Original Article

Stages of change for regular physical activity among government employees

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Abstract:

Problem statement: Changes in lifestyle have led to the rising rate of nutrition-related chronic diseases in Malaysia. Purpose: A cross-sectional study was conducted to identify demographic characteristics and lipid profile by individuals' readiness for regular physical activity. Approach: A total of 675 employees from five government agencies in Putrajaya were selected using multi-stage random sampling. Results: The majority of the participants (46.4%) considered themselves to be physically active. There was no significant association between stages of change and demographic factors, except gender. The adjusted mean body mass index for the Pre-contemplation/Contemplation group (27.12 ± 0.27 kg/m²) was significantly higher than that of the Preparation/Action group (25.92 ± 0.37 kg/m²) and the Maintenance group (24.71 ± 0.52 kg/m²) [$F = 9.60$; $p < 0.001$]. In addition, there was a statistically significant difference in adjusted mean waist circumference [$F = 11.49$; $p < 0.001$], waist-to-hip ratio [$F = 8.01$; $p < 0.001$], HDL cholesterol [$F = 11.66$; $p < 0.001$] and triglycerides [$F = 6.88$; $p < 0.001$] between stages of change groups. Conclusions: Gender may play a vital role towards the intention to engage in regular physical activity. Furthermore, anthropometric and some lipid parameters (HDL cholesterol and triglycerides) differ significantly among stages of change groups.

Key words: Physical activity, stages of change, government employees, lipid profile

Introduction

The number of global deaths due to nutrition-related non-communicable diseases are anticipated to rise from 23.8 million in 2002 (World Health Organization, 2003) to 34.8 million in 2030 (Mather & Loncar, 2006). Similarly, non-communicable diseases are the main causes of morbidity and mortality in Malaysia (Ministry of Health, 2004). The Malaysian National Health and Morbidity Survey showed that the prevalence of overweight and obesity increased from 43.1% in 2006 (Institute for Public Health, 2008) to 44.5% in 2011 (Institute for Public Health, 2011). The prevalence of diabetes and hypertension among adults aged ≥ 18 years has also increased from 11.6% and 32.2% (Institute for Public Health, 2008) to 15.2% and 32.7% in 2011 (Institute for Public Health, 2011), respectively.

Physical inactivity is pandemic and noticeably one of the top four risk factors for non-communicable diseases (World Health Organization, 2009). Approximately 3.2 million people die annually due to physical inactivity (World Health Organization, 2011). People who are inadequately physically active have a 20-30% greater risk of all causes of mortality. Regular physical activity lowers the risk of cardiovascular disease stemming from high blood pressure, as well as morbidity from high blood glucose, breast cancer and associated psychological problems. Inadequate physical activity is highest in high-income nations. However, very high levels are now seen in some middle-income nations as well as among women (World Health Organization, 2011). In Malaysia, the National Health and Morbidity Survey in 2011 (Institute for Public Health, 2011) demonstrated that 35.2% of Malaysian adults aged ≥ 18 years old were physically inactive, with the highest prevalence of physical inactivity reported in Putrajaya (57.3%). For instance, 10.2% of the burden of disease in Malaysia caused by coronary heart disease can be eradicated if all inactive Malaysians become active. The burden of disease among Malaysians due to physical inactivity was 12.6% for type 2 diabetes, 17.1% for breast cancer and 18.2% for colon cancer (Lee et al., 2012).

The advantages of engaging in regular physical activity are evident (Warburton, Katzmarzyk, Rhodes & Shephard, 2007; Warburton, Nicol & Bredin, 2006) and the majority of Malaysians are aware of the substantial physical and psychological health advantages achieved from an active lifestyle and intend to engage in physical activity (Warburton et al., 2007). However, prevalence of inactivity among Malaysians is high, as discussed

earlier. Connecting the intention to engage in physical activity with following through with the behaviour seems a suitable task for health promoters(Rhodes, Plotnikoff & Courneya, 2008).

The Transtheoretical Model was initially proposed to explain smoking behaviour change(Prochaska & DiClemente, 1983) and was later applied to the study of exercise behaviour(Marcus & Simkin, 1993). This health behaviour change model is also referred to as the Stages of Change Model,and has been frequently used to classify individuals' readiness to change and adopt an active lifestyle. The model can be categorized into five stages, with each stage requiring a different approach to meet the individuals' requirements and ultimately aims to change his behaviour(Prochaska & DiClemente, 1983).

