EFFECTS OF DIFFERENT SCHOOL LOCATIONS AND SIZES ON PHYSICAL ACTIVITY LEVELS AMONG THAI SECONDARY-SCHOOL STUDENTS

Jirachai Karawa[1,5] Satian Laoprasert[2,5] Suparat Karawa[3] Teerachpan Maneetam[2,5] and Kurusart Konharn[4,5]

[1] Faculty of Management Sciences and Information Technology, Nakhon Phanom University
[2] Exercise and Sport Sciences Program, Graduate School, Khon Kaen University
[3] Faculty of Education, Mahasarakam University
[4] School of Physical therapy, Faculty of Associated Medical Sciences, Khon Kaen University
[5] Research Center in Back, Neck, Other Joint Pain and Human Performance (BNOJPH), Khon Kaen University

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Abstract

Purpose: The purposes of this study were to examine and compare physical activity (PA) levels of secondary-school students between different school locations and sizes, and to determine their compliance with the physical activity guidelines (PAG).

Methods: This observational study was carried out in 160 Thai secondary-school students (averaged aged 15.6 ± 1.1 years, BMI 21.1 ± 3.6 kg.) from 4 different secondary schools in the northeast of Thailand. All participants were requested to wear the activity monitor (Feelfit) on their right hip for 7 consecutive days with a minimum of 10 hours wearing time. Independent Sample t-test and Chi-square test were used to analyze all dependent variables.

Results: Boys and normal-weight students in urban school had significantly spent more time at only light PA compared to students in rural school ($p<0.05$). Furthermore, students in a small-to-medium school size had more time spent in moderate PA compared to students in a large-school size ($p<0.05$). However, there were no significant differences in compliance with the PAG observed between groups ($p>0.05$).

Conclusion: School locations and sizes are important factors that influence PA among Thai secondary-school students.

Key Words: Size and location of school / Thai adolescents / Feelfit Activity Tracker

Corresponding author: Kurusart Konharn, Faculty of Associated Medical Sciences, Khon Kaen University; E-mail: mf__thailand@yahoo.com

BACKGROUND

Excessive sedentary time can lead to poor health outcomes and associated chronic disorders (Fung et al., 2000). It also links with being overweight or obesity (Costigan, Barnett, Plotnikoff, & Lubans, 2013; Mitchell, Pate, Beets, & Nader, 2013). A systematic analysis reported the increasing prevalence of overweight and obesity in children and adolescents in both developed and developing countries (23.8% for boys and 22.6% for girls) (Ng et al., 2014). Similarly, the prevalence of overweight and obesity in Thai children and adolescents was 10.0% and 4.4%, respectively, with a magnitude was higher in boys than girls (Pengpid, Peltzer, Pengpid, Peltzer, & Peltzer, 2013). Furthermore, a previous study indicated that the prevalence of overweight and obesity in urban was higher than rural resident (Aekplakorn et al., 2007). Recent studies also found that PA and SED was strongly associated with weight status (Maples et al., 2012). According to physical activity (PA) guidelines (PAG), it was recommended that children and youth aged 5-17 year should spend time at least 60mins of moderate to vigorous intensity physical activity (MVPA) everyday (Tremblay et al., 2011). However, there evidence has indicating that only 45.3% of adolescents in the United States aged 11-15 years met the PAG as measured by accelerometer (Sanchez et al., 2007). Additionally, it has been reported that only 23.7% of Estonian children aged 6-13 years met this PAG (Mooses et al., 2016). In Thailand, only one study was conducted in Thai adolescents (aged 13-18 years) and found that 34.5% of them met the PAG. There were no differences between urban and rural schools in the compliance with PAG meeting (Konharn, 2012). This is contrast with a previous study reporting that youth in rural area achieved fewer minutes of MVPA daily than that of youth in urban area (Comte et al., 2013).

