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Predictors of physical activity for weekdays and weekends among adolescent – a cross-sectional study in Sarawak, Malaysia

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Abstract

Background: This study aimed to describe the patterns of physical activities both at weekends and on weekdays and to identify their associated factors. Material/Methods: This was a cross-sectional study conducted among secondary school students aged 13-15 years old in Kuching Division, Sarawak, Malaysia. A self-administered questionnaire was used to collect socio-demographic information and to measure perceived barriers, self-efficacies and social influences. Anthropometric measurements were taken and used to determine BMI-for-age, while pedometers were used to assess the physical activity levels. Data were analyzed using SPSS. Results: A total of 474 students from six secondary schools participated. About 16% of the respondents were overweight and obese, majority of them males. The mean BMI was 21.21 ±12.93, higher among males. The mean steps per day were 6251.37±3085.31, with weekends recorded a higher number of steps. The number of steps among males was higher than among females. On weekdays, self-motivation scores significantly predicted the participants' number of steps/ physical activity rate (b = 521.43, 95% CI -72.78 to 1050.19). At weekends, lack of interest and knowledge scores (b = -427.82, 95% CI -837.72 to 17.92) and making choices scores (b = 737.41, 95% CI -197.94 to 1276.88) were significant to predict the number of steps/physical activity levels. Conclusions: These findings indicated the importance of investigating predictors of physical activity for weekdays and weekends. Thus, efforts should focus on how to motivate adolescents to be more physically active targeting the identified predictors for weekdays and weekends.

Keywords

determinants, physical behavior, youth

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ORIGINAL

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Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
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Conclusions These findings indicated the importance of investigating predictors of physical activity for weekdays and weekends. Thus, efforts should focus on how to motivate adolescents to be more physically active targeting the identified predictors for weekdays and week ends.

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INTRODUCTION

The prevalence of obesity has increased rapidly among younger age groups in recent years, partly as a result of rapid socioeconomic development and urbanization. Longitudinal studies showed that as children progress through adolescence, their level of physical activity declines and sedentary behavior increases [1]. Children who are inactive may become inactive in their adulthood, resulting in a higher risk of lifestyle related health diseases such as obesity, diabetes mellitus, and hypertension. Although promoting physical activity among children and adolescents have been prioritized in many intervention programs, only few have shown to be effective [2].

In order to produce an effective promotion strategy, knowledge on potentially modifiable factors influencing physical activity is crucial [3]. Nevertheless, to identify the predictors for physical inactivity is a challenge as it is a multi-factor by nature. Furthermore, the use of different physical activity outcomes and predicting variables has made the interpretation inconsistent [4]. Pattern of physical activity in adolescents using a pedometer is preferred than the self-report method as it is more accurate and can reduce respondent bias.

There has been some work done to explore the association between psychosocial correlates of physical activity – perceived barriers, self-efficacy, social influence and beliefs for physical activity outcome. Previous studies on adolescents showed there was an inverse association between perceived barriers and physical activity level [5]. Self-efficacy, social influence were identified as consistent predictors of change in overall physical activity among children and adolescents [6]. Children and adolescents who have less perceived barriers, higher self-efficacy, better social influence and higher beliefs for physical activity outcome are more likely to be physically active.

Studies have showed that different physical activity pattern was observed between weekdays and weekend days among children, and different factors were found to be associated with these two different times of a week [7]. To date, majority of the studies in adolescents use average values over all days of measurement. The identification of predictors could not reflect the actual pattern of physical activity with different times of a week. Therefore, the purpose of this study was to determine the predicting factors which contributed to the physical activity level between weekend days and weekdays among adolescents in Kuching, Sarawak, Malaysia. With this study, a more focus and suitable physical activity promotion intervention could be developed to target the needs of the adolescents.

MATERIAL AND METHODS

This was a cross-sectional study carried out in secondary schools in Kuching Division. Kuching Division is one of the 11 administrative divisions in Sarawak, Malaysia, on the island of Borneo. It is the center of modern Sarawak with three administrative districts: Kuching, Bau and Lundu. Based on year 2010 census, Kuching Division has a population of 705,546 that consists of Chinese, Malays and indigenous groups such as Iban, Bidayuhs, Melanaus and Orang Ulu, among others. There were 26 secondary schools in Kuching Division.

