Sains Malaysiana 43(8)(2014): 1165–1174

Metabolic Risk Factors among Government Employees in Putrajaya, Malaysia

(Faktor Risiko Metabolik dalam Kalangan Kakitangan Kerajaan di Putrajaya, Malaysia)

CHEE, H.P., HAZIZI, A.S.*, BARAKATUN NISAK, M.Y. & MOHD NASIR, M.T.

ABSTRACT

*This study aimed to assess the metabolic risk factors among government employees in Putrajaya, Malaysia. Government employees (*n*=675) were recruited from five government agencies in Putrajaya using a multi-stage random sampling method. Data on sociodemographic characteristics, stages of change for physical activity, anthropometric and biochemical and clinical examinations were collected. A total of 154 (23.4%) men and 505 (76.6%) women with the mean age of 34.49±8.80 years participated in this study. The number of government employees that met the metabolic syndrome criteria based on a 'Harmonized' definition (48.9%) was higher than that in the general Malaysian population. High blood pressure was higher in men (56.5%) compared to women (39.8%). The male participants had a significantly higher mean ± standard deviation in all the metabolic risk factors except HDL-cholesterol, compared to a significance level of 0.05 in the female participants. A high proportion of government employees (84.5%) had at least one metabolic risk factor. Men were 54% more likely to have metabolic syndrome than women based on 'Harmonized' definition. Participants in the pre- contemplation stage for physical activity were approximately 17 times more likely to have metabolic syndrome compared to participants in the maintenance stage according to 'Harmonized' definition. In general, this study suggested that a high proportion of government employees (84.5%) had at least one metabolic risk factor. There is a pressing need to commence intervention programs in the workplace to identify and manage government employees at high risk for cardiovascular disease and diabetes.*

Keywords: Government employees; metabolic risk factors; workplace

ABSTRAK

*Kajian ini bertujuan untuk menilai faktor risiko metabolik dalam kalangan kakitangan kerajaan di Putrajaya, Malaysia. Kakitangan kerajaan (*n*=675) daripada lima agensi kerajaan di Putrajaya telah dipilih dengan menggunakan kaedah persampelan rawak berperingkat. Pengumpulan data melibatkan data sosio demografi, peringkat perubahan terhadap aktiviti fizikal, pengukuran data antropometri, biokimia dan pemeriksaan klinikal. Seramai 154 (23.4%) lelaki dan 505 (76.6%) wanita telah mengambil bahagian dalam kajian ini dengan min umur 34.49±8.80 tahun. Prevalens bagi kakitangan kerajaan yang memenuhi kriteria sindrom metabolik (48.9%) dalam kajian ini berdasarkan definisi 'Harmonized' adalah lebih tinggi berbanding penduduk Malaysia secara keseluruhan. Tekanan darah tinggi adalah lebih tinggi dalam kalangan lelaki (56.5%) berbanding dengan wanita (39.8%). Lelaki mempunyai lebih tinggi min ± sisihan piawai bagi semua faktor risiko metabolik kecuali kolesterol HDL berbanding dengan wanita pada tahap kesignifikanan 0.05. Sebahagian besar daripada kakitangan kerajaan (84.5%) mempunyai sekurang-kurangnya satu faktor risiko metabolik. Lelaki adalah 54% lebih cenderung untuk mempunyai sindrom metabolik berbanding dengan wanita berdasarkan definisi 'Harmonized'. Peserta dalam peringkat pra- pertimbangan untuk aktiviti fizikal adalah kira- kira 17 kali ganda lebih cenderung untuk mempunyai sindrom metabolik berbanding dengan peserta di peringkat berterusan mengikut definisi 'Harmonized'. Secara umumnya, kajian ini mencadangkan bahawa sebahagian besar daripada kakitangan kerajaan (84.5%) mempunyai sekurang-kurangnya satu faktor risiko metabolik. Terdapat keperluan yang mendesak untuk memulakan program intervensi di tempat kerja untuk mengenal pasti serta menguruskan kakitangan kerajaan yang berisiko tinggi untuk penyakit kardiovaskular dan diabetes pada masa akan datang.*