Previous studies have also demonstrated that characteristics of the school physical and social environments are strongly correlated with children's MPVA and the differences of PA across the population is dependent on school location and gender (Brug et al., 2012; Martin, Bremner, Salmon, Rosenberg, & Giles-Corti, 2012). For example, previous studies found that urban adolescents had more time spent in PA levels (PAL) than rural adolescents, as measured by accelerometer (Itoi, Yamada, Watanabe, & Kimura, 2012; Machado-Rodrigues et al., 2012; Shearer et al., 2012). Moreover, a previous study reported that urban adolescents tended to have less time spend in MVPA than rural the counterpart (Ojiambo et al., 2012). On the other hand, a previous study conducted in Thai adolescents showed there was no differences in PAL between urban and rural (Konharn, 2012). Interestingly, recent studies indicated that boys in urban showed more time spent in PAL than boys in the rural; however, but girls in urban show less time spent in PAL

than girls in rural (Machado-Rodrigues, et al., 2012). In American youths, it was found that there was no differences between urban and rural of in PAL based on gender (Moore, Beets, Morris, & Kolbe, 2014). These differences in result from differences studies may be due to differences in characteristic of country, population, and culture that may influence to PAL. Clearly, there is still a need to examine PAL in different school locations.

Interestingly, other important factors such as school size should be considered whenever to promote PA in adolescents during the school day. The number of PA breaks indoor and outdoor facilities differed by region of the country, school socioeconomic status, and school size (Hood, Colabianchi, Terry-McElrath, O'Malley, & Johnston, 2014). Several researchers also suggested that school sizes was associated with higher levels of PA and sports in adolescents (Cradock, Melly, Allen, Morris, & Gortmaker, 2007; Morin, Lebel, Robitaille, & Bisset, 2016). However, Powers et al. (2002) found no association between school size and extracurricular activities. Nevertheless, it should be noted that in most studies PAL was measured by subjective method (asking student and Self-administered questionnaires), only few studies measured PAL by objectively method (TriTrac-R3D accelerometer) (Cradock, et al., 2007; Hood, et al., 2014; Morin, et al., 2016; Powersm, et al., 2002). This may affect the accuracy of time spent in PA of adolescents between school sizes. Thus, there is still a need for evaluating PAL in Thai adolescents and according to school size. Therefore, the aims of this study were two folds. The fist objective was to examine PAL between differences in school location and school size based on gender and BMI in Thai secondary-school students, and the second objective was to determine the compliance of Thai secondary-school students with the PAG. In the present, a new model of objectively PA measure (Activity Tracker: Feelfit) was used for assessing PAL. This activity tracker was developed with more features in order tomonitor the activity: such as PAL classifications, calories burned calculation, step count, distances, calories, and total time of activity (Arnin, Anopas, Triponyuwasin, Yamsa-ard, & Wongsawat, 2014).

OBJECTIVES

To examine and compare students' physical activity levels of secondary-school students between different school locations and sizes and to determine their compliance with the physical activity guidelines (PAG).

METHODS

Participants

This observational study was carried out on 160 secondary-school students (81 boys and 79 girls) from 2 urban small-medium schools and 2 rural large school sizes from the Northeast region of Thailand. Their averaged

age, weight, height, and BMI were 15.62 and 1.14 years, 57.16 ± 11.07 kg., 164.53 ± 8.17 cm, 21.07 ± 3.57 kg/m^2, respectively respectively). Participants were classified based on school locations into 1) urban, a school in economic area or city/town area, and 2) rural a school in agricultural area or district area. In addition, they were further classified into two different school sizes: 1) a small-medium school size (less than 1,499 students) and 2) a large school size (more than 1500 students), according to the Office of the Basic Education Commission (OBEC), Thailand. All participant provided a written informed consent before participating in the study. The study was approved by The Khon Kaen University Ethics Committee in Human Research (Reference No#HE592077).

