

THE ASSOCIATIONS BETWEEN DAILY STEPS AND CARDIOVASCULAR RISK FACTORS AMONG FEMALE TEACHERS

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Abstract

Physical activity is an important component of cardiovascular health. The fact that physical activity is also associated with a substantial number of cognitive and academic benefits, therefore school teachers can be an important role model in promoting a physically-active lifestyle in school children. The aim of this study is to examine the levels of physical activity (PA) and its association with cardiovascular risk factors in a sample of school teachers. Forty-nine (n=49) female teachers from primary and secondary schools around Klang Valley urban areas were recruited. The PA level was determined using pedometer, worn for three consecutive days. Anthropometric measurements and blood samples were collected to determine cardiovascular risk factors. Findings showed that the school teachers recorded an overall mean (\pm SEM) of 7707 ± 490 steps/day, which is below the recommended target of 10 000 steps per day. According to pedometer-determined physical activity indices proposed by Tudor-Locke and Bassett (2004), 20.83% of the sample were classified as 'sedentary' (<5000 steps/day), 35.40% were 'low active' (5000 – 7499 steps/day) and only 18.70% achieved more than 10 000 steps/day. The mean values for waist circumference, fasting blood sugar, and cholesterol level, systolic and diastolic blood pressure were 83.96 ± 1.90 cm, 5.41 ± 0.26 mmol/l, 4.64 ± 0.26 mmol/l, 118.90 ± 1.72 mmHg and 72.40 ± 1.58 mmHg respectively. Fisher Exact Test shown that there were significant association between daily step and age category. Daily steps weakly negative correlated with systolic blood

pressure ($r = -0.024$, $p > 0.05$) as well as blood sugar levels ($r = -0.061$, $p > 0.05$), diastolic blood pressure ($r = -0.079$, $p > 0.05$), body mass index ($r = -0.271$, $p > 0.05$), waist circumference ($r = -0.196$, $p > 0.05$), as well as blood cholesterol levels ($r = -0.037$, $p > 0.05$). In conclusion, there were weak negative correlations between steps per day and cardiovascular risk factors. Generally, the level of physical activity in the sample of female workers were low moderate active. Therefore, should be an interventions programme in promoting PA.

Keywords: Pedometer, cardiovascular, intensity, daily steps

Introduction

Non-communicable diseases (NCD) is one of the leading cause of death worldwide. There four major types of NCDs are cardiovascular disease, cancer, chronic respiratory diseases and diabetes (WHO 2014). According to the recent National Health Morbidity Survey in 2019, cardiovascular disease is the leading cause of death in Malaysia (IPH 2019). The risk factors for cardiovascular disease are unhealthy lifestyle behaviors such as lack of physical activity, unhealthy diet and tobacco smoking, amongst others (Mendis et al., 2011; Pope et al., 2014). Physical activity is regarded as the cornerstone in the prevention and management of cardiovascular disease and its risk factors. Physically active individuals are at least half as likely to experience an incident cardiovascular event, die from CVD, or die from any cause compared to those who were categorized as physically inactive and did not achieve other healthy lifestyle goals (Lacombe et al., 2019). Individuals involved in high intensity activity such as running, jogging or intense training for 3 hours a week were less likely to have enlarged waist circumference and elevated blood pressure (Barengo et al., 2006)

The American College of Sports Medicine recommends that most adults engage in moderate-intensity exercise for at least 30 minutes, 5 days a week, or vigorous-intensity exercise training for at least 20 minutes, 3 days a week, which sums up to at least 150 minutes a week. Adults who are unable or unwilling to meet these exercise targets can still benefit from engaging in either less amounts of exercise than recommended or in light-intensity exercises (Garber et al., 2011). Light-intensity exercises are the activities that causes a slight increase in respiratory rate such as brisk-walk (Briffa et al., 2006). According to Torstveit et al. (2010), walking is an activity that uses large muscle groups of the lower limb and is the simplest, easiest physical activity that can be performed by everyone. Studies have suggested that doing light-intensity physical activity is better than not doing it at all (Grimbley et al., 2010) as many benefits can be achieved including maintaining fitness, improving mood and quality of life (Thune et al., 2010). Physical activity can be measured using direct techniques such as pedometer or accelerometer and indirect techniques using survey forms, log book or diary and interview (Kowalski et al., 2012).

