Original Article

Physical Activity (PA) of Pre-Clinical and Clinical Medical Students: Is Clinical Medical Student Less Physically Active than Pre-Clinical Medical Student?

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Background: An increase of sedentary behavior was observed in each year especially in clinical year. This accounts for a decrease in physical activities (PAs) of medical students, which could lead to reduced overall health and physical performance.

Objective: To compare the levels of PA between pre-clinical and clinical medical students of Mae Fah Luang University (MFU) and to explored association between the levels of PA and school year.

Materials and Methods: A cross-sectional study was conducted between May and August 2019. Online questionnaire, including personal profiles and global PA questionnaire, were distributed to all MFU medical students currently studying in the academic year of 2019.

Results: One hundred fifty-six medical students participated in the present study. From the questionnaires, 67.74% of pre-clinical medical students (n=63) and 52.99% of clinical medical students (n=36) had moderate to high levels of PA. Pre-Clinical students had significantly higher levels of PA by median metabolic equivalent value (MET) at 1,908.73 versus 1,339.05 MET-minutes/week (p=0.03). The sixth-year medical students increased risk of lower PA than the first year about 8.34 times (p<0.01).

Conclusion: One-third of the medical students reported as having low levels of PA. Clinical medical students had reduced levels of PA compared to pre-clinical medical students. Therefore, PA should be promoted to help increase the overall health of medical students.

Keywords: Physical activity; Metabolic; Equivalent; Medical Student; Clinic; Pre-clinic

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Physical activity (PA) has long been a popular topic amongst the young generation and has been talked about for at least a decade, regarding its benefits and its ability to prevent some chronic future diseases. PA affects the brain's flexibility by stimulating the neurogenerative, neuroadaptive, and neuroprotective processes, which can amplify possibilities in treatment prevention, decrease the neural response, and reduce the clinical symptoms of several diseases, such as obesity, cancer, and depression[1].

Medical students were generally active and had a good understanding of the links between PA and health but were lacking skills for giving advice on PA. Competence and skills in PA counselling need to be further developed within clinical training as part of an overall curriculum strategy[2]. Not only that, but the physicians also being physically active are proven to affect the patient's perspective towards their physicians. Patients were more confident and found the physician more credible and motivating when consulting with non-obese physicians who exhibited a healthy lifestyle[3,4].

Previous research has shown that physical fitness of medical students is considered low when compared to the Thai population of the same age, except for forced vital capacity and leg strength measurement[5]. Several studies have shown that pre-clinical students had a higher level and sufficient quality of PA than

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clinical students, particularly male students[6-10]. Key supporting factors were domestic and social support from friends and families and reduced levels of PA was due to lack of time, laziness, study-related activities, and overtime shift work[9].

The medical curriculum, the Doctor of Medicine program of 2013 of the School of Medicine, Mae Fah Luang University (MFU), requires that students, for the first three years, take required classes in basic medical science and pathology, called preclinical subjects, and for the second three years undertake clinical medical training at an approved hospital. The curriculum consists of theoretical lectures, integration of clinical practice, with lectures lasting six to nine hours per day, which might cause prolonged sedentary behavior and less time for being physically active[11]. There is a need to improve the quality and accessibility of the built environment as well as the natural environment, to establish health promoting policies. PA counselling training is required to develop the medical students' essential skills and awareness for future practice. Monitoring and subsequent surveillance of PA in the medical school is necessary[6].

Considering the importance and the effects of PA, together with past research of PA in medical students from other schools, the authors found results that could not be collated and correlated with the faculty due to difference of curriculum and extra-curricular activities. None of the previous study showed correlation of PA and each school year. The present study intended to determine the PAs of the present study medical students to further promote a healthier lifestyle.

Objective

The objectives of the present study were to compare the level of PAs between pre-clinical and clinical year, and to compare the levels of PA in each school year in medical students of MFU.

Materials and Methods

Study design and participants

The present research design was a cross-sectional analytic study between May 1 and August 31, 2019 at the School of Medicine, MFU. The present study was approved by Mae Fah Luang University Ethics Committee on Human Research, Thailand (EC 19299-21). All the medical students in academic year 2019 (n=192) were invited and informed to join the present study by electronic consent form. After that, participants would answer the electronic questionnaires via Google. The general participant profiles questionnaire included gender, school year, birthday, weight, height, underlying disease, and history of orthopedic surgery. The Thai version of the Global Physical Activity Questionnaire (GPAQ)[12], translated by the Ministry of Public Health, Thailand was provided to measure the PA[13].