Kata kunci: Faktor risiko metabolik; kakitangan kerajaan; tempat kerja

INTRODUCTION

The workplace environment has gradually become the focus for interventions aimed at the reduction of risk for chronic diseases. Because the majority of adults are employed (Department of Statistics 2013), spend a substantial amount of their time at work, interventions in the workplace can be successful approach to affecting risk factors for chronic diseases in the total population (Freak-Poli et al. 2010). Although it is generally believed that employed adults are healthier than the general population (Li & Sung 1999), it has been recently reported that occupations have progressively become more sedentary (Freak-Poli et al. 2010; Puig-Ribera et al. 2008; WHO 2009). The National Health and Morbidity Survey 2011 (Institute

for Public Health 2011) found that 35.2% of adults aged 18 years or more in Malaysia were not active physically and the highest prevalence of physical inactivity was in Putrajaya (57.3%). In addition, the National Strategic Plan for Non-communicable Diseases (Ministry of Health 2010) aimed to strengthen workplace-based health programs. In spite of these efforts, a barrier to determine the effectiveness of workplace interventions is the lack of data on the prevalence of metabolic risk factors among government employee populations.

Metabolic syndrome is defined as the presence of numerous risk factors that include abdominal obesity, atherogenic dyslipidemia, raised blood pressure and plasma glucose (Gami et al. 2007; Grundy 2007). In 1988, the World Health Organization (Alberti & Zimmet 1998) characterized metabolic syndrome as insulin resistance and two additional risk factors as mandatory in diagnosis. Later, the National Cholesterol Education Program Expert Panel III (NCEP ATP III) (NCEP 2002) and the International Diabetes Federation (IDF) (Alberti et al. 2005) extended the WHO definition. The NCEP ATP III definition is based on the existence of any three of five risk factors, whereas IDF regards abdominal obesity as an obligatory feature of metabolic syndrome with specific cut-off points for waist circumference applied to specific populations. Recently, the IDF Task Force on Epidemiology and Prevention, the National Heart, Lung and Blood Institute, the American Heart Association, the World Heart Federation and the International Association for the Study of Obesity made a joint interim statement in order to standardize the criteria for diagnosing metabolic syndrome. According to the 'Harmonized' definition, abdominal obesity should no longer be the requisite component of metabolic syndrome. Instead, the 'Harmonized' definition is based wholly on the existence of any three of five risk factors (Alberti et al. 2009) with specific cut-off points for waist circumference applied to specific populations, as formerly proposed in the IDF definition. A summary of the definitions of metabolic syndrome is shown in Table 1.

The overall prevalence of metabolic syndrome is approximately 25% in general populations in the United States and Europe (Alegria et al. 2005; Dallongeville et al. 2005; Salsberry et al. 2007). In a national survey conducted among the general Malaysian population (Wan Nazaimoon et al. 2011), 40.2% of men and 43.7% of women were reported with metabolic syndrome. However, the prevalence of metabolic syndrome among government employees in Malaysia, specifically in Putrajaya, is not sufficiently known. A total of 109 adults in Federal Territory and Selangor aged ≥30 years reported a prevalence of 22.9 and 16.5% by IDF and NCEP ATP III definitions, respectively (Tan et al. 2008). Another national survey conducted from January to December 2008 reported that the overall prevalence of metabolic syndrome was 32.1, 34.3, 37.1 and 42.5%, based on WHO, NCEP ATP III, IDF and 'Harmonized' definitions, respectively (Wan Nazaimoon et al. 2011).

