

## The Effect of Physical Activity Levels on Health-Related Physical Fitness of University Students

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### Abstract

The purpose of the study was to clarify the effects of physical activity on physical fitness. The study was conducted under comparative study design. The participants of the study were 322 sophomore students (92 male students, 230 female students, 23.5 years old). Physical fitness was measured by Fitnessgram (PACER, Push-Up, Curl-Up, Sit and Reach) as well as body fat percentage by skinfold caliper and Body Mass Index by height. The data related to students' physical activity were collected by distributing the Short-Form of International Physical Activity Questionnaire containing questions about students' vigorous activity, moderate activity, walking activity, and sitting time in the last 7 days. The data of participants were categorized into high level, moderate level, and low level of physical activity. The results show that there are significant differences on Curl-Up, Push-Up, and Flexibility scores of the students from the three different levels of physical activity. Students with higher physical activity level gain higher scores on the test. There are no significant differences in Vo2max, BMI, and Body fat percentage. Students with high level physical activity has a better muscle strength and endurance and better flexibility but need to exercise to get better cardiorespiratory fitness.

**Keywords:** fitnessgram, university students, physical activity, physical education, physical fitness.

### Introduction

Physical activity is one of the factors that could overcome sedentary behavior that could increase the risk of non-communicable diseases (NCD). Promoting and increasing physical activity and physical fitness are important to reduce metabolic risk factors (Moreira et al., 2011). In the other hands, physical activity has an important role for an individual in improving and maintaining their health in the future (Poitras et al., 2016). Previous studies show that physical activity could give positive impacts on our health, including in improving cardiorespiratory endurance and muscle strength (Masterson Creber, Smeeth, Gilman, & Miranda, 2010; Mazis et al., 2009), reducing body fat percentage (Morano & Colella, 2012), reducing the risk of heart disease (Pitsavos, Kavouras, Panagiotakos, Arapi, & Anastasiou, 2008), improving bone condition (FitzGerald & Carpenter, 2010), and even improving mental health and reducing stress (Abu-Omar, Rutten, & Lehtinen, 2004; Bland, Melton, Bigham, & Welle, 2013). Thus, it concludes that physical activity could enhance students' better health.

Due to the importance of physical activity, the developed countries and the World Health Organization had developed physical activity guidelines. For example, there is the Canadian Physical Activity Guidelines for Children and Youth in Canada (Tremblay et al. 2010b, 2011), specific guidelines for Australian (Okely et al., 2012), specific guidelines in United States (US Dep. of Health Services, 2014), and Global Physical Activity Recommendation guidelines arranged by the World Health Organization for the countries that have not developed the guideline (WHO, 2010). All of the guidelines have the same purposes. The purpose is to lead people into the active lifestyle until the duration and the intensity targets are achieved, so that they could cultivate the benefits of physical activity.

Besides physical activity, Health-related Fitness (HRF) is also related to the prevention of non-infectious diseases. Health-Related fitness is divided into four components, including cardiorespiratory fitness (symbolized as  $Vo_{2max}$ ), muscular fitness (consists of Push-up and Curl-Up), flexibility, and body composition (consists of Body Mass Index and Body Fat Percentage) (Ferguson, 2014). The research related to balanced physical activity treatment with FITT (frequency, intensity, time, and type) concept could improve Health-Related Fitness (Carrick-Ranson et al., 2014; Knaeps, Bourgois, Charlier, Mertens, & Lefevre, 2017; Martinez-Gomez et al., 2012; Moore, Beets, Barr-Anderson, & Evenson, 2013; Raudsepp & Päll, 2006). Unfortunately, research examining the impact of an active lifestyle without treatments on Health-Related Fitness is limited. Meanwhile, the most important part of the physical fitness study is not how to improve the physical fitness, but to maintain the long life physical fitness. Therefore, it is necessary to discuss the impact of an active lifestyle on physical fitness without involving any program. Will a person who has a high physical activity level automatically have a high level of physical fitness? Therefore, this research is aimed at examining if there are differences in the students' physical fitness components based on their physical activity level.

## Method

The study was conducted under a comparative study design. The participants of the study were 322 sophomore of non-sport students (92 male students, 230 female students, 23+5 year old) at one of the state universities in Bandung, Indonesia. All participants were recruited from online recruitment through university unofficial social media and direct recruitment through physical education courses. Health-related physical fitness was measured by Fitnessgram (Plowman & Meredith, 2013). Cardiorespiratory endurance was measured by 20-meter PACER test. Muscle strength and endurance were measured by Curl-up and Push-up. Flexibility was measured by modified sit and reach box. Body fat percentage was measured by the three site skinfold caliper. Body mass index was measured by weight and height formula. The data of physical activity were collected by distributing International Physical Activity Questionnaire Short-Form that has internationally recognized as a valid and reliable questionnaire for measuring physical activity (Craig et al., 2003). The questionnaire contains questions related to vigorous activity, moderate activity, walking activity, and sitting time in the last 7 days. All of the data of the participants were categorized into high level, moderate level, and low level of physical activity. The data were analyzed by using one-way ANOVA technique with statistical software SPSS.

## Results and Discussion

Table 1. shows the number of participants with high physical activity level, moderate physical activity level, and low physical activity level. The table shows that most of the students are in the moderate physical activity level. There are 156 students in the moderate physical activity level in total (48 male students and 108 female students). Eighty students (28 male students and 52 female students) were in the high physical activity level, while other 86 students (16 male students and 70 female students) were in low physical activity level. Besides categorizing the students based on their physical activity level, all students participated in this study were also categorized based on their body mass index status. Table 1 shows that 218 students are in the normal weight category; 29 students are in the underweight category; 51 students are in the overweight category; and 24 students are in the obese category.