Physical activity measurement

Data collection from the Thai-version GPAQ was calculated for median metabolic equivalent value (MET) following the World Health Organization (WHO) analysis guide[14]. The present study divided level of PA into three groups. High PA was selected if the answer in question 2 and question 11 of GPAQ was three days or more, MET ≥1,500 MET-minutes/week; or if answer in question 2, 5, 8, 11, and 14 was seven days or more, MET ≥3,000 MET-minutes/week. Moderate PA was selected if the answer in question 2, 5, 8, 11, and 14 was five days or more, MET ≥600 MET-minutes/week. Finally, low PA was selected if the value does not reach the criteria for either high or moderate levels of PA.

Statistical analysis

Data analysis was done by Stata Statistical Software, version 16.0 (StataCorp LLC, College Station, TX, USA). A p-value of less than 0.05 was considered statistically significant. Analysis of variance was conducted to compare participants' characteristics between preclinical and clinical year. Linear regression was used for determining difference of MET between preclinical and clinical year. Univariable and multivariable logistic regression, adjusted for gender, underlying disease, and previous orthopedic surgery, which the present study suggested that all those variables were confounders and had effect to PA, was used to identified correlation and association between MET and clinical year. Ordinal logistic regression was used for correlation and association between level of PA, clinical year, and each school year.

Results

Participants' profiles

One hundred fifty-six medical students participated in the present study. The response rate was 81.25% with 59.61% (n=93) of pre-clinical medical students and 69.89% (n=65) of clinical medical students. Most participants were female at 69.87% (n=109) with 69.89% (n=65) in pre-clinical years, and 69.84% (n=44) in the clinical years. The

Table 1. Comparison of basic information, metabolic equivalent value (MET), and level of physical activity in pre-clinical and clinical medical students

	Pre-clinical year (n=93); n (%)	Clinical year (n=63); n (%)	p-value
Sex			0.99
Male	28 (30.11)	19 (30.16)	
Female	65 (69.89)	44 (69.84)	
Body mass index (kg/m^2); median (min-max)	21.79 (16.38 to 33.95)	21.13 (15.60 to 31.14)	0.42†
Underlying disease	19 (20.43)	16 (25.40)	0.47
Diabetes mellitus	1 (5.26)	0 (0.00)	
Dyslipidemia	0 (0.00)	3 (18.75)	
Allergy	19 (100)	3 (18.75)	
Asthma	1 (5.26)	0 (0.00)	
Anemia	1 (5.26)	1 (6.25)	
Hyperthyroidism	0 (0.00)	1 (6.25)	
Others	2 (10.53)	3 (18.75)	
Previous orthopedics surgery	2 (2.15)	1 (1.59)	0.64
MET (minutes/week)*	1,908.73 (0 to 11,520)	1,339.05 (0 to 7,280)	0.02†
Physical activity			0.07
High	37 (39.78)	14 (22.22)	
Moderate	26 (27.96)	22 (30.77)	
Low	30 (32.26)	27 (42.86)	

† Mann-Whitney U test

Table 2. The correlation of metabolic equivalent value (MET) in pre-clinical and clinical medical students

	MET	Coefficient*	95% CI	p-value
Clinical year	1,339.05 (0 to 7,280)	–593.51	–1,140.88 to –48.71	0.03
Pre-clinical year	1,908.73 (0 to 11,520)	Reference		

CI=confidence interval

* Linear regression adjusted by gender, underlying disease, and previous orthopedic surgery

mean body mass index (BMI) was 21.79 kg/m² with a range of 16.38 to 33.95 kg/m² in pre-clinical students and 21:13 with a range of 15:60 to 31.14 in clinical medical student. Nineteen (20.43%) of the pre-clinical students and sixteen (25.40%) of the clinical medical student had underlying diseases. Few students had undergone surgery with 2.15% (n=2) in pre-clinical years and 1.59% (n=1) in clinical medical student. Gender, BMI, underlying disease, and previous orthopedic surgery were not different between pre-clinical and clinical medical students (Table 1).

Pre-clinical year had significantly higher MET than clinical year at 1,908.73 with a range of 0 to 7,280 versus 1,339.05 with a range of 0 to 11,520 MET-minutes/week (p=0.02). According to the level of PA at high, moderate, or low, 39.78% (n=37) of the pre-clinical students were at the high level of PA, 27.96% (n=26) were at moderate PA, and 32.26% (n=30) were at low PA. Most clinical students, 42.86% (n=27) were low PA, with 30.77% (n=22) at moderate PA, and 22.22% (n=14) at high PA, but this was not statistically significant (Table 1).