A total of seven schools were randomly selected using a cluster sampling method based on geographical areas. From each of the school, one class representing each morning and afternoon session was randomly selected. On average, each of the class has 40-50 students. All students who were intellectually capable, physically fit without illnesses (e.g. asthma, heart condition, etc.) were invited to participate. A total of 474 respondents have given their consent to participate in this study.

Ethical approval for this study was obtained from the University Malaysia Sarawak ethics committee (reference: UNIMAS/TNC(AA)-03.02/06-11 Jld.2 [3]). Prior to the day of data collection, the researchers visited the schools to explain the study and its data collection method, and distributed the informed consent form among the students. Students who obtained their parents' consent were recruited for the study. The recruited participants were gathered in the school hall or a classroom arranged by the teacher in charge on a given date. The participants were briefed on the questionnaire and the usage of the pedometer, which was fitted on the participants at the end of the session. Anthropometric measurements were taken during the same time. The pedometers were collected from the participants one week later. Data collection was carried out between October 2012 to June 2013.

Physical activity was objectively assessed using Yamax Digi-Walker CW-70. The pedometer is one of the most preferred instrumentation because of its affordability and easiness to interpret [8]. A special custom-made rubber belt was given to each participant to fix the pedometer. Participants were asked to wear the pedometer during waking hours for 7 days and to remove them during bathing, showering, swimming or any sports that involved a lot of physical contact with others.

For data processing, a minimum of 2 days of weekday data and 1 day of weekend data was required for inclusion in the analyses respectively. Body weight and height were measured using the SECA portable weighing scale and a stadiometer. For weight taking, the participants were asked to remove their shoes before measurement. Participants were asked to stand upright with the heels and occiput against the stadiometer for height measurement. Weight was taken to the nearest 0.1kg and height to 0.1cm. The body mass index (BMI) was calculated and plotted onto BMI-for-age percentiles charts for different genders and classified into thinness, normal and overweight and obese based on the WHO reference 2007 [9].

The perceived barriers to physical activity were assessed by a 21-item scale [10]. Items were scored on a 5-point scale ranging from "not at all" (1) to "a great deal"(5). Using exploratory factor analysis (principal components with varimax rotation), five factors were obtained: stress, lack of interest and knowledge, low self-esteem, lack of time and lack of support. Internal consistency was adequate ($\alpha = 0.826$ for stress, $\alpha = 0.819$ for lack of interest and knowledge, $\alpha = 0.834$ for low self-esteem, $\alpha = 0.692$ for lack of time, $\alpha = 0.730$ for lack of support).

Self efficacy instrument is a 17-item questions adopted from Saunder et al. [11]. It assesses the participants' perceived self-efficacy or confidence in carrying out any physical activity. The scoring is based on a 5-point scale from

"not at all confident"(1) to "extremely confident" (5). Three factors were extracted: self-motivation, making decision, external self-efficacy with α ranging from 0.811 to 0.867 indicated acceptable internal consistency.

Social Influences for Physical Activityis an eight-item questionnaire that measures peer and family influences on a person's physical activity [11]. It uses a 5-point scale from "not at all"(1) to "a great deal" (5). Two factors were extracted: peer influence (α = 0.770) and family influence (α = 0.772).

Based on a total of 16 items, Beliefs in Physical Activity Outcomes questionnaire is adapted from Saunder et al. [11]. Using a 5-point scale from "strongly disagree" (1) to "strongly agree" (5), this instrument assesses beliefs in physical activity outcome. Higher scores indicate a stronger positive belief in the outcome of physical activity. Internal consistency was acceptable within the range of 0.783 to 0.847.

Data was entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20. The descriptive and inferential statistical output was generated based on a p value of less than 0.05 (2-sided). Associations between potential predictors and physical activity were assessed using multiple linear regression separately for weekday and weekend days. Multiple linear regression was used to assess the linear relationship between possible independent variables with a continuous dependent variable while adjusting for potential confounders. The numerical independent variables were checked for normality after ascertaining the skewness and kurtosis and confirmed by the Kolmogorov Smirnov statistics. The linearity between the independent and dependent variable was confirmed using scatterplots and partial residual scatterplots. Otherwise, a non-linear operation with transformation could be indicated. Multicollinearity was not present after it was checked via the VIF values of not more than 10. All the data were stable and did not contain any influential outliers, as checked using the Cook's distance method.