The prevalence of cardiovascular disease has increased rapidly in Asian countries because of westernised lifestyles, which characterized by the over consumption of calories and physical inactivity (Nestel et al. 2007; Rakugi & Ogihara 2005). In Malaysia, cardiovascular disease is the first leading cause of mortality in Malaysia (Ministry of Health 2011, 2006). The factors associated with increased risk of cardiovascular disease tend to cluster in metabolic syndrome. It has been shown that metabolic syndrome is associated with cardiovascular disease (Johnson & Weinstock 2006). Furthermore, it has been shown that individuals with metabolic syndrome are at higher risk of cardiovascular disease as well as Type 2 diabetes compared with those without metabolic syndrome, regardless of the definition used in the diagnosis (Sundstrom et al. 2006; Wilson et al. 2005).

The prevalence of metabolic syndrome varies, depending on the definition used and on ethnicity (Khunti & Davies 2005). However, there is a scarcity of research about metabolic syndrome prevalence and metabolic risk factors among employees (Davila et al. 2010; Lin et al. 2009; Nair 2010; Sanchez-Chaparro et al. 2008). The prevalence of metabolic syndrome among Malaysian employees is unknown. Recognising the significance of this data, we conducted a cross-sectional study among government employees to assess the prevalence of metabolic risk factors and to help bridge the gap. Here, we report the metabolic syndrome and related risk factors among government employees in Putrajaya, the Federal Government Administrative Centre of Malaysia.

Materials and Methods

Participants and Study Design

A minimum sample size (n=385) was attained using the formula by Daniel (1999). The maximum value for n was obtained by utilizing the proportion of 0.5 (Johnson & Kuby 2008). The present cross-sectional study was conducted at government agencies in Putrajaya, Malaysia through multi-stage random sampling. Five parcels or precincts were selected randomly and one government agency was selected randomly from each of the five parcels or precincts. A total of 675 government employees were randomly selected using the Table of Random Numbers from a list of 3173 government employees coming from those five government agencies.

Procedures

Approval for this study was obtained from the Medical Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Permission to carry out this study was also provided by the respective directors of the Human Resource Department of the government agencies. Participants were employees who willingly agreed to participate in the study. Signed informed consent was obtained from all participants prior

to data collection. The flow chart for the data collection is shown in Figure 1.

MEASUREMENT

A self-administered questionnaire, which has been pre-tested, was employed to collect socio-demographic data, including sex, ethnicity, education level, grade of position, marital status and age. To measure the participants' current behavioural stage of physical activity, a self-reported stage of change measure developed by Marcus et al. (1992) was used.

All enumerators received training before they begin the actual work in the field. Anthropometric measurements were collected according to standardized procedure (WHO 1997). Waist circumference (WC) was assessed between the lowest rib and the iliac crest at the end of normal expiration by a non-elastic measuring tape to the nearest 0.1 cm. Where suitable, the waist circumference cut-off points for abdominal obesity among South Asians (≥90 cm and ≥80 cm for men and women, respectively) were used in the analysis (WHO/IASO/IOTF 2000).

Duplicate measurements of blood pressure (mmHg) were measured 2 min apart with a digital automated blood pressure monitor (Omron HEM-907 model, Omron, Japan) after the participants had rested in a seated position for 5 min. An average of the two readings was taken (Murphy et al. 2006). The right arm was placed on a table and a cuff was placed on the right upper arm. The mean values of the two measurements were computed. Elevated blood pressure was defined as either elevated systolic blood pressure (≥130 mmHg) or diastolic blood pressure (≥85 mmHg) or a combination of both (Alberti et al. 2009).

Venous fasting blood (5 mL) was obtained from each participant. Three mL blood was placed into a test tube (yellow cap) for HDL-cholesterol and triglycerides tests. Another 2 mL blood was loaded into a grey cap-test tube with fluoride oxalate for blood glucose measurement. Participants were asked to fast the night before the blood was collected. Each participant's identification and date of blood drawn were written on the test tubes. The blood-taking procedure was carried out using an aseptic technique with a 21 G needle and syringe. All vials were sent to the laboratory in a cool box with dry ice after all blood samples were collected. Triglycerides, HDL-cholesterol and glucose were analysed by automated Beckman Coulter AU480 with the system reagent kit (Beckman Coulter Inc., Fullerton, CA, USA). Triglycerides were analysed using triglycerides reagent with lipase, glycerol kinase and GPO-PAP. Elimination with direct HDL-cholesterol reagent was carried out to isolate HDL-cholesterol. Plasma glucose was analysed using a glucose hexokinase method with glucose hexokinase II reagent. All blood-taking procedures were carried out after the blood pressure measurement. The lipid and fasting glucose parameters were measured in mmol/L (Ministry of Health 2006a). The cut off used to define metabolic syndrome is described in Table 1.

