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Physical activity, screen time, serum lipid and body mass index among Malay female university students

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ABSTRACT

Technology advancements and urbanization implicate a negative lifestyle by promoting physical inactivity and sedentary behaviour. This situation may lead to obesity, an important risk factor for the development of diseases such as dyslipidemia and coronary heart disease. This study was conducted to evaluate physical activity, screen time, serum lipid profiles and body mass index (BMI) among Malay female university students. A total of 22 female individuals aged 19 to 23 years old from a private university in Selangor, Malaysia participated in the study. BMI was measured according to standard protocol. Physical activity (PA) and screen time (ST) were determined using questionnaires, and serum lipid profiles (total cholesterol and high-density lipoprotein cholesterol (HDL)) were analyzed using spectrophotometry. Our data showed that mean BMI for the participants was 23.0±4.2 with 13.6% of the participants were categorized as underweight and 4.5% were obese. The level of PA represented as metabolic equivalent in minutes (METmin) showed a median of 340 (IQR=1360) while median ST was 285.0 (IQR=213.8) minutes. The results also showed that median total cholesterol was 179.8 (IQR=78.4) mg/dL and mean HDL was 56.9±9.8 mg/dL. Only 9 (40.9%) participants were identified as physically active. HDL was significantly lower in obese participants compared to other groups (F=5.542, p=0.007). A significant moderately strong negative correlation (r=-0.730, p<0.001) between BMI and HDL was observed. As a conclusion, the majority of the participants were physically inactive with a considerable amount of ST daily. The increase of BMI was inversely associated with HDL. Interventions for lifestyle modification among university students are therefore recommended to reduce the risk of related diseases.

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INTRODUCTION

Lifestyle and behaviour choices are important factors in influencing weight status. Less amount of physical activity (PA) is one of the great factors that lead to overweight and obesity with subsequent increased risk of cardiovascular disease, diabetes and others (National Health Service Information Centre, 2011). Among university students, health risk behaviour and lack of knowledge on the importance of PA in relation to health were proposed as some of the factors contributing to physical inactivity (Haase *et al.,* 2004). Research conducted in 24 universities from 23 countries showed the prevalence of physical inactivity among undergraduate students was approximately 41%. It appears that the highest rate of physical inactivity was from the Southeast Asian countries with 50.5% (Pengpid *et al.,* 2015).

It is known that high levels of PA, particularly moderate-to-vigorous physical activity (MVPA), are associated with improved health, often in a dose-response manner (Bakrania *et al.,* 2016). It is evident that there is a direct association between PA and reduced risk of coronary heart disease (CHD) (Sofi *et al.,* 2008). Despite this, advancement in technology has brought major structural transformation in the society that resulted in the changes in total PA levels. These can be characterized by changes in the workplace where there is a decline of physically active occupations; in the home with an advent of labour-saving devices, and in transport system where there is a widespread use of automobiles where people no longer need to walk but use vehicles instead (Brownson *et al.,* 2005). Revolution in the information and communication technologies also allows people to communicate in various ways with one another from a wide distance without having to be physically present (Deb, 2014).

It was reported that the increase of obesity in the adult American population from 1989 to 2009 had been affected by less of PA. A trend of increasing total screen time (ST), i.e. watching television, using computers and playing video games over recent years was also observed (Brownson *et al.,* 2005). The average time spent on viewing television daily has increased from 1.8 to 2.2 hours among 15 to 24 years old in Finland from the end of the 1980s to 2000 (Niemi, 2001). A study has also revealed that increased time spent on using computers and viewing television was associated with increased prevalence of overweight and obesity among Finnish female adolescents (14-, 16- and 18-years old) (Kautiainen *et al.,* 2005).

The aims of the present study were; (1) to determine the body mass index (BMI), metabolic equivalents in minutes (METmin) per week to represent PA level, ST and lipid profiles among female university students, and (2) to determine the association between PA and ST to lipid profiles based on BMI categories.

MATERIALS AND METHODS

Study Design, Population and Sampling

This research was conducted as a cross-sectional study among female individuals aged 19 to 23 years old recruited from a private university in Selangor, Malaysia. Written informed consent was obtained from all participants prior to participating in the study. Participants were required to answer questionnaires related to the measurement of the level of physical activity per week and daily screen time. Blood sampling for serum lipid analysis and assessment of BMI were performed subsequently.

Body Mass Index (BMI)

Measurement of BMI was performed for the estimation of body composition. Height was measured using a stadiometer (Seca, Germany) and weight was measured with body composition analyzer, Karada Scan HBF-362 (Omron, Japan). BMI was derived by using the formula of weight (kg) divided by the square of height (m^2) which was automatically calculated by the body composition analyzer. According to WHO (1998) recommendation, BMI between 18.5 to 24.9 kg/m^2 is categorized as 'Normal', equivalent or more than 25.0 kg/m^2 is categorized as 'Overweight' and equivalent or more than 30 kg/m^2 is categorized as 'Obese'.