The Stages of Change Model has been used to identify individuals' readiness for physical activity. Many studies have recommended that matching stages of change of an individual with intervention strategies can produce better outcomes(Adams & White, 2003; Bock, Marcus, Pinto & Forsyth, 2001). Interventions which apply the Transtheoretical Model have been suggested as an effective method of encouraging physical activity(Adams & White, 2003). Identifying the characteristics of individuals undergoing physical activitybehaviour change is a crucial step to understand their needs for physical activity intervention. Thus, this study was conducted to determine the relationship between demographic characteristics, lipid profiles and stages of change for regular physical activity among government employees in Putrajaya, Malaysia.

Material and method

Participants and study design

This cross-sectional study was carried out at government agencies in Putrajaya, Malaysia. A total of 675 employees from five government agencies in Putrajaya were selected using multi-stage random sampling as indicated below (Figure 1).

Fig 1. Multi- stage random sampling

A total of five geographical areas were randomly selected. Following with that, a total of five government agencies were randomly selected. A minimum sample size of 385 was obtained using the formula by Daniel(1999). A proportion of 0.5 was applied because this gave the maximum value for n(Johnson & Kubu, 2012). A total of 675 participants were recruited in the present study to cater for the possibility of non- response.

Measurement

A pre-tested self-administered questionnaire was used to collect information on demographics (age, gender, ethnicity, religion and marital status) and stages of change for regular physical activity amongst the selected individuals.

In order to measure the participants' current behavioural stage of physical activity, a self-reported stage of change measure was developed by Marcus, Rossi, Selby, Niaura and Abrams(1992). Forward and backward translation validation was carried out on the questionnaire in English language in order to obtain the questionnaires in Malay language in accordance to guideline stipulated in US Census Bureau Guideline. Further on, a pre-testing was conducted on a group of 30 government employees to identify any flaws in Malay version. Thequestionnaire consists of four statements. The answers were then converted to the five stages of change, according to the Transtheoretical Model. The five stages in this model are: (1) Pre-contemplation stage, (2) Contemplation stage, (3) Preparation stage, (4) Action stage and (5) Maintenance stage. Some studies characterize Preparation stage as engaging in physical activity but not on a regular basis, while others define as the intention to engage in physical activity within the next 30 days(Dumith, Gigante & Domingues, 2007). In the present study, the authors chose the first definition.

All enumerators were received training before they begin actual work in the field. Anthropometric measurements were taken, following a standardised procedure (World Health Organization, 1997). Body weight (to the nearest 0.1 kg) was measured using a Tanita body composition analyser model 418 (Tanita Co., Tokyo, Japan) with participants standing without shoes in the minimum clothing possible while height (to the nearest 0.1 cm) was measured using a Seca wall stadiometer model 222 (Seca, Hamburg, Germany). Participants were keeping their shoulders in a relaxed position, their arms hanging freely and with their head aligned in Frankfort plane. Body Mass Index (BMI) was calculated using the formula: weight in kilograms divided by height in meters squared, categorized according to World Health Organization (2000) cut-off points. Waist Circumference (WC) was measured at the end of normal expiration between the lowest rib and the iliac crest using an inelastic measuring tape to the nearest 0.1 cm and was then classified based on WHO standards (World Health Organization, 1998). Abdominal obesity was defined as WC ≥ 90 cm for men and ≥ 80 cm for women (WHO/IASO/IOTF, 2000). Hip Circumference (HC) was taken at the maximal protrusion of buttocks with the feet together. The measurements of the waist and hip circumferences were used to calculate the Waist-to-Hip Ratio (WHR) and classified based on WHO standards (World Health Organization, 1998), for which ≥ 0.90 in men and ≥ 0.85 in women indicates being at risk of non-communicable diseases.

Venous fasting blood (five ml) was obtained from participants for total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides tests. Participants were requested to fast the night before blood was drawn. Participant's identification and date of blood collection was noted on the test tubes. The blood-collecting procedure was performed using aseptic technique via a syringe with a 21G needle and was filled into a yellow cap-test tube. All vials were delivered in a cool box packed with dry ice to an accredited pathology laboratory (Gribbles Pathology (M) Sdn Bhd, Bangi, Malaysia) after collection of samples. Total cholesterol, HDL cholesterol and triglycerides were determined by standardized automated enzymatic methods using the automated Beckman Coulter AU480 (Beckman Coulter Inc., Fullerton, CA, USA), and LDL cholesterol was calculated by the Friedewald formula (Friedewald, Levy & Frederickson, 1972).

