association between socio-demographic factors and health-related behaviours with academic achievement of university students. We found that male students tend to obtain lower GPA than their counterpart females. The previous studies conducted in US found similar findings where gender was correlated with students' achievement, in which female students mostly obtained higher GPA score than male students (Deliens et al., 2013; Richardson et al., 2012). It is partly could be explained by the fact that females had higher motivation and more likely to pay attention in class, work with other classmates, and more organize. In contrast, males more often have discipline problems in class, as well as score lower in motivation to learn (Severiens & ten Dam, 2012). In fact, concentration, motivation, and discipline play important role in supporting students to perform well during college years. Some researches state that gender achievement gaps are also due to competence differences, as measured by standardized performance test. Nonetheless, several studies have refuted this findings, which show that female students still obtained higher grades than male students even if they had the same level of competence (Workman & Heyder, 2020). GPA difference is also found in year spent in university, where students in their third year presented higher GPA than their counterparts.

Another significant finding in this study reveals the influence of parental factor on students' GPA. Present study found that living arrangements are correlated with academic achievement, in which students that lived with their parents tend to obtain higher GPA. This is related to the parents' role, where previous researches about the involvements of parent in monitoring the learning process mentioned that it will have an impact on student academic achievement (Bakouei et al., 2019; Santiago et al., 2014). The importance of the parents' role is also highlighted by Barrera et al. (2001), as lack of parental monitoring will result in the increase practice of students' unhealthy behaviour and poorer academic achievement, especially students who live in dormitories or boarding houses. It was supported by the fact that this study was conducted during Covid-19 pandemic where almost students had no choice but learning from home, so most of them were living with their parents and had them monitored their study (Tan et al., 2022). In addition to the living arrangement, a higher average GPA was also found in students having higher-income parents and higher educated mothers. This can be explained that mothers who have attained higher education and fathers who have quite better jobs will be more aware of the importance of children's education, which will motivate them to invest more time, efforts, and materials for their children to develop their cognitive aspects (Abuya et al., 2018).

Regarding physical activity, the results of present study indicate that the level of physical activity is related to student academic performance. This is in line with other studies conducted on university students in Belgium (Deliens et al., 2013), but also conflicts with the previous systematic review conducted by Singh et al. (2012) which found a strong positive correlation between physical activity and academic performance in children and adolescents. The study mentioned that regular PA improved students' learning concentration and classroom behavior (Singh et al., 2012). Another study conducted by Hillman et al. (2008) agreed with this finding, implying that regular physical activity is associated with an increase in brain function related to cognitive aspects, where this can then positively affect academic performance. Previous literatures in children and adolescents explained that more physically active students show better academic performance (Howie & Pate, 2012; Wunsch et al., 2021). Gomez-Pinilla & Hillman (2013) suggest a positive association between practicing exercise or physical activity and brain function, resulting in improved memory capabilities, learning, and academic performance. Furthermore, college students who engage in regular PA are reported to have better mood, mental health, and being more personally content (Arslan & Akkas, 2013), as well as more successful than their peers who are less physically active (Slavinsky et al., 2021).

While the researches on PA and academic achievement have made great progress in the last five years, there is still a lot of work to be done. Most studies related to PA and GPA in university students continue to be cross-sectionals, not many observational or longitudinal studies have been conducted during the last decade. With so many observational studies, it is important to highlight that causal inferences cannot be made from cross-sectional correlations (Howie & Pate, 2012). Therefore, more observational studies using cohort design need to be carried out in the future. And to get more accurate results, the assessment of physical activity can be measured objectively using tools such as accelerometers.

CONCLUSION

This cross-sectional study shows a positive relationship between physical activity and academic performance in university students. Larger sample sizes across different major or university are needed to investigate confounding factors of socio-demographic characteristics such as gender, age, parental factors, and health-related behavior. Future

longitudinal analyzes could investigate with greater precision whether increased physical activity could really improve cognition and academic performance of students.

ACKNOWLEDGMENTS

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