Preventive Medicine 57 (2013) S14–S17

Contents lists available at SciVerse ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Associations of occupational, transportation, household and leisure-time physical activity patterns with metabolic risk factors among middle-aged adults in a middle-income country

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ARTICLE INFO

Available online 28 December 2012

Keywords:
Physical activity
Metabolic syndrome
Blood glucose
Central obesity
Hypertension
Serum lipids
Obesity
Cross-sectional studies
Malaysia

ABSTRACT

Objective. This study investigates physical activity in different domains and its association with metabolic risk factors among middle-aged adults.

Method. The study was performed in Kuala Lumpur, Malaysia from August 2010–August 2011. Body mass index (BMI), waist circumference, systolic/diastolic blood pressure, and fasting blood glucose/lipid profile were measured in 686 Malay participants (mean age 45.9 ± 6.5 years). Self-reported physical activity was obtained with the validated IPAQ (Malay version) and categorized into low-, moderate- and high-activity levels across occupational, transportation, household and leisure-time domains.

Results. Participants spent most of their time on household (567.5, 95% CI: 510–630 MET-minutes/week) and occupational activities (297, 95% CI: 245–330 MET-minutes/week). After adjusted for gender and smoking, participants with low-activity levels in occupational, transport and household domains were associated with significantly higher odds for metabolic syndrome (2.02, 95% CI: 1.33–3.05; 1.49, 95% CI: 1.01–2.21; 1.96, 95% CI: 1.33–2.91). Significantly higher odds for obesity and abdominal obesity were consistently reported among those with low-activity levels across all four domains.

Conclusion. High-activity levels in occupational, transportation and household domains were each negatively associated with metabolic syndrome among our cohort. Increase participation of physical activity across all four domains (including leisure-time activity) should be encouraged.

Introduction

The cardiovascular epidemic is a reflection of population aging and changed of lifestyle due to rapid urbanization and globalization (Mendis et al., 2007). This endemic is no longer limited to developed countries, and the prevalence in Asian countries was experiencing an unprecedented increase over the last decade (Lee et al., 2011). In Malaysia, cardiovascular disease has been the leading cause of death for both men and women over the past 40 years (Rampal et al., 2008). There has been a growing interest in the constellation of cardiovascular risk factors: increasing levels of obesity, dyslipidemia, hyperglycemia, and hypertension, which make up another major health problem — the metabolic syndrome (Alberti et al., 2005).

There was ample evidence supporting the inverse relationship between physical activity and metabolic syndrome (Mohan et al., 2005; Mabry et al., 2012). Participation of physical activity across the various domains (occupation, transport, household and leisure) is a novel concept in public health study (Khaing Nang et al., 2010). Although participation of adults' physical activity in specific life domains has been investigated, the impact of the amount in which activities are performed in certain domains on health outcomes remains unclear in our country. Hence, in contrast to previous studies which only compared overall physical activity amount in moderate and vigorous activity, this study investigates the participation of adults' physical activity across daily life domains separately, and their association with risk factors for metabolic syndrome among middle-aged adults.

Methods

This was an analytical cross-sectional study. All eligible employees (aged 35 years and above) of a public university in Kuala Lumpur, Malaysia were invited to participate in the annual free worksite health screening. A random sample of 1000 employees was selected and invited to participate in our study. Out of these, 686 agreed to participate in the study giving a response rate of 68.6%. Ethics clearance was obtained from the Medical Ethics Committee of the university (Reference Number: MEC 782.18). Written informed consent was obtained from all participants.

Socio-demographic information (gender, age, educational level, smoking status), anthropometric parameters (weight, height and waist circumference);

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http://dx.doi.org/10.1016/j.ypmed.2012.12.011

systolic/diastolic blood pressure, fasting blood glucose and fasting lipid profile were collected. Weight was taken using the SECA digital scale, while height by the SECA stadiometer. Body mass index (BMI, kg/m^2) was calculated and categorized according to the WHO classification (1998). Blood pressure was measured using a clinically validated digital automatic blood pressure monitor (Omron HEM-907 model) after at least 10 min of seated rest. Two blood pressure readings were obtained and averaged for used in analysis. The analysis of biochemical indicators were conducted by the Clinical Diagnostic Laboratory of the University Malaya Medical Centre.

According to the modified NCEP ATP III criteria for Malay population (Moy and Bulgiba, 2010), the presence of any three or more of the following five factors is required to be diagnosed with metabolic syndrome: abdominal obesity (waist circumference >90 cm in men and >80 cm in women for Asian), hypertriglyceridemia (≥1.7 mmol/L or on drug treatment); low HDL-cholesterol (≤1.03 mmol/L for men and ≤1.29 mmol/L for women or on drug treatment); hypertension (≥130 mmHg systolic and/or ≥85 mmHg diastolic or on drug treatment); and hyperglycemia (fasting plasma glucose ≥5.6 mmol/L or on drug treatment).

Physical activity across domains was assessed by the self-administered, long form, Malay version of the International Physical Activity Questionnaire (IPAQ-M) (Chu and Moy, 2012). Participants were asked to recall about their type and duration of various activities in the last 7 days. For the analysis of the physical activity data collected from IPAQ-M, a metabolic equivalent of task (MET) value was assigned to each type of activity according to the compendium by Ainsworth et al. (2011). The MET-minutes/week was calculated as: minutes of activity/day × days per week × MET value.