Levels of LDL cholesterol were not calculated if triglycerides were higher than 4.5 mmol/L. The concentration of total cholesterol was measured using system cholesterol reagent with cholesterol oxidase/peroxidase. HDL cholesterol was isolated by elimination with a direct HDL cholesterol reagent. Triglycerides were measured using a triglycerides reagent with lipase, glycerol kinase and GPO-PAP. The classifications were based on the latest available definition, in which triglycerides and HDL cholesterol were classified based on Alberti et al. (2009) while total cholesterol and LDL cholesterol were classified based on National Cholesterol Education Program (2002).

Procedures

This study was approved by the Medical Research Ethics Committee of Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Permission to conduct this study was also obtained from the respective director of Human Resource Department of the government agencies. Prior to data collection, signed informed consent was obtained from all participants.

Statistical analysis

The SPSS version 20.0 software was used for data analysis. Descriptive data were presented in frequency, mean and standard deviation. The chi-square test was used for association between stages of change and demographic factors while a general linear model for Analysis of Covariance (ANCOVA) accounted for differences in BMI, WC, WHR, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides by stages of change for regular physical activity with age, gender and waist circumference as covariates. A significance level was set at 0.05.

Results

A total of 675 employees from five government agencies in Putrajaya were selected using multi-stage random sampling and, of these, 659 consented to participate, giving a response rate of 97.6%.

The majority of the participants were women (76.6%) and fell in the age range from 20 to less than 50 years (88.9%) (Table 1). Most of the participants were Malays (90.1%), and 92.6% of the participants were Muslims. More than two-thirds of the participants were married.

The mean BMI for men (27.30 ± 4.81 kg/m²) was higher than that of women (26.15 ± 5.38 kg/m²). More men (70.1%) were overweight and obese than women (52.9%). The mean WC for men and women were 94.72 ± 9.79 cm and 87.16 ± 10.34 cm respectively, with 78.9% of the participants abdominally obese based on their WC (men ≥ 90 cm; women ≥ 80 cm). Almost half of the participants (49.0%) had increased risk of non-communicable diseases based on their WHR (men ≥ 0.90 ; women ≥ 0.85).

Almost equal numbers of participants had normal and elevated total cholesterol level, with more men (65.6%) than women (45.3%) showing elevated total cholesterol levels. The majority of men and women had normal HDL cholesterol levels (68.2% of men with HDL cholesterol ≥ 1.00 mmol/L; 53.3% of women with HDL cholesterol ≥ 1.30 mmol/L). More than half of the participants had normal LDL cholesterol and triglycerides

levels, but men (mean LDL cholesterol: 3.56 ± 0.88 mmol/L; mean triglycerides: 2.08 ± 1.28 mmol/L) had higher mean LDL cholesterol and triglycerides level than women (mean LDL cholesterol: 3.19 ± 0.81 mmol/L; mean triglycerides: 1.30 ± 0.81 mmol/L).

By looking at the stages of change for regular physical activity criteria (Table 1), a small percentage (10.2%) of the participants fell in the Pre-contemplation stage; 46.4% were contemplating starting to exercise and be physically active, while 25.8% of the participants were in the Preparation stage. Only 3.0% were active as they fell in the Action stage and a total of 14.6% were in the Maintenance stage.

For further analysis, stages of change were collapsed into three groups: Pre-contemplation/Contemplation, Preparation/Action and Maintenance. More than half of the participants (56.6%) were in Pre-contemplation/Contemplation stages. More women (59.6%) than men (46.8%) were in the Pre-contemplation/Contemplation stage (Table 2). There was no significant association between stages of change and demographic factors, except gender.