STATISTICAL ANALYSIS

Data analysis was performed using the SPSS version 20.0 software. Categorical variables were presented as frequency and percentages and quantitative variables were presented as mean ± standard deviation where appropriate. Student's *t*- test was used to compare the risk factors between sexes. The odds ratio of metabolic syndrome was calculated using logistic regression analysis.

RESULTS

Government employees (*n*=675) from five government agencies in Putrajaya were randomly selected via multi-stage random sampling. A total of 659 employees agreed to participate, which was a response rate of 97.6%.

The prevalence of metabolic syndrome was generally higher in men (57.1%) than in women (46.3%) (Table 2).

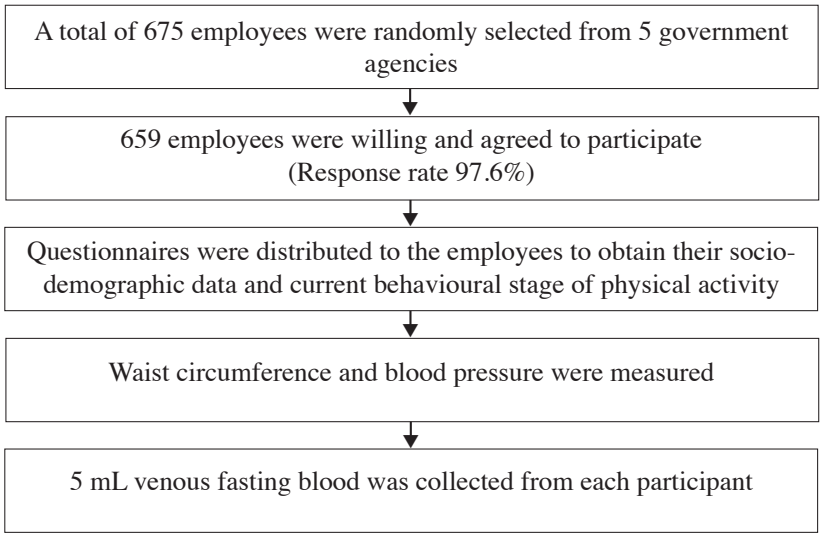

FIGURE 1. Flow chart of data collection

TABLE 1. Definitions of metabolic syndrome

Clinical measure	Metabolic syndrome	Waist circumference	Triglycerides	HDL- cholesterol	Blood pressure	Glucose
NCEP ATP III (NCEP 2002)	None, but any three of the five risk factors	WC ≥102 cm in men or ≥88 cm in women	≥1.7 mmol/ L	<1.03 mmol/ L in men or <1.29 mmol/ L in women	≥130/ 85 mmHg	≥6.1 mmol/ L or diabetes
IDF (Alberti et al. 2005)	Increased waist circumference plus any two of the risk factors	Increased waist circumference (population specific)	≥1.7 mmol/ L or on triglycerides treatment	<1.03 mmol/ L in men or <1.29 mmol/ L in women or on HDL- cholesterol treatment	≥130/ 85 mmHg or on hypertension treatment	≥5.6 mmol/ L or diabetes
'Harmonized' (2009) (Alberti et al. 2009)	None, but any three of the five risk factors	Increased waist circumference (population specific)	≥1.7 mmol/ L on triglycerides treatment	<1.0 mmol/ L in men or <1.3 mmol/ L in women or on HDL- cholesterol treatment	≥130/ 85 mmHg or on hypertension treatment	≥5.6mmol/ L or diabetes