Instruments

All participants were asked to wear the activity monitor (Activity Tracker: Feelfit, Bangkok, Thailand) on their right hip, with 90% accuracy for assessing PAL as previously described. (Arnin, et al., 2014) Anthropometric data were collected. Both weight and height were measured by using a standard scale (Camry, Model BR9807, Kowloon, Hong Kong.) and a stadiometer (Seca, Model 213, Hamburg, Germany), respectively. Body mass index (BMI) was calculated from the ratio of weight/height^2.

Procedures

Prior to data collection, a Feelfit activity tracker was calibrated. The device was initialized as described by an instruction manual for all participants in this study briefly. Participants were given instructions to wear a Feelfit for 7 consecutive days during all waking hours, except for bathing or doing other water-based activities. Participants had to wear at least four days of recording completed (3 weekdays and a weekend day). They were worn with a minimum of 10 hours (7.00 AM and 10.00 PM) to provide a representative of daily activity (Corder, et al., 2008). Participants were instructed to self-record data of time (minute/day) spent at each PAL from a Feelfit to a recording form. All participants were contacted daily during monitoring periods by a cell phone to remind them to wear the activity monitor equipment. For data analysis. PA were further classified into; sedentary (SED) (1-1.4 METs), light physical activity (LPA) (1.5-3.5 METs), moderate physical activity (MPA) (3.6-5.9 METs), vigorous physical activity (VPA) (6-8 METs), and very vigorous physical activity (VVPA) (> 8 METs) (Arnin, et al., 2014). In addition, time spent in MPA, VPA, and VVPA were summed to obtain MVPA. Participants were categorized as meeting the PAG if they accumulated 60 mins/day of MVPA.

Data Analysis

Data were analyzed using a SPSS statistical analysis software (IBM SPSS Statistics version .21, Armonk, New York, United States). Descriptive statistics were presented as mean and standard deviation. Differences in time spent at each PAL (minute/day) between school

locations and school sizes were analyzed by Independent sample t-test. Dependent sample t-test were applied to compare time spent at each PAL between gender and BMI classifications. Chi-square test was used to determine the differences in with PAG between school location and sizes, and between urban and rural based on gender, The level of statistical significance was set at $p<0.05$.

RESULTS

Table 1 showed the average age, weight, height and BMI of the participants. There were no significant differences in age, weight, and BMI according to gender, school locations ($p>0.05$). However, urban adolescents were significantly taller than that of rural adolescents. The average height were 163.26 ± 9.01 and 165.52 ± 7.32 cm. respectively ($p<0.05$). Normal weight group had significantly lesser BMI than the overweight/obesity group. However, boys and girls showed no significant differences in all anthropometric data.

Table 2 showed the comparison of mean time spent at each PAL between urban and rural adolescents, according to gender. In the present study, boys in urban had significant more time spent in LPA than that of boys in rural ($p<0.05$). However, no significant difference was observed on time spent in other variables

Table 1. Characteristics of participants based on school location, gender and BMI classifications.

Variable	Age (year)		Weight (kg.)		Height (cm.)		BMI (kg/m^2)	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
School location								
Urban (n=81)	15.61	1.16	54.96	9.11	163.26[a]	9.01	20.61	3.09
Rural (n=79)	15.63	1.31	58.89	12.67	165.52	7.32	21.44	3.88
Gender								
Boys (n=81)	15.59	1.17	60.19	11.19	170.03	5.81	20.74	3.31
Girls (n=79)	15.64	1.12	54.09	10.11	158.94	6.21	21.41	3.81
BMI								
Normal weight (n=143)	15.59	1.12	54.73	7.64	164.54	7.99	20.18[b]	2.17
OW/OB (n=17)	15.88	1.31	78.91	13.35	164.46	9.95	29.09	3.63
All participants								
Total (n=160)	15.62	1.14	57.16	11.07	164.53	8.17	21.07	3.57

[a] Significant difference between school locations ($P< .05$), [b] Significant difference between BMI ($P< .05$), OW= Overweight, OB= Obesity

Table 2. Time spent (minutes/day) at each PAL of different school locations and school sizes, based on gender.