Correlation of MET value between preclinical and clinical year

When comparing the mean of MET value, clinical students had lower MET than pre-clinical students at about 593.51 MET-minutes/week, (p=0.03) as shown in Table 2.

Level of PA in each school year

The year with the highest level of PA was found in the first-year medical students (37.25%). The fourth and the fifth years both had the same level, which was

Table 3. The level of physical activity (PA) in each school year

	High PA; n (%)	Moderate PA; n (%)	Low PA; n (%)	p-value
1st year	19 (37.25)	9 (18.75)	4 (7.02)	0.03
2nd year	11 (21.57)	9 (18.75)	11 (19.30)	
3rd year	7 (13.73)	8 (16.67)	15 (26.32)	
4th year	5 (9.80)	10 (20.83)	10 (17.54)	
5th year	7 (13.73)	10 (20.83)	11 (19.30)	
6th year	2 (3.92)	2 (4.17)	6 (10.53)	

Chi-square test

Table 4. The correlation of the level of physical activity in pre-clinical and clinical medical students and each school year

	Crude OR	95% CI	p-value	Adjusted OR*	95% CI	p-value
Clinical year**	1.86	1.03 to 3.36	0.04	1.94	1.06 to 3.54	0.03
School year						
1st year	Reference					
2nd year	3.03	1.17 to 7.88	0.02	3.23	1.23 to 8.49	0.02
3rd year	5.73	2.15 to 15.30	<0.01	7.06	2.57 to 19.39	<0.01
4th year	4.67	1.73 to 12.64	<0.01	6.42	2.26 to 18.25	<0.01
5th year	4.17	1.58 to 11.02	<0.01	4.08	1.51 to 11.04	0.01
6th year	8.34	1.98 to 35.07	<0.01	9.49	2.20 to 41.16	0.01

OR=odds ratio; CI=confidence interval

* Ordinal logistic regression adjusted by gender, underlying disease, and previous orthopedics surgery

** Pre-clinical year is reference

at the moderate level (20.83%), with the lowest level of PA in the third year (26.32%) as shown in Table 3.

Correlation of level of PA between clinical year and school year

Clinical students had a 1.94 times risk of having a lower PA than pre-clinical students (CI 1.06 to 3.54, p=0.03). Once focus on school year, the last year or sixth-year medical student had highest risk of lower level of PA by 9.49 times than first-year medical student (CI 2.20 to 41.16, p=0.01) as shown in Table 4.

Discussion

PA and physical fitness are important for everyone, including medical students. Many studies prove the association between PA and surrogate endpoints of metabolic diseases such as high serum triglyceride (TG), high-density lipoprotein (HDL)-cholesterol, and blood pressure. A single exercise session at an intensity of moderate to high intensity resulted in a reduction of serum triglycerides by 3% to 15%, an increase in HDL-cholesterol by 4% to 43%, and a lowering of 18 to 20 mmHg and 7 to 9 mmHg in systolic and diastolic blood pressure, consecutively, with the changes remaining for 12 to 16 hours after the exercise. As for the acute effects on blood glucose and insulin sensitivity, it has been shown that PA at moderate intensity results in a lowering of 20 to 40 mg/dL of blood glucose for two to three days[15]. Another study has shown that participants who are physical inactive are more prone to an increase of intra-abdominal fat, peripheral insulin resistance in skeletal muscle and adipose tissue, and loss of muscle mass[16]. The good direct effect of PA to severity of some diseases is stated in a previous study, especially type 2 diabetes mellitus (T2DM) with HbA1c decreasing about 0.5% to 1% and a 6% linear decrease in age adjusted risk for the development of diabetes for each 500 kcal expended weekly[15].

Mental health is also affected by PA. Aerobic exercise training for 6 to 12 weeks resulted in pharmacologic-like improvements in mild-to-moderate depression and anxiety[15]. Proper and high level of PA associates with better control of attention, memory, and cognition[17,18]. One study in Saudi Arabia reported that at least 30 minutes of PA or exercise showed significant positive association with high GPA with GPA scores at 85% or better, among

medical student (OR 3.56, p=0.001)[18].