Table 1. The Number of Participants based on PA level and BMI Status

		Gender		Total
		Male	Female	
Physical Activity Level	High	28	52	80
	Moderate	48	108	156
	Low	16	70	86
Body Mass Index	Underweight	8	21	29
	Normal Weight	59	159	218
	Overweight	17	34	51
	Obese	8	16	24
Total		92	230	322

Table 2. shows the differences of the student's health-related fitness according to the mean and standard deviation of the six fitness components (vo2max, push-up, curl-up, sit and reach, body fat percentage and body mass index). The measurement was also conducted based on the students' physical activity level category (high, moderate and low).

Table 2. Mean differences of Students' Health-Related Fitness based on Their Physical Activity Level

HRF	PA Level	Mean + SD	F	P-value
Vo2max	High	32.66 + 4.65	1.323	0.268
	Moderate	33.15 + 5.19		
	Low	31.33 + 3.58		
Push-Up	High	11.60 + 8.31	4.699	0.010
	Moderate	10.03 + 7.44		
	Low	7.86 + 5.79		
Curl-Up	High	9.73 + 7.07	5.579	0.004
	Moderate	8.94 + 6.94		
	Low	6.83 + 4.6		
Sit and reach	High	11.54 + 7.99	4.240	0.015
	Moderate	10.6 + 7.84		
	Low	9.55 + 7.9		

Table 2. Cont

Body Fat (%)	High	19.18 + 5.99	2.453	0.088
	Moderate	20.4 + 6.1		
	Low	21.21 + 5.63		
BMI	High	22.43 + 4.34	0.332	0.718
	Moderate	22.92 + 4.64		
	Low	22.83 + 4.4		

The table presents that there are significant differences on Curl-Up and Push-Up with *P*-value (0.010) for push-up and (0.004) for curl-up. Students with higher physical activity level got higher scores on the test. Students with the high level of physical activity gained higher scores in push-up and curl-up (11.60±8.31; 9.73±7.07); students with moderate level of physical activity gained 10.03±7.44; 8.94±6.94 scores for push-up and curl-up; students with low level of physical activity got 7.86±5.79; 6.83±4.6. The data indicate that physical activity level has an effect on the university student's muscular fitness.

The table also shows that there are significant differences on sit and reach scores with *P*-value 0.015. The mean of sit and reach scores of the students with high level of physical activity is 11.54±7.99. The score is the highest score compared to other two student groups. Students with moderate physical activity level gained 10.6±7.84 and students with low level of physical activity gained 9.55±7.9. It concludes that the more active the students, the more flexible they can be.

The result of the study is in line with the result of the study conducted by Knaeps et al., (2017) who studied 296 participants (male and female) to examine the relationship between physical activity, measured by SenseWear Pro Armband, and physical fitness, measured by fitness index. The result of the study shows that the more active a person in doing physical activity, the higher the physical fitness they have. However, It is different with the result of the study conducted by Martinez-Gomez et al., (2012) who measured physical activity and physical fitness of 1045 adolescents aged 12.5 to 17.5 years. The measurement was conducted through two types of measurement, including self-reported measurement and objective measurement by using a measuring device. The result of the study shows that there is no relationship between physical activity and inflammation physical fitness.

There are no significant differences in the high, moderate, and low physical activity level groups in relation to the mean of Vo2max, BMI, and body fat percentage. The results were relevant with the Silva, Braga, & Morais, (2005) study that examined the physical activity of 162 postmenopausal women, aged 40–65 years, by using IPAQ and several fitness measurements. The results showed that there were no significant differences between the inactive group and active group in relation to their BMI, body fat percentage, hip-to-waist ratio, waist circumference, and VO2max. On the other hand, several studies found different results, such as the results of the study conducted by Knaeps et al., (2017) that found that as long as the intensity of physical activity is high, health-related fitness will also be high.

However, the present study has limitations. The first limitation is related to the instrument for measuring physical activity. The current study used self-reported questionnaire to measure physical activity. Meanwhile, other studies had used objective tools for measuring physical activity such as accelerometer (Actigraph, ActivPal, Geneactive) or pedometer (Sasayama & Adachi, 2016). In Indonesia, the use of objective measuring device for measuring physical activity is still limited due to the availability of the tools. The second limitation is the large number of the female participants compared to male participants, thus there are no gender-related analysis of physical fitness. The last limitation is the imbalance number of participants in relation to their physical activity categories where the most of the participants were in the moderate physical activity level.

This study recommends that, in the further research, physical activity should be measured through an objective tool. The use of questionnaire as a measuring instrument for physical activity could be less accurate, especially when the participants fill the questionnaire unassisted since the questionnaire might not be familiar to some of the participants. Moreover, a research related to program or treatment for university students, such as physical activity treatment to improve physical fitness and physical fitness program to improve students' physical activity level, is important to be considered for the further research. Any intervention or treatment that we might choose in the future research, this research has concluded that university students who are in the high level of physical activity gained a better muscle strength, endurance, and flexibility. However, to achieve an ideal body shape and a good cardiorespiratory endurance, a special program is needed.

## Conclusions

The results show that there are significant differences on Curl-Up, Push-Up, and Flexibility of the students of the three different physical activity levels. Students with a higher physical activity level got higher scores on the test. There are no significant differences in Vo<sub>2</sub>max, BMI, and body fat percentage. Students with high level physical activity has a better muscle strength and endurance and better flexibility but need to exercise to get better cardiorespiratory fitness.

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