Physical Activity (PA) and Screen Time (ST) Questionnaire

PA was measured using the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization (WHO, n.d.). The questionnaire covers three main domains of PA performed, i.e. activity at work, travelling-related and recreational activity. Components of PA assessed were intensity, duration and frequency. Time estimates spent in PA were converted to metabolic equivalents in minutes (METmin) per week for estimation of energy expenditure. The cleaning and analysis of the data were done based on the GPAQ analysis guide provided; equivalent or more than 600 METmin per week were considered to achieve the PA according to guidelines (Office of Disease Prevention & Health Promotion (ODPHP), 2008; WHO, 2010) and labelled as 'Moderate'. Participants with equivalent or more than 3000 METmin per week were labelled as 'High' and less than 600 METmin per week were labelled as 'Low'. Briefly, 1 MET is defined as the amount of oxygen consumed while sitting at rest; in other words, it is the rate of energy expenditure while at rest which is equal to 3.5 mL of oxygen (O_2) per kg body weight times minutes (Jette *et al.,* 1990).

ST was defined as time spent watching television or videos, playing computer games (including gaming on a mobile phone) or using a computer not related to work/study. It was measured using questions related to ST which were extracted from the 2012 National Health and Nutrition Examination Survey (NHANES) - National Youth Fitness Survey Questionnaire (Centers for Disease Control and Prevention (CDC), 2011). Times spent on screen daily were reported in minutes.

Serum Lipid Analysis

Approximately 6.0 mL of venous blood was withdrawn from all participants into plain tubes. After complete coagulation, samples were centrifuged at 1117 x*g* for ten minutes. Serums obtained were subjected to lipid analysis such as total cholesterol and high-density lipoprotein cholesterol (HDL) using Cholesterol Liquicolor Reagent Kit (Human, Germany). The level of total cholesterol and HDL were determined using a spectrophotometer (Zuzi 4201/20, Spain) at 500 nm wavelength and calculated subsequently.

Statistical Analysis

Results were statistically analyzed using IBM SPSS Statistics 21. Normality test for our data was checked prior to each analysis. Mean±standard deviation (SD) or median (interquartile range (IQR)) were reported accordingly. Statistical test with p-value equivalent or less than 0.05 was considered significant.

RESULTS

Descriptive Analysis

From 22 participants, 13.6% (n=3) were categorized as underweight, 54.5% (n=12) normal, 27.3% (n=6) overweight and 4.5% (n=1) obese with mean BMI of 23.0±4.2. The level of PA represented as METmin per week showed a median of 340 (IQR=1360) and median screen time was 285.0 (IQR=213.8) minutes equivalent to approximately four hours and 45 minutes. Median for total cholesterol was 179.8 (IQR=78.4) mg/dL and mean HDL was 56.9±9.8 mg/dL.

Physical Activity (PA), Screen Time (ST) and Lipid Profiles

Only 9 (40.9%) respondents were identified as physically active where they met the recommendation of performing PA of at least 600 METmin per week, the equivalent of 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity. This result highlights that majority of the respondents (59.1%) were physically inactive at quite a young age. Table 1 shows the distribution of participants according to the PA status. Contrary to what might have been expected, no significant association was seen between PA and ST (r_s=-0.382, p=0.08) where less PA was not due to more time spent on screen. The relationship between both PA and ST with lipid profiles were also not established where no significant results were obtained either with total cholesterol or HDL level.

Stratification according to BMI

Obese participants had significantly lower HDL compared to other BMI groups (F=5.542, p=0.007). Further analysis revealed a significant moderately strong negative correlation (r=-0.730, p<0.001) between BMI and HDL. Figure 1 illustrates the scatter plot between BMI and HDL. There was, however, no significant association seen between BMI to total cholesterol level. For PA, results showed that METmin was neither significantly different with BMI statuses, nor was it associated with BMI status. Similar to PA results, no difference of ST was observed between groups as well as the association between these two parameters. Distributions of PA level stratified by BMI among study participants are detailed out in Table 2.

Table 1: Distribution of participants according to physical activity (PA) status

PA status	Frequency, n	Percentage, %
Low (<600 METmin/week)	13	59.1
Moderate (≥600 & <3000 METmin/week)	7	31.8
High (≥3000 METmin/week)	2	9.1
TOTAL	22	100

Table 2: Level of physical activity (PA) stratified by body mass index (BMI) (n=22)

BMI	Physical activity, n (%)	
	Do not meet recommendation	Meet recommendation
Underweight	3 (13.6)	0 (0)
Normal	6 (27.3)	6 (27.3)
Overweight	3 (13.6)	3 (13.6)
Obese	1 (4.5)	0 (0)
TOTAL	13 (59.1)	9 (40.9)