Table 3 presents the differences in nutritional status across stages of change, adjusting for covariates. The adjusted mean BMI for the Pre-contemplation/Contemplation group (27.12 ± 0.27 kg/m²) was significantly higher than that of the Preparation/Action group (25.92 ± 0.37 kg/m²) and Maintenance group (24.71 ± 0.52 kg/m²) [$F = 9.60$; $p < 0.001$]. In addition, there was a statistically significant difference in adjusted mean WC [$F = 11.49$; $p < 0.001$] between Pre-contemplation/Contemplation with the Maintenance group and the Preparation/Action group with the Maintenance group. The adjusted mean WHR between Pre-contemplation/Contemplation with Maintenance and Preparation/Action with Maintenance groups were significantly different [$F = 8.01$; $p < 0.001$]. There were no significant differences in the total cholesterol and LDL cholesterol observed in all groups. However, there was a statistically significant difference in adjusted mean HDL cholesterol [$F = 11.66$, $p < 0.001$] in which the highest value was observed in Maintenance group. In contrast, the adjusted mean triglycerides level differs significantly [$F = 6.88$; $p < 0.001$], with the lowest value observed in the Maintenance group.

Table 1. Demographic characteristics, anthropometric status, lipid profiles and stages of change for regular physical activity of the participants (n= 659)

Variables	Men (n= 154)	Women (n= 505)	Total (n= 659)
	-----n (%)-----		
Age (years)			
Mean±SD	34.97±8.35	34.34±8.94	34.49±8.80
20-<30	47 (30.5)	192 (38.0)	239 (36.3)
30-<40	73 (47.4)	207 (41.0)	280 (42.5)
40-<50	20 (13.0)	50 (9.9)	70 (10.6)
≥50	14 (9.1)	56 (11.1)	70 (10.6)
Ethnicity			
Malay	132 (85.7)	462 (91.5)	594 (90.1)
Chinese	5 (3.2)	12 (2.4)	17 (2.6)
Indian	7 (4.5)	15 (3.0)	22 (3.3)
Other Bumiputra	9 (5.8)	9 (1.8)	18 (2.7)
Other Ethnic	1 (0.6)	7 (1.4)	8 (1.2)
Religion			
Islam	138 (89.6)	472 (93.5)	610 (92.6)
Buddhism	3 (1.9)	8 (1.6)	11 (1.7)
Hinduism	7 (4.5)	13 (2.6)	20 (3.0)
Christian	6 (3.9)	11 (2.2)	17 (2.6)
Taoism	0 (0.0)	1 (0.2)	1 (0.2)
Marital status			
Single	39 (25.3)	155 (30.7)	194 (29.4)
Married	113 (73.4)	344 (68.1)	457 (69.3)
Divorced	1 (0.6)	4 (0.8)	5 (0.8)
Widow/ Widower	1 (0.6)	2 (0.4)	3 (0.5)
Body mass index (kg/m²)			
Mean±SD	27.30±4.81	26.15±5.38	26.42±5.27
Underweight (<18.50)	3 (1.9)	14 (2.8)	17 (2.6)
Normal weight (18.50-24.99)	43 (27.9)	224 (44.4)	267 (40.5)
Overweight/ Obesity (≥25.00)	108 (70.1)	267 (52.9)	375 (56.9)
Waist circumference (cm)			
Mean±SD	94.72±9.79	87.16±10.34	88.92±10.70
Low risk (M<90; F<80)	37 (24.0)	102 (20.2)	139 (21.1)
Increased risk (M≥90; F≥80)	117 (76.0)	403 (79.8)	520 (78.9)

Waist-to-hip ratio			
Mean±SD	0.90±0.05	0.85±0.06	0.86±0.06
Low risk (M<0.90; F<0.85)	80 (51.9)	256 (48.3)	336 (51.0)
Increased risk (M≥0.90; F≥0.85)	74 (48.1)	249 (51.7)	323 (49.0)
Total cholesterol (mmol/L)			
Mean±SD	5.55±0.98	5.14±0.92	5.24±0.95
Normal (<5.18)	53 (34.4)	276 (54.7)	329 (49.9)
Elevated (≥5.18)	101 (65.6)	229 (45.3)	330 (50.1)
HDL- cholesterol (mmol/L)			
Mean±SD	1.11±0.22	1.37±0.30	1.31±0.30
Low (M<1.00; F<1.30)	49 (31.8)	236 (46.7)	285 (43.2)
LDL- cholesterol (mmol/L) (n=644)^a	105 (68.2)	269 (53.3)	374 (56.8)
Mean±SD	3.56±0.88	3.19±0.81	3.27±0.84
Normal (<3.36)	63 (43.8)	315 (63.0)	378 (58.7)
Elevated (≥3.36)	81 (56.2)	185 (37.0)	266 (41.3)
Triglycerides (mmol/L)			
Mean±SD	2.08±1.28	1.30±0.81	1.48±0.99
Normal (<1.70)	69 (44.8)	391 (77.4)	460 (69.8)
Elevated (≥1.70)	85 (55.2)	114 (22.6)	199 (30.2)
Stages of change			
Pre- contemplation	13 (8.4)	54 (10.7)	67 (10.2)
Contemplation	59 (38.3)	247 (48.9)	306 (46.4)
Preparation	50 (32.5)	120 (23.8)	170 (25.8)
Action	5 (3.2)	15 (3.0)	20 (3.0)
Maintenance	27 (17.5)	69 (13.7)	96 (14.6)