Pedometer is an inexpensive device used to count daily steps in assessing physical activity. It is simple to use and has been used in many physical activity interventions that involved

walking to promote physical activity among adults (Tudor-Locke et al., 2004). The purpose of this study is to assess the associations between daily steps, measured by pedometer, and cardiovascular risk factors (i.e. body mass index, blood pressure, serum cholesterol, fasting glucose and waist circumference) in a sample of school teachers. We hypothesized that higher daily steps are associated with lower cardiovascular risk factors.

Materials and methods

Forty-nine (n=49) female teachers from secondary schools around Klang Valley were recruited for the study. Subjects who were above 21 years old and had no history of diagnosed non-communicable disease (e.g. type 2 diabetes, hypertension, coronary heart disease) were eligible for the study. Exclusion criteria were pregnancy and any disabling physical condition that may affect daily physical activity.

Anthropometric assessment

Anthropometric measurements were performed in the morning on the day after screening process which included weight (to the nearest 0.1 kg), height (to the nearest 0.1 cm), body mass index (BMI) and waist circumference (WC).

Cardiovascular risk factors

Assessment of cardiovascular risk factors were performed after anthropometric measurements. Subjects were instructed to fast for 12 h prior to assessment. Blood pressure was measured according to a standardised operating procedure using a calibrated sphygmomanometer and brachial inflation cuff (HEM-7200 M3, Omron Healthcare, Kyoto, Japan). Finger prick samples were taken for the determination of fasting glucose and cholesterol using a portable monitoring system (OneTouch, LifeScan Scotland Ltd.).

Daily steps count

Each subject was provided with a pedometer (Yamax Digi- Walker SW 200, Japan) to measure their daily steps for three consecutive working days. Pavlidou (2011) showed that the record of physical activity performed during the three days is valid and reliable where the Interclass Correlation Coefficient (ICC) is 0.74. Subjects were instructed to attach the pedometers on the waistband or belt in the same position during the measurement period and to be removed only while bathing or swimming. Pedometers were to be worn first thing in the morning and removed during night time before bed. Physical activity levels were determined based in the pedometer-step index: <5000 steps/day are classified as 'sedentary', 5000-7499 steps/day as 'low active', 7500-9999 steps/day as 'moderate active', and $\geq 10\ 000$ steps/day as 'active' and individuals who take $> 12\ 500$ steps/day are classified as 'highly active (Tudor-Locke et al., 2004). The Research Ethics Committee Universiti Kebangsaan Malaysia has approved the study and subjects t give consent before participate in this study (UKM 1.5.3.5/244/JEP2016019)

Statistical analyses

Analyses are performed using the Statistical Package for the Social Sciences (SPSS Version 22).

Results

Table 1 shows the sociodemographic characteristics of the subjects. The age range for the subjects was between 28 to 56 years. Majority of subjects were Malay (98%) and 78% of subjects were married. About 96% subjects using car as a mode of transportation to work and only 4% rode used motorcycles. About 57% of them had normal body mass index (BMI), while 31% were classified as obese. Moreover, 53% of subjects have a waist circumference greater than 80 cm, which indicated higher risk for cardiovascular disease.

Table 1: Subject’s characteristics (n=49).

Parameter	(%)	
Age		
25-35	27	55
36-45	15	31
46-56	7	14
Marital status		
Single	11	22
Married	38	78
BMI (kg/m²)		
Normal	28	57
Overweight	6	12
Obesity	15	31
Waist circumference (female)		
Normal (≤ 80 cm)	23	47
Increased risk (> 80 cm)	26	53
Mode of transportation to work		
Car	47	96
Motorcycle	2	4

Table 2 showed the cardiovascular risk factors of subjects. Overall, subjects were classified as overweight with a mean WC of above 80 cm (84 ± 2). Systolic and diastolic blood pressure, fasting blood glucose and total cholesterol showed to be within normal values.