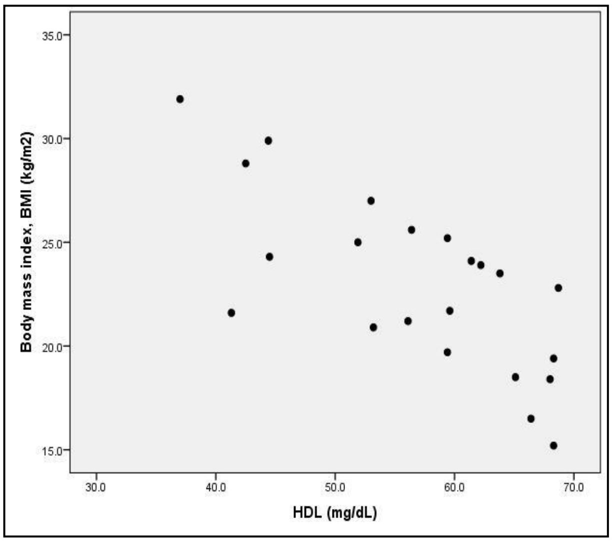

Figure 1: Association between BMI and HDL among participants. A moderately strong negative association between BMI and HDL was observed (r=-0.730, p<0.001), (n=22)

DISCUSSION

In this cross-sectional institutional-based study of local university female students, the majority of the participants were physically inactive regardless of their BMI. Time spent on screen was of considerable amount where respondents spend approximately 4 hours and 45 minutes daily on screen. Increased level of low PA was not associated with ST. Reduced HDL level was inversely associated with BMI but no association with total cholesterol. There was no observed relationship between PA and ST to total cholesterol and HDL level.

Global recommendations on physical activity for substantial health benefits in healthy individuals aged from 18 to 64 years old recommended that the minimum amount of PA per week required is 150 minutes of moderate-intensity aerobic PA or 75 minutes of vigorous-intensity aerobic PA or an equivalent combination of moderate- and vigorous-intensity activities. It should be performed in episodes of at least ten minutes duration and spread throughout the week (Office of Disease Prevention & Health Promotion, 2008; WHO, 2010). The recommendations could be regarded as roughly equivalent to 600 metabolic equivalents in minutes (METmin) (Office of Disease Prevention & Health Promotion, 2008). For additional health benefits, adults should increase their moderate-intensity aerobic PA to 300 minutes per week or engage in 150 minutes of vigorous-intensity aerobic PA per week or an equivalent combination of moderate- and vigorous-intensity activity (ODPHP, 2008; WHO, 2010).

Approximately 60% of Spanish university students did not meet the recommended PA guidelines (Cocca *et al.,* 2014). The report from National Health and Morbidity Survey (NHMS) 2015 revealed that only 31% of men and women adults aged 18 to more than 60 years old were physically inactive. Yet, the level of PA was inversely related to the risk of overweight/obesity only in men but not in women (Chan *et al.,* 2017). Findings from NHMS 2017 focusing on adolescent health reported a low level of PA activity with 19.8% (IPH, 2017). A different study conducted earlier, highlighted a downward trend in 2012 to 2014 in the PA level observed among local female adolescents (Majid *et al.,* 2016). Despite a contradicting prevalence of PA level reported for adults and adolescents, low level of PA among adolescents might explain the current result of low PA among the study participants. We postulated that they have been physically inactive since adolescents with regards to the trend reported as the current studied population were young adults only. A longitudinal prospective study in a cohort of adolescents growing into adulthood is however recommended for consideration of future study to investigate the PA trend. In addition to that, similar to our finding, Serrano-Sanchez and colleagues (2011) reported that there was no significant relationship between total ST to the achievement of meeting the PA recommended level among females. On the contrary, PA was influenced by ST in male individuals (Serrano-Sancheza *et al.,* 2011). Low PA level was not necessarily due to increased time spent on screen but may have been contributed by other factors. Knowledge about the benefits of PA seemed to be an important factor where it was evidently deficient even in certain developed countries (Haase *et al.,* 2004).

Consistent with our finding, a significant inverse association between BMI and HDL was apparently well established in either at local or global settings (Majid *et al.,* 2016; Shamai, 2010). Shamai (2010) proposed that the relationship may be explained by insulin resistance resulting from obesity with subsequent effect of lowering the HDL among the respective obese individuals. As HDL is commonly regarded as the 'good cholesterol', a reduced HDL level at a young age is quite worrisome.

The study, however, presented several limitations. The respondents were recruited from one study location only, and the limited sample size may contribute to some of the non-significant results. Assessment of PA which relied on questionnaire also presented limited information as compared to measurement by the accelerometer.

CONCLUSION

Majority of the respondents were physically inactive with a considerable amount of daily ST regardless of their BMI status. The increase of BMI was associated with decreased HDL. Investigation of factors contributing to low PA with subsequent interventions for lifestyle modification such as engagement in regular PA among university students are therefore recommended to reduce the risk of related diseases.

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