M= Male; F= Female

^a LDL- cholesterol results are invalid when triglycerides are >4.5 mmol/L

Table 2.: Demographic factors by stages of change for physical activity of the participants

Stages of change	Pre-contemplation/ Contemplation (n= 373)	Preparation/ Action (n= 190)	Maintenance (n= 96)	X ²	P
Gender				7.958	0.019
Men	72 (46.8)	55 (35.7)	27 (17.5)		
Women	301 (59.6)	135 (26.7)	69 (13.7)		
Age (years)				0.851	0.653
Mean±SD	34.99±9.04	34.13±8.37	33.24±8.63		
≤40	292 (56.3)	148 (28.5)	79 (15.2)		
>40	81 (57.9)	42 (30.0)	17 (12.1)		
Ethnicity				4.280	0.118
Malay	334 (56.2)	168 (28.3)	92 (15.5)		
Non- malay	39 (60.0)	22 (33.8)	4 (6.2)		
Religion				3.060	0.217
Islam	343 (56.2)	174 (28.5)	93 (15.2)		
Non- Islam	30 (61.2)	16 (32.7)	3 (6.1)		
Marital status				0.547	0.761
Single/ Divorced/ Widow/ Widower	110 (54.5)	61 (30.2)	31 (15.3)		
Married	263 (57.5)	129 (28.2)	65 (14.2)		

Table 3. Anthropometric status and lipid profile by stages of change for physical activity of the participants (n=659)

Stages of change	Pre-contemplation/ Contemplation (n= 373)	Preparation/ Action (n= 190)	Maintenance (n= 96)	F-value
	-----Mean±SE-----			
Body mass index (kg/m ²) ^a	27.12±0.27	25.92±0.37	24.71±0.52	9.60 ^{*x, **y}
Waist circumference (cm) ^a				11.49 ^{*xy, *z}
Male	96.98±1.10	94.62±1.26	88.91±1.80	
Female	88.26±0.58	86.36±0.87	83.90±1.21	
Waist-to-hip ratio ^a				8.01 ^{*y, *z}
Male	0.91±0.01	0.89±0.01	0.88±0.01	
Female	0.86±0.00	0.85±0.01	0.83±0.01	
Total cholesterol (mmol/L) ^{a, b}	5.22±0.05	5.21±0.07	5.33±0.09	0.64
HDL-cholesterol (mmol/L) ^{a, b}				11.66 ^{**y, **z}

Male	1.08±0.02	1.09±0.03	1.25±0.04	
Female	1.35±0.02	1.36±0.02	1.48±0.03	
LDL-cholesterol (mmol/L)(n= 644) ^{a, b}	3.24±0.04	3.27±0.06	3.37±0.08	0.90
Triglycerides (mmol/L) ^{a, b}	1.55±0.05	1.51±0.07	1.17±0.09	6.88 ^{**y, **z}

Mean ± SE= Mean ± Standard Error; ^a Adjusted for age and gender; ^b Adjusted for waist circumference

* p<0.05, **p<0.001, Bonferroni post- hoc test for: ^x= Pre- contemplation/Contemplation vs Preparation/Action;

^y= Pre- contemplation/ Contemplation vs Maintenance; ^z= Preparation/ Action vs Maintenance