Table 2: Cardiovascular risk factors (n=49).

Cardiovascular Risk Factors	Mean± SEM
BMI (kg m ⁻²)	27.04 ± 0.93
WC (cm)	83.96 ± 1.90
Systolic blood pressure (mmHg)	118.90 ± 1.72
Diastolic blood pressure (mmHg)	72.40±1.58
Fasting blood glucose (mmol L ⁻¹)	5.41±0.26
Total cholesterol (mmol L ⁻¹)	4.64±0.26

The levels of physical activity of subjects is shown in Table 3. Subjects recorded an average of 7707±490 steps/day, lower from the recommended 10,000 steps per day. According to pedometer-determined physical activity indices proposed by Tudor-Locke and Bassett (2004), 21% of the study sample were classified as ‘sedentary’ (<5000 steps/day), 35% were ‘low active’ (5000 – 7499 steps/day) and only 19% achieved more than 10,000 steps/day.

Table 3: Levels of physical activity of subjects (n=49).

Physical activity levels	Percentage
Sedentary (<5000 steps/day)	35.4
Low active (5000-7499 steps/day)	20.8
Moderate active (7500-9999 steps/day)	25.0
Active (10 000-12499 steps/days)	8.3
Very active (>12500 steps/day)	10.4

Table 4 shows the differences in mean daily steps according to demographic variables. There was no significance difference in the number of daily steps between age groups, marital status, BMI and WC categories.

Table 4: shows the differences in mean daily steps according to demographic variables.

Sociodemographic	n	Daily steps mean ± SEM	F/t	p
Age				
25-35	27	6745± 584 ^b	2.429	0.100
36-45	15	8752± 944		
46-56	7	9039± 1388		
Marital status				
Single	11	6414± 649 ^a	3.523	0.153
Married	38	8091± 595		
BMI (kg m⁻²)				
Normal	28	7799± 827 ^b	0.687	0.508
Overweight	6	8662 ± 847		
Obesity	15	7280± 788		
WC				
Normal (≤ 80 cm)	23	7763± 474 ^a	3.185	0.905
Obesity (> 80 cm)	26	7645± 897		

^aIndependent T test

^bANOVA Test

Table 5 shown the result of Pearson correlation between daily steps and risk factors. There was a weakly negative correlated between daily steps with systolic blood pressure ($r = -0.024$, $p>0.05$) as well as blood sugar levels ($r = -0.061$, $p>0.05$), diastolic blood pressure ($r = -0.079$, $p>0.05$), body mass index ($r = -0.271$, $p>0.05$), waist circumference ($r = -0.196$, $p>0.05$), and blood cholesterol levels ($r = -0.037$, $p>0.05$).

Table 5: Correlation between cardiovascular risk factors with daily steps.

Factor	r	p
Systolic blood pressure (mmHg)	-0.024	0.881
Diastolic blood pressure (mmHg)	-0.079	0.593
Fasting glucose level (mmol L ⁻¹)	-0.061	0.715
BMI (kg m ⁻²)	-0.271	0.061
WC (cm)	-0.196	0.181
Total cholesterol (mmol L ⁻¹)	-0.037	0.800

Discussion

During the past century, our habitual physical activity has reduced dramatically and concurrently, the prevalence of sitting time has increased. Physical activity and exercise are powerful strategies to reduce the risk for adverse health outcomes and mortality in a dose-dependent way. High-intensity exercises generally produce larger health benefits compared with moderate-intensity exercise (Eijsvogels et al., 2017). Light-intensity physical activity, performed at under 3 METs, including casual walking, doing household chores or activities of daily living, has received much less research attention in the past. More recently, researchers are beginning to realise the importance of light-intensity physical activity, as a feasible means to increase volume of physical activity because it does not require dedicated time commitment or planning as it usually involves activities of daily living and that is especially beneficial for those with limited fitness capacity or having difficulties to participate in more intense physical activity of exercise (Chastin et al., 2018). Physical activity such as doing household, climbing the stairs, gardening and walking are amongst the activities that can be performed by many as part of their daily lives (Jansson et al., 2010). Walk for 30 minutes every day for five times a week can reduce the risk of cardiovascular disease by 19% (Hancock, 2012). Achieving the recommended 10,000 steps/day has been shown to be very effective in stabilizing the blood pressure, reduce body weight (Bohannon, 2007) and waist circumference, and also improve cholesterol levels (Hancock, 2012).