The results in the present study showed that more than 70% of clinical medical student and more than 50% of pre-clinical medical student had low to moderate level of PA, so, the sedentary lifestyle found more in clinical year and correlate with MET. The clinical year had MET less than preclinical year about –593.51 MET-minutes/week (p=0.03). Risk of achieving poor level PA was increased about 1.94 times in clinical year when compared with preclinical year (p=0.03). The present study finding was correlated with the previous studies in Thailand that reported that pre-clinical medical students were more physically active than clinical students at 58.2% versus 40.6% of PA of ≥150 minutes/week[6]. This phenomenon could be explained with difference of learning style between preclinical and clinical year. Firstly, clinical medical student had a higher workload and lower amount of leisure time than preclinical year[19]. A qualitative study showed three causes for lower PA. First, was feeling exhausted and having less free time due to increased responsibilities, studying hours, and overtime shift work[11]. Secondly, was having inconvenient schedules and inability to fit exercising into study schedules and shift work[20]. Third, was the lack of facilities such as fitness centers or sports field, heavy traffic, or transportation in the city might that cause difficulty to exercise[21]. Most medical student knew the benefits and had good attitude with PA such as "living a healthy lifestyle was very or extremely important to them (91.0%)", "Prioritizing PA as moderately, very, or extremely important (86.9%)", and "Exercise is important for their future patients (95.5%)"[22].

More than the comparison between preclinical and clinical year as previously descripted, the present study was the first study that demonstrated and explored correlation in each studied year to the risk of becoming poor level PA. The comparison of level of PA in each school year also showed that most first-year students had high level of PA at 37.25%, where third-year students had low level of PA at 26.32%. From the comparison of the level of PA of each school year to the first-year students, the results showed that second-, third-, fourth-, fifth-, and sixth-year students had more risk of having low PA at 3.23, 7.06, 6.42, 4.08, and 9.49 times than the first-year students, respectively. These showed that the sixth-year medical students had the highest risk of having a low level of PA, and the third-year students being the second highest. By the author's observation, the finding could be due to overnight shifts and significantly less free time than other school years, resulting in insufficient moderate and high intensity PA. As for the third-year students, most of their time was spent in lectures and preparation for the first step national license examination leading to prolonged sedentary time and less body movements then other preclinical years.

The curriculum including PA or sport activity course would significantly increase physical fitness and cardiopulmonary function of medical students with prevalence of healthy cardiopulmonary capacity increased by 41.3% in female and 28.5% in male medical student (p<0.001)[23]. PA helped in maintaining a healthy body weight, losing excess body weight, or a successful and well-maintained weight loss[17]. Good physician image affects a patient's trust and confidence[24]. Overweight or obese physician might be vulnerable to biased attitudes from patients, and negatively affect patients' perceptions of their credibility, level of trust, and inclination to follow medical advice[25].

However, integration of PA in curriculum is challenging for medical schools. Evidence shows that only one of medical schools in southern of Thailand had integrated 25 hours PA education in curriculum[6]. The present study institution does not have specific course or timing for PA education but integrated with health promotion and disease prevention in each organ system block and occupational medicine in preclinical year, as well as each subspecialty ward such as rehabilitation in clinical year[5]. Digital technology is considered one of the tools in increasing PA level in medical students. The smart phone application for promoting PA and weight loss, helped decreasing participants' weight after end of intervention (p<0.01)[26], thus a good solution to promoting good PA.

The authors believe many medical students and physicians in Thailand would hear a joke or funny quote from seniors like "Once you step up each year, your weight will increase" or "Once you step up each year, your fitness will decrease". This study proves the truth of that quote and demonstrates the association between study year and PA. In addition, the strength in the present study was the appropriate selection of regression analysis that represented the level of PA as ordinal scale. Cross-sectional study is one of the major limitations of the present study. The results of the present study could not directly predict the risk of cardiovascular or metabolic diseases in medical students. However, the results could represent the trend of PA in each school year. The executives of medical school or institute could use this data

for health promotion planning among the medical students. Another limitation was the small sample size and the use of a single medical school for the present study, but the risk and correlation of lower PA level was strong enough to be detected by statistical analysis. Multicenter study might be considered for further investigation that would represent MET and PA level of medical students in Thailand.

Conclusion

About one-third of the medical students were reported as having low levels of PA. Clinical medical students had reduced levels of PA compared with pre-clinical medical students especially in the sixth-year medical students. PA should be promoted to help increase the overall health of medical students, which might improve physical performance and enforce being a good role model to their patient in clinical practice.

What is already known on this topic?

PA can reduce the risk of cardiovascular and metabolic diseases. Strengthened musculoskeletal system and maintenance of neurological system are results of good PA. Medical students have higher workload and lower amount of leisure time causing lower PA and fitness. However, the authors were aware of no previous study exploring the correlation between PA and academic level or school year.

What this study adds?

This study explored and proved the correlation between PA and level of study and school year among the medical student in Thailand. Clinical medical students have more risk in lower PA level than preclinical year. The interesting results showed decreasing of PA in each school year, especially in the students attending the last year of the medical school.

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Conflicts of interest

The authors have no conflicts of interests.

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