Discussions

We found that a high proportion of adults in the present study were overweight/obese (56.9%), specifically men rather than women. The higher proportion of overweight and obesity among men in the present study (70.1%), as compared to women (52.9%), is similar with the findings reported by Norimah and Haja Mohaideen (2003), which involved school and university communities. On the other hand, some other studies showed contradicting results (Hejar, Shaza Wahieda, Junainah, Zaiton & Long, 2003; Khor & Zalilah, 2003; Mohd Yunus, Sherina, Nor Afiah, Rampal & Tiew, 2004; Narayan & Abdul Rashid, 2007). The present study may not be directly comparable to those studies since the present study involved government employees in particular, whereas those studies involved rural villagers or health clinic patients. Other studies have revealed that women are more conscious of their health and more responsive to health and nutrition issues and information than men (Kristal, Hedderson, Patterson & Neuhauser, 2001; Laforge, Veliver, Richmond & Owen, 1999; Lopez-Azpiazu et al., 2000; Nothwehr, Snetselaar, Yang & Wu, 2006). Furthermore, the proportion of overweight/obese adults in the study (56.9%) was comparable to that of the overall proportion of overweight/obese adults in National Health and Morbidity Survey 2011 (44.5%) (Institute for Public Health, 2011), especially in the area of Putrajaya (47.5%), which was the location of the present study.

We also found that a high proportion of adults in the present study were hypercholesterolemic (50.1%), specifically men. This study reported a lower percentage of individuals with hypercholesterolemia as compared to a study conducted by Wong, Zalilah and Yap (2009), and a higher percentage of individuals with low HDL cholesterol as compared to studies conducted by Wong, Zalilah and Yap (2009) as well as Moy, Atiya and Wong (2008), which involved non-academic employees in a university. The proportion of adults with hypercholesterolemia in the present study (50.1%) was comparable to that reported in National Health and Morbidity Survey 2011 (35.1%) (Institute for Public Health, 2011). A higher proportion of Malays (38.4%) had been reported to have hypercholesterolemia in the National Health and Morbidity Survey 2011, which was the major ethnic group in the present study.

The high proportion of overweight/obese and hypercholesterolemic adults reported in the present study, specifically men, could be due to many reasons, including consumption of high energy density diets, types of fat consumed or low fruit and vegetable intakes. However, data on dietary intakes was not obtained in the present study. According to the National Health and Morbidity Survey 2011 (Institute for Public Health, 2011), the proportion of fruit consumption was significantly lower among men (14.5%) than women (16.6%). Meanwhile, there was no significant difference in vegetable intake between men and women at 13.8% and 13.5%, respectively. In addition, the proportion of adults having three cups or more of drinks with added sweetened condensed milk/cream was significantly higher in men (18.3%) than in women (9.0%).

The highest proportion of participants (46.4%) in the present study was in the Contemplation stage, which was almost similar with the findings of 40.3% and 39% contemplators in the study by Arango, Patino, Quintero and Arenas (2011) among urban populations from municipalities in the United States and found by Nishida, Suzuki, Wang and Kira (2003) among female employees in Japan. However, other studies reported that the majority of participants were in Pre-contemplation (Dumith, Gigante & Domingues, 2007; Park et al., 2008) or Action stages (Ronda, Assema & Brug, 2001). The differences in these findings could be due to the different staging algorithms applied to classify participants into stages, as there is no standard algorithm available, which causes the comparison of the findings to sometimes be difficult. Assessment formats, concept of the stages and definition of physical activity significantly varies between studies. The most divergent concept is related to the preparation stage.

A total of 17.6% of the participants were active regularly (Action and Maintenance groups), based on their stages of change. This is rather low when compared to 44.9% based on physical activity level in a cross-sectional study conducted in Perlis, Malaysia (Zahratul, Hazizi, Mohd Nasir, Zaitun & Tabata, 2012), as well as 42.7% based on National Health and Morbidity Survey 2011 (Institute for Public Health, 2011), specifically in Putrajaya area. The lower prevalence of active participants in the present study may be due to differences in the assessment method. Physical activity in Zahratul's study was assessed by objective measures using an accelerometer while a short International Physical Activity Questionnaire with four generic items was employed in the National Health and Morbidity Survey 2011. In the present study, physical activity was determined

through the stages of change questionnaire. Further investigation using objective measure is warranted to ascertain the physical activity level among government employees in Putrajaya, Malaysia.

Significant association was observed between stages of change and gender, whereby higher proportions of females were in early stages of change (Pre-contemplation and Contemplation). Similarly, Garber, Allsworth, Marcus, Hesser and Lapene (2008) demonstrated that men were less likely, than women, to be in the Pre-contemplation stage compared with the Maintenance stage. This result is consistent with the global survey by Hallal and colleagues (2012), which showed that 33.9% of women in 122 countries are inactive, as opposed to 27.9% of men. Perhaps the roles of women in completing household tasks (Arango et al., 2011), which leads to less free time (Heesch & Masse, 2004), hinders them in participating in physical activity.