RESULTS

Based on the total number of respondents, 42.8% were Malay and 61.2% were female. Of these, 16 (3.4%) were found to be obese, and 12.7% were overweight. More males were found to be obese and overweight, and their mean BMI was also higher than females. In terms of physical activity, mean steps for males was higher than females for overall, as well as on weekdays and weekend days. A summary of BMI and physical activity is shown in Table 1.

Table 2 shows the associations between potential predictors and changes in physical activity for weekdays. Under simple linear regression analysis, significant associations were identified with stress, lack of interest and knowledge, a lack of support, self-motivation, making decision, and external self-efficacy. However, only one predictor, self-motivation was found to be significant in the final model of the multiple linear regression (adj *b*: 521.46, 95% CI -72.78 to 1050.19. $p < 0.001$).

For weekend days physical activity, analysis of simple linear regression showed a lack of interest and knowledge, self-motivation, making decisions, peer

support and self-benefit to have a significant association. Based on multivariate analysis, two factors – lack of interest and knowledge (adj *b*: -427.82, 95% CI -837.72 to 17.92), and making decision (adj b:737.71, 95% CI -197.94 to 1276.88) were found to have significant association with weekend days physical activity (see Table 3).

Table 1. Participants' Body Mass Index and physical activity (N = 474)

	Mean (+SD)/n (%)		
	All	Male (n = 184)	Female (n = 290)
Classification of BMI			
Obese	16 (3.4%)	11 (6.0%)	5 (1.7%)
Overweight	60 (12.7%)	26 (14.1%)	34 (11.7%)
Normal	391 (82.5%)	144 (78.3%)	247 (85.2%)
Thinness & below	7 (1.5%)	3 (1.6%)	4 (1.4%)
BMI (kg/m^2)	21.21 ±12.93	22.27±20.01	20.53±4.34
Physical activity			
Physical activity level (step±SD)	6251.37 ±3085.31	7200.54 ±3396.64	6014.29 ±2427.38
Weekends physical activity	7369.59 ±3815.91	8119.52 ±4358.68	6893.76 ±3349.14
Weekdays physical activity	5579.96 ±3137.57	6281.55 ±3593.80	5134.81 ±2724.25

Table 2. Factors associated with Weekdays Physical Activity (N = 474)

Variables	Simple Linear Regression			Multiple Linear Regression			
	b[b]	95% CI	p value	Adj. *b*[c]	95% CI	t statistics	p value
Stress	-411.00	-806.97, -15.034	0.042	-272.69	-843.72, 298.33	-0.938	0.349
Lack of interest & knowledge	-439.06	-753.82, -124.30	0.006	-227.74	-667.30, 211.81	-1.018	0.309
Lack of support	-393.42	-757.40, -29.44	0.034	-135.17	-624.54, 354.19	-0.543	0.588
Self-motivation	592.42	270.61, 914.23	<0.001	521.46	-72.78, 1050.19	1.938	<.001*
Making decision	415.42	73.36, 757.48	0.017	-139.31	-683.84, 405.22	-0.503	0.615
External self-efficacy	468.96	138.73, 799.18	0.005	201.29	-255.47, 658.05	0.866	0.387

Abbreviations : 95% CI, 95% Confidence interval
[a] $R^2 = 0.046$. The model fits reasonably well. Model assumptions are met. There is no interaction between independent variables, and multi-collinearity problem.
[b] Crude regression coefficient
[c] Adjusted regression coefficient.

Table 3. Factors associated with Weekend days Physical Activity (N=474)

Variables	Simple Linear Regression			Multiple Linear Regression			
	b[b]	95% CI	p value	Adj. *b*[c]	95% CI	t statistics	p value
Lack of interest & knowledge	-455.40	-839.04, -71.76	0.020	-427.82	-837.72, 17.92	-2.051	0.041*
Self-motivation	620.36	227.57, 1013.14	0.002	360.34	-280.33, 1001.00	1.105	0.270
Making decision	673.98	259.93, 1088.03	0.001	737.41	-197.94, 1276.88	2.686	0.007*
Peer support	495.02	117.73, 873.30	0.010	259.21	-259.28, 777.70	0.982	0.326
Self-benefit	663.70	131.10, 1196.30	0.015	575.79	-72.90, 1158.86	1.94	0.053

Abbreviations : 95% CI, 95% Confidence interval
[a] $R^2 = 0.053$. The model fits reasonably well. Model assumptions are met. There is no interaction between independent variables, and multi-collinearity problem.
[b] Crude regression coefficient
[c] Adjusted regression coefficient.