Total physical activity of MET-minutes/week among participants in four domains was categorized into three tertiles: the lowest tertile was classified as "low", the medium tertile as "moderate" and the upper tertile as "high".

Data was analyzed using SPSS version 16.0. The significant level was preset at $p<0.05$. Associations between categorical variables were tested using chi-squared test, Mann–Whitney *U* test was used for asymmetric continuous variables; Fisher's exact test was used to compare the prevalence of smoking among gender. Logistic regression estimated the odds ratio (OR) with 95% confidence intervals (CI), using the highest-activity level as the reference. The analyses were adjusted for gender and smoking (never, former, current). Age was not included in the adjustment as it was not significantly associated with physical activity.

Results

Sociodemographic and clinical characteristics of the participants are shown in Table 1. None of the women were smokers or have smoked before. A total of 46.1% of the participants had moderate-activity level followed by low and high-activity levels. Our participants spent most of their time on household and occupational activities. There were significantly more men engaging in high-activity level compared to women ($p<0.05$). However, they had poorer lipid profile and higher prevalence of metabolic syndrome ($p<0.05$).

In adjusted analyses, participants with low-activity level in occupational, transport and household domains were associated with significantly higher odds for metabolic syndrome (2.02, 95% CI: 1.33–3.05; 1.49, 95% CI: 1.01–2.21; 1.96, 95% CI: 1.33–2.91), but not leisure-time activity (1.18, 95% CI: 0.80–1.73), as compared to those engaged in high-activity level (Table 2). Significantly higher odds for obesity and abdominal obesity were consistently reported among those with low-activity level across all four domains, but not for other metabolic risk factors (hypertriglyceridemia, low HDL-cholesterol, hypertension and hyperglycemia). Comparatively lower odds for metabolic syndrome, obesity and abdominal obesity were also reported among those with

Table 1
Characteristics of participants (n = number of subjects).

	Total[a] (n = 686)	Men (n = 272)	Women (n = 414)	p-value[b]
Mean age (years ± sd)	45.9 ± 6.5	46.4 ± 6.9	45.5 ± 6.0	0.14
40 years and below	139 (20.3)	52 (19.1)	87 (21.0)	
40–49 years	349 (50.9)	131 (48.2)	218 (52.7)	
50 years and above	198 (28.8)	86 (31.6)	108 (26.1)	
Educational level				0.01
Primary	142 (20.7)	66 (24.3)	76 (18.4)	
Secondary	247 (36.0)	80 (29.4)	167 (40.3)	
Tertiary	297 (43.3)	126 (46.3)	171 (41.3)	
Smoking status				<0.01
Never	548 (79.9)	134 (19.5)	414 (60.3)	
Former	81 (11.8)	81 (11.8)	0 (0)	
Current	57 (8.3)	57 (8.3)	0 (0)	
Body Mass Index (kg/m^2)[c]				<0.01
Underweight < 18.5	10 (1.5)	3 (1.1)	7 (1.7)	
Normal 18.6 to 24.9	226 (32.9)	86 (31.6)	140 (33.8)	
Overweight 25 to 29.9	269 (39.2)	131 (48.2)	138 (33.3)	
Obese ≥ 30	181 (26.4)	52 (19.1)	129 (31.2)	
Levels of physical activity				<0.01
Low	186 (27.1)	59 (21.7)	127 (30.7)	
Moderate	316 (46.1)	116 (42.6)	200 (48.3)	
High	184 (26.8)	97 (35.7)	87 (21.0)	
Physical activity domains (MET-min/week)				
Occupational	297 (245, 330)	480.0 (330, 495)	231.0 (169, 268)	<0.01
Transportation	165 (132, 198)	231.0 (198, 297)	99.0 (66, 165)	0.01
Household	567.5 (510, 630)	520.0 (420, 630)	600.0 (540, 720)	0.01
Leisure-time	165.0 (99, 198)	315.5 (231, 396)	54.8 (0, 99)	<0.01
Waist circumference (cm)	86.5 ± 10.7	89.1 ± 9.7	84.9 ± 11.1	<0.01
Systolic blood pressure (mmHg)	126.4 ± 15.3	130.8 ± 13.5	123.6 ± 15.8	<0.01
Diastolic blood pressure (mmHg)	79.2 ± 10.8	81.6 ± 9.8	77.7 ± 11.1	<0.01
Triglycerides (mmol/L)	1.5 ± 0.9	1.8 ± 1.0	1.2 ± 0.6	<0.01
HDL-cholesterol (mmol/L)	1.3 ± 0.3	1.2 ± 0.2	1.5 ± 0.4	<0.01
Fasting glucose (mmol/L)	5.4 ± 1.9	5.6 ± 2.1	5.2 ± 1.8	0.01
Metabolic syndrome	219 (31.9)	101 (37.1)	118 (24.2)	0.02

The data represents averages ± SD, number (%), median (95% CI).
[a] The study was performed in Kuala Lumpur, Malaysia from Aug 2010 to Aug 2011.
[b] Significant difference between men and women.
[c] Classification according to World Health Organization (1998).