The aim of this study to determine the association between daily steps and cardiovascular risk factors among female school teachers. Our study findings showed that greater daily steps are not associated with reduction in cardiovascular risk factors. The average daily steps recorded by the study sample was approximately 7000 steps/day. The percentage of those who recorded less than 5000 steps/day was 35%. Our findings indicate that the average daily steps among our study sample was slightly higher compared with a group of university employees in Kuala Lumpur (Abdullah et al., 2015). Our study sample also recorded an average daily steps much higher compared with other studies (Tudor-Locke et al., 2004; Wyatt et al., 2005). However, the average daily steps of adult at Belgian has slightly higher compared with teachers in this study which is 9650 steps/day (Cocker et al., 2007). Furthermore, based on the index measures introduced by Tudor-Locke and Bassett (2004), the majority of our study sample is low-active and only a small proportion of subjects (19%) achieving 10,000 steps/day. However, this percentage is more higher compared with United States population which is only 13.9% (Tudor-Locke et al., 2004).

The study findings also indicate that the cardiovascular risk factors such as blood pressure, blood glucose levels, and total cholesterol were mostly within the normal ranges, which possibly explained for the lack of associated between the daily steps and cardiovascular risk factors. However, the overall waist circumference and body mass index was slightly higher than normal from the normal range. This probably happened due to the majority of subjects are overweight and obese, an observation that is similar to other studies involving female populations (Poh et al., 2010; Abdullah et al., 2015). Previous studied proved that individuals who achieved 10 000 steps per day have a normal body weight whereas individuals with have a step less than 5000 steps per day are overweight or obesity (Dwyer et al., 2007; Tudor-Locke et al., 2010). Additionally, Sisson et al. (2010) also stated that people who are most active have a smaller waist circumference and vice versa.

There was no significant mean difference showed of daily steps between the age groups in this study. However, there is a different in average steps taken per day between the age groups where the increase the age, the greater the average of daily steps. This may be due to the lack of exercises among adults above 40's, where 16% only exercise once or twice per month according to a study in Malaysia (Norimah et al., 2003) and more than 50% of Malaysian adults are inactive (Jamil et al. 2015). Another study by Melo et al., (2010) stated that people who are higher income and in a healthy condition have a higher number of steps taken per day compared with individuals that are less income and sick. Moreover, there are also no significant differences between marital status and daily steps. This results are contrast from previous studies by Wyatt et al., (2005) which shown there are significant different of daily steps between marital status. However, in average daily steps according marital status which shows teachers who are married have higher average daily steps compared with single teachers. Probably because people who are married have more commitment and have a limited time for relax as compared to single people (Wyatt et al., 2005). Lastly this study also found there was a weak negative correlation between cardiovascular risk factors and daily steps. Thus, the higher the number of steps per day the lower the risk of a teacher at Klang Valley urban area to suffer from cardiovascular disease.

Previous study indicated there was many barriers in physical activity such as personal, environment and physical. A study done in Malaysia showed that the significant barriers for personal category was marriage status and BMI (Ibrahim et al., 2013). Other study indicated among female subjects in Selangor there was positive and low correlation between perceived barriers and physical activity. This study is also parallel with previous study in Selangor, where the type of carrier was not associated with the level of physical activity (Siti et al., 2011).

Conclusion

Almost half of the study sample is categorized as low-moderate active. There seems to be a weak association between daily steps and cardiovascular risk factors among female school teachers. Therefore, intrinsic motivation may be an effective strategy to enhance teachers' physical activity by providing teachers with knowledge, understanding and awareness necessary to obtain a physically active lifestyle.

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