DISCUSSION

A higher physical activity level was observed at weekends compared to weekdays. This pattern is common as school students are normally busy on weekdays attending school, tuition or any school related activities. Although the weekend physical activity was found to be higher, the total steps per day (7369.59 ±3085.31) was below the international recommended standard steps for children and adolescents 8,000 to 16,000 steps per day [8]. This phenomena is common among Asian countries where adolescents spend more time either attending tuition or stay at home playing computer games, smart phones and watching television [12, 13, 14].

This study investigated factors contributing to physical activity for weekdays and weekend days. Out of the thirteen tested factors, only one factor – self-motivating – affected physical activity for weekdays. This result suggested self-motivating as playing an important role in encouraging adolescents to be physically active, especially considering the exhaustion after attending school for half a day, and some tuition. According to the Self-Determination Theory, to engage people to be more physically active, one has to be in the stage of intrinsically motivated where he or she enjoys doing physical activity and finds it interesting and challenging [15]. This is evidenced in a study carried out in the United Kingdom where intrinsic goals had positive indirect effects on leisure-time exercises [16]. In order to improve the exercise behavior in adolescents, fostering intrinsic goals could be beneficial not only for health but also for the overall well-being of the adolescents.

As for the physical activity during the weekends, two factors were found to have significant association – a lack of interest and knowledge in making a decision to be physically active. Literature has shown there were many factors that can cause a lack of interest and knowledge – exercise is not regarded as important, a fear of injury or illness, a belief that adolescents should spend their time studying or helping at home rather than playing outside [17].

Though the results did not indicate that family support was a significant predictor for both physical activities for weekday and weekend, the role of parents/family affects the involvement of adolescents in physical activity [7]. Parents can play an important role in promoting physical activity if they are more knowledgeable on the benefits of being physically active and educate their children to be more active.

At the school level, increasing school children's knowledge and their interest in physical activity can be done through a structured manner, for example as part of a syllabus under health education [17]. A lack of interest in physical activity was also found to be associated with the availability of sport facilities in the neighborhood. Characteristics of built environments can affect the level of physical activity where recreation facilities, community design; transportation facilities have a positive association with physical activity [18]. Literature also indicated that to understand how adolescents make decisions to be physically active particularly at weekends, we need to acknowledge their physical and mental growth. During their development stage, adolescents tend to be more concerned about their body and appearance. They perceive physical activities in terms of how they are related to self-concept and what they wanted to do with their lives. Neumark-Sztainer et al. [19] in their study using the Social Cognitive Theory found that in making a decision to be physically active, adolescents commonly will develop and display personal competence and autonomy in order to prove that they are more mature. In most cases, identity was one of the major factors. Sporting prowess generally brought higher status to male compared to female adolescents. Among female adolescents, continuing participation in physical activity can often be perceived as not "feminine" and clumsy. Therefore, many female adolescents perceived that their competence in sport and physical activities as low.

CONCLUSION

In conclusion, the weekend physical activity was found to be higher as compared to weekdays; however, the total steps per day was low. Self-motivation was found to be a significant predictor for weekday physical activity. For the physical activity during the weekends, two factors were found to have a significant association – a lack of interest and knowledge, making a decision to be physically active.

This was a cross-sectional study, thus the causality association between physical activity and its factors could not be affirmed. Although a pedometer was used in place of self-reported physical activity, it was not able to assess some activities such as swimming or any vigorous exercises involving a lot of body contact. The weekday data used here included both the time at school as well as outside school. Therefore, we were not able to determine the time spent on physical activity at school and outside school. The study was based on voluntary participation, and only those who were given consent by their parents participated.

The calculated coefficient of determination of physical activity for both models had a relatively low value 4-5%. This is expected as any human behavior study typically has R-squared values lower than 50%.

Despite the limitations mentioned above, the outcomes of this study highlighted the importance of investigating time-specific predictors for physical activity and provided some suggestions for intervention. In the planning of intervention programs, it is important to increase autonomous types of motivation in order to help adolescents to be more self-motivated, overcome the lack of interest and knowledge in physical activity, so that they can make the right decision that affects their physical activity level. Future qualitative research on the reasons for been physical inactive from the participants' perspective is recommended in order to complement insight gained into this issue obtained through quantitative studies. This would ensure more matching interventions to encourage adolescents to be physically active.

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