School location	Boys (n=81)				Girls (n=79)				All participants			
	Urban		Rural		Urban		Rural		Urban		Rural	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
SED (min)	638.27	65.75	652.58	77.81	682.61	72.79	638.52	83.15	661.37	72.53	667.35	81.43
LPA (min)	122.86*	28.17	112.94	37.47	108.79	21.64	107.54	28.89	115.53	25.79	110.39	33.61
MPA (min)	40.89	13.56	32.05	13.24	23.02	9.85	17.97	9.46	31.58	14.75	25.41	13.54
VPA (min)	6.12	5.91	4.19	6.89	1.44	2.04	1.52	7.81	3.68	4.91	2.93	4.43
VVPA (min)	6.36	4.87	4.29	6.87	1.09	1.69	.48	1.77	3.62	4.43	2.49	5.45
MVPA (min)	53.38	22.11	40.54	23.31	25.57	12.71	19.98	15.63	38.89	22.57	30.84	22.45
School	**Small-medium**		**Large**		**Small-medium**		**Large**		**Small-medium**		**Large**	
size	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
SED (min)	650.05*	83.95	642.57	59.04	697.55*	62.16	668.99	89.34	672.92	77.58	656.12	76.78
LPA (min)	110.21	32.07	124.53	34.94	98.09	20.37	117.91	26.58	104.38	27.59	121.18	30.97
MPA (min)	39.09	14.68	32.17	12.43	19.55	10.58	21.10	9.29	29.68*	16.13	26.57	12.22
VPA (min)	5.56	5.48	4.39	7.53	.69*	1.19	2.26	8.09	3.22	4.69	3.32	7.84
VVPA (min)	5.73	4.71	4.54	7.43	.51	1.24	1.03	2.12	3.22	4.36	2.76	5.68
MVPA (min)	50.39	22.52	41.12	23.96	20.75	12.19	24.39	16.43	36.12	23.51	32.65	22.03

Note: *Significant difference between school locations (P< .05)

between urban and rural adolescents based on gender (p>0.05). It also was found that adolescents in a small-medium school size had significant more time spent in MPA than a large school size (p<0.05). In addition, boys and girls in a small-medium school size had a significant more time spent in SED than that of boys and girls in a large school size (p<0.05). Only girls in a small-medium school size showed less time spent in VPA than girls in a large school size. No significant difference was found on time spent in other variables between two groups with respect to gender (p>0.05).

Table 3 showed the comparison of mean time spent at each PAL between urban and rural adolescents, according to BMI. In this study, normal-weight group in urban adolescents had significant more time spent in LPA than that of boys in rural adolescents (114.55 ± 24.26, 108.85 ± 34.06 mins, p<0.05). However, no significant different was found in time spent

Table 3. Average time spent (minutes/day) at each PAL between urban and rural students, based on BMI classifications.

Physical activity levels	Normal weight				OWOB				All participants			
	Urban		Rural		Urban		Rural		Normal weight		OWOB	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
SED (min)	661.44	72.82	675.31	78.77	660.67	75.95	611.57	81.38	668.96	76.15	628.89	80.79
LPA (min)	114.55*	24.26	108.85	34.06	126.02	20.45	121.34	29.31	111.45	30.04	122.99	32.46
MPA (min)	31.94	14.91	25.05	12.93	27.61	13.41	27.92	17.77	28.19	14.24	27.82	15.92
VPA (min)	3.85	5.06	3.03	7.85	1.88	2.28	2.22	3.15	3.41	6.7	22.11	2.81
VVPA (min)	3.71	4.46	2.54	5.69	2.74	4.53	2.18	3.41	3.07	5.19	2.37	3.70
MVPA (min)	39.49	22.94	30.63	22.49	32.23	18.26	32.32	23.25	34.66	23.04	32.29	21.02

Note: *Significant difference between school locations (P< .05), OW= Overweight, OB= Obesity

in other variables between two groups of BMI (p>0.05).