Although we did not find any significant association between stages of change and other demographic factors, which might be due to the homogeneous sample of government employees, several studies found that race and ethnicity were strong predictors of some stages of change (Bull, Eyler, King & Brownson, 2001; Garber et al., 2008). The correlation between marital status and the stages of change for regular physical activity has been shown in other studies, indicating that the prevalence of the Pre-contemplation stage is higher for those individuals with a partner, while the prevalence of individuals in the Maintenance stage is higher for those without a partner (Kearney, de Graaf, Damkjaer & Engstrom, 1999). Dumith and colleagues (2007) also revealed similar findings with the present study. In their findings, marital status was not associated with the stages of change. The association between age and the stages of change for regular physical activity tends to be divergent. Most studies found that the proportion of older adults is higher in the Pre-contemplation stage (Dumith et al., 2007).

Participants in the early stage (Pre-contemplation/Contemplation) had significantly higher mean BMI than those in the later stages (Preparation/Action and Maintenance). In addition, participants in the Maintenance group had significantly lower WC and WHR compared to participants in other groups. This finding was supported by several studies, which found that participants who had lower BMI were more likely to be in the Maintenance group for physical activity and less likely to be in Contemplation or Preparation stages as compared with participants who had higher BMI (Arango et al., 2011; Boutelle, Jeffrey & French, 2004; Garber et al., 2008). These findings could imply that extremes of weight are associated with the motivation and desire to engage in physical activity and changes in the behaviour towards physical activity (Centers for Disease Control and Prevention, 2004).

In the present study, HDL cholesterol and triglycerides differ significantly among stages of change groups. The participants in later stages had better mean HDL cholesterol and triglycerides compared to those at earlier stages. This could be because participants in later stages are more physically active, as several studies have shown that an active lifestyle has a beneficial effect on HDL cholesterol and triglycerides, and only a little effect on total cholesterol and LDL cholesterol (Bernstein et al., 2002; Kraus et al., 2002).

The present study had several limitations. Detailed investigations into the dietary habits and physical activity in this population are required for better analysis. Misclassification of individuals into stages might occur since no standard staging algorithm is available (Dumith et al., 2007). Although stages of change algorithms have been shown to be useful tools for classifying individuals' readiness to change, there is a lack of strong supportive evidence on the physical activity application of Stages of Change Model in nutrition and health promotion. There is emerging evidence that physical activity behaviour is not a single behaviour. Marttila, Laitakari, Nupponen, Miilunpalo and Paronen (1998) identified five different categories of physical activity: occupational, lifestyle, commuting, fitness and sports activities. Stages for physical activity should be evaluated depending on the specific activity being considered (Adams & White, 2005). Nevertheless, it should be stressed that the present study is more inclined towards investigating the readiness to change for physical activity regardless of the type of physical activity. Detailed information regarding physical activity, including the types of physical activity, can be obtained using the long International Physical Activity Questionnaire (Craig et al., 2003) or the Global Physical Activity Questionnaire (Armstrong & Bull, 2006). The lack of significant association between stages of change and demographic factors could be as a result of lack of heterogeneity of the sample due to the study location. Putrajaya's ethnic population comprises around 96.8% Malays, 0.7% Chinese, 1.2% Indians, 1.2% other Bumiputra and 0.1% of other ethnic origins (Department of Statistics, 2010). The similar ethnic distribution of the present study participants indicated that the findings from the present study were representative to the population in Putrajaya. Finally, the cross-sectional design of the present study did not infer to the cause and effect between stages of change and lipid profile. Hence, a future longitudinal study design is warranted for further understanding.

The high proportion of contemplators in the present study is worrying and emphasises an ongoing need to strengthen physical activity promotion in Malaysia, particularly among government employees in Putrajaya. In order to maximize the prevalence of regularly active individuals (Action/Maintenance stage), both government and non-government agencies should work collectively in a concerted effort to further promote an active lifestyle among the Malaysian population, particularly among the government employees in Putrajaya.

Conclusions

In conclusion, the study revealed that a high proportion of participants were in the Contemplation stage for regular physical activity. Gender may play a vital role towards the intention to engage in a regular physical activity. Furthermore, anthropometric and some lipid parameters (HDL cholesterol and triglycerides) differ significantly among stages of change groups.

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