Table 4 showed the percent of compliance with the PAG of urban and rural adolescents, according to gender. No significant differences were observed between urban and rural adolescents in the percent of compliance with PAG (for boys 13.6% vs. 8.6%, for girls 0.0% vs 2.5%, p>0.05. There was also no significant difference between urban and rural school in the percent of compliance with the PAG in all participants (6.9% vs. 5.6%, p>0.05). There was only 12.5% of all adolescents who had met the PAG. In addition, Table 4 also showed the percent of compliant with PAG of a small-medium school size and a large school size adolescents, according to gender. No significant differences between a small-medium school size and a large school size adolescents based on gender in the percentage of compliant with PAG (for boys 14.8% vs. 7.4%, for girls 1.3% vs 1.3%, p>0.05). In addition, there was no significant differences between a small-medium school size and a large school size in terms of the percent of compliance with PAG (8.1% vs. 4.4%, p>0.05).

Table 5 showed the percent of compliance with the PAG in urban and rural adolescents. No significant differences were observed between two groups based on BMI in the percent of compliance with PAG (p>0.05).

Table 4. Percentage of meeting the PAG of different school locations and school sizes, based on gender.

	Gender						All participants		
	Boys		P (X^2, V)	Girls		P (X^2, V)	Total		P (X^2, V)
	Missed	Met		Missed	Met		Missed	Met	
School location									
Urban	28.4%	13.6%	.062	46.8%	0.0%	.179	37.5%	6.9%	.307
Rural	49.4%	8.6%	(3.479,	50.6%	2.5%	(1.808,	50.0%	5.6%	(1.045,
Total	77.8%	22.2%	.207)	97.5%	2.5%	-.151)	87.5%	12.5%	.081)
School size									
SM	37.0	14.8	.154	48.1	1.3	.986	42.5	8.1	.169
L	40.7	7.4	(2.035,	49.4	1.3	(1.000,	45.0	4.4	(1.890,
Total	77.8	22.2	.158)	97.5	2.5	.002)	87.5	12.5	.109)

P: p-value, X^2: Pearson Chi-square test, V: Cramer's V coefficient, SM: small-medium school size, L: large school size

Table 5. Percentage of meeting the PAG between urban and rural schools, based on BMI.

	BMI						BMI			
School	Normal weight		P (X^2, V)	OW/OB		P (X^2, V)	BMI	Total		P (X^2, V)
location	Missed	Met		Missed	Met			Missed	Met	
Urban	37.8	7.7	.089	35.3	0.0	.159	**Normal weight**	78.8	10.6	.497
Rural	50.3	4.2	(2.884,	47.1	17.6	(1.987,	**OW/OB**	8.8	1.9	(.471,
Total	88.1	11.9	.142)	82.4	17.6	.342)	**Total**	87.5	12.5	.054)

P: p-value, X^2: Pearson Chi-square test, V: Cramer's V coefficient, OW= Overweight, OB= Obesity

DISCUSSION

This study aimed to assess PA of adolescents in urban and rural schools. The major finding of this study was that adolescents in both school location showed no differences in all the PAL. This finding is consistent with a previous report showing that Thai adolescents in both school locations had similar in MVPA (Konharn, 2012). In contrast, this result was inconsistent with some previous findings. They showed that youth in urban spent more time in MVPA than the suburban/rural (Shearer, et al., 2012). For example, Machado-rodrigues et al. (2012) found that urban adolescents were more active than their rural counterparts in Portuguese adolescents. These differences in results may stem from demographic differences including socioeconomic status or ethnicity between studies (Hodgkin, Hamlin, Ross, & Peters, 2010). Nevertheless, our finding was consistent with previous findings in Italian children showing that there was no different in time spent in TV watching, videogames playing, sports attendance and free time activities between urban and rural areas (Tognarelli et al., 2004). In addition, PAL of both school locations were reported to associate with number of friends and family member participated in PA (Raudsepp & Viira, 2000). Clearly, adolescents in both school locations need specific strategies and policy to promote sufficient PA among Thai adolescents.

With respect to school locations, it was found that there were no differences in most of PAL in both genders. Previous researches indicated that there were no difference between urban and rural of time spent in MVPA among boys (Moore, et al., 2014). In contrast, Ojiambo, et al. (2012) found that Kenyan adolescents in urban were physically active than their rural counterpart. Another study indicated that urban boys were more active than rural boys, whereas urban girls were less active than rural girls (Machado-Rodrigues, et al., 2012). In addition, only urban girls had more time spent in MVPA than rural girls (Comte, et al., 2013). These different findings may be due to the different population and range age of participants used between studies. Furthermore, previous research also suggested that schools had an important role for enhancing PA levels through appropriate curriculum for their practice in the PA domain, by providing sports gym, sports equipment and play facilities that may promote equal engaging in both boys and girls (Loucaides, Plotnikoff, & Bercovitz, 2007).

In the present study, we also found that Thai adolescents did not differ in their time spent in most of the PAL between urban and rural school, regardless of BMI. Similar findings were also reported by Stone, Rowlands, & Eston (2009). Taken together, these results suggested that the time spent in PA were associated with weight status among adolescents (Maples, et al., 2012). Additionally, our finding showed that normal weight adolescents

in both school locations were more likely to be active than overweight/obesity adolescents. Interestingly, however when compared in subgroup, it was found normal weight adolescent in urban were more likely to be active than overweight/obesity adolescent in urban. As the results, the current finding suggests that there should be providing strategy for preventing a decline in PA in over BMI =Thai adolescents.

In addition, this study found that boys and girls in a small-medium school size had more time spent in SED than that in a large school size. Moreover, only girls in a small-medium school size engaged in less VPA time than that of girls in a large school size. Therefore, this suggests that school size may affect PAL. This finding is consistent with a previous report of Morin et al. (2016) who indicate that a large-size school can provide a larger infrastructure and more opportunities in PA than those in small-size school. As a results, a large school size may organized some special activities class for their students. Therefore, it is possible that adolescents in larger-size schools have more opportunities in PA participation and were more likely to active than adolescents living in small-medium size school.

With respect to PAG, our study showed that only 12.5% adolescent were complied with PAG (6.9% of urban and 5.6% of rural. This current result is consistent with previous results in Kenya showing that only 12.6% of Nairobi children achieved the PAG (Muthuri, Wachira, Onywera, & Tremblay, 2014). Similarly, previous research found that approximately 16.5% of children from Eldoret in Kenya that met the PAG (Ojiambo, et al., 2012). However, this finding is in contrast to a previous report of Thai adolescents showing that there was 34.5% of adolescents that met the PAG, as measured by accelerometer (Konharn, 2012). Based on these findings, it suggests that strategies are needed for promoting PA in Thai adolescents, regards of school locations, school size, and BMI.

This study still has some limitations. First, since this study was conducted in northeastern region of Thailand, there may be not generalized to all Thai adolescents. Thus, future studies in other regions of Thailand are required. Second, since this study was a cross-sectional design, which had collected the PA data at a specific point of time. Therefore a longitudinal design study is still encouraged for examining trend of PA pattern among Thai adolescents.

CONCLUSIONS

Our findings suggest that there were no differences in most of the PAL and time spent in each the PAL observed with respect to school locations and gender. However, adolescents in a large-size school engaged more PA than in a small-medium size school. Nevertheless, there was a small percentage of adolescent that met the PAG. To sum up, a school size is one of the most important factor that influence

PAL among adolescents in secondary school. Therefore, PA promotion should take this factor into consideration for increasing PA among Thai adolescents.

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