The prevalence of metabolic syndrome among government employees using the NCEP ATP III, IDF and 'Harmonized' definitions were 27.9, 46.3 and 48.9%, respectively (Table 3). The highest prevalence was obtained when the 'Harmonized' definition was applied, in which the diagnosis was based on the presence of any three of five risk factors, in contrast to the IDF definition, which specifies abdominal obesity as a prerequisite component. Conversely, the lowest prevalence rate was obtained when the NCEP ATP III definition was used. This was because of higher cut-off points for waist circumference (≥102 and ≥88 cm for men and women, respectively) and fasting glucose (≥6.1 mmol/L) (NCEP 2002).

As shown in Table 3, according to all three definitions of metabolic syndrome, more than 40.0% of the government employees had low HDL- cholesterol. Elevated plasma glucose was the least common component according to these definitions (9.4, 15.9 and 15.9%, respectively). Abdominal obesity, as defined by NCEP ATP III, IDF and the 'Harmonized' criteria, demonstrated the highest prevalence at 36.4%, 78.9% and 78.9%, respectively. Based on the three definitions, high blood pressure was observed in 43.7% of the participants. The results showed that 30.2% of the government employees had a high level of triglycerides according to the NCEP ATP III, IDF and 'Harmonized' definitions.

TABLE 2. Prevalence of metabolic syndrome based on the 'Harmonized' definition by sex

	Figure 1. Flow chart of data collection		Women (*n*= 505)		Total (*n*= 659)	
Metabolic syndrome	Yes	No	Yes	No	Yes	No
	88(57.1)	66(42.9)	234(46.3)	271(53.7)	322(48.9)	337(51.1)
Ethnic group						
Malay	75(56.8)	57(43.2)	213(46.1)	249(53.9)	288(48.5)	306(51.5)
Chinese	3(60.0)	2(40.0)	4(33.3)	8(66.7)	7(41.2)	10(58.8)
Indian	5(71.4)	2(28.6)	7(46.7)	8(53.3)	12(54.5)	10(45.5)
Other Bumiputra	4(44.4)	5(55.6)	6(66.7)	3(33.3)	10(55.6)	8(44.4)
Other Ethnic	1(100.0)	0(0)	4(57.1)	3(42.9)	5(62.5)	3(37.5)
Education level						
Lower than tertiary education	51(58.0)	37(42.0)	153(46.8)	174(53.2)	204(49.2)	211(50.8)
Tertiary education or above	37(56.1)	29(43.9)	81(45.5)	97(54.5)	118(48.4)	126(51.6)
Grade of position						
Implementer group	53(56.4)	41(43.6)	178(48.2)	191(51.8)	231(49.9)	232(50.1)
Professional and management group	35(58.3)	25(41.7)	56(41.2)	80(58.8)	91(46.4)	105(53.6)
Marital status						
Single/Divorced/ Widow/ Widower	22(53.7)	19(46.3)	69(42.9)	92(57.1)	91(45.0)	111(55.0)
Married	66(58.4)	47(41.6)	165(48.0)	179(52.0)	231(50.5)	226(49.5)
Age (Years)						
20-<30	22(46.8)	25(53.2)	71(37.0)	121(63.0)	93(38.9)	146(61.1)
30-<40	49(67.1)	24(32.9)	103(49.8)	104(50.2)	152(54.3)	128(45.7)
40-<50	10(50.0)	10(50.0)	28(56.0)	22(44.0)	38(54.3)	32(45.7)
50	7(50.0)	7(50.0)	32(57.1)	24(42.9)	39(55.7)	31(44.3)
Stages of change for physical activity						
Pre- contemplation	8(61.5)	5(38.5)	35(64.8)	19(35.2)	43(64.2)	24(35.8)
Contemplation	42(71.2)	17(28.8)	132(53.4)	115(46.6)	174(56.9)	132(43.1)
Preparation	36(72.0)	14(28.0)	59(49.2)	61(50.8)	95(55.9)	75(44.1)
Action	0(0.0)	5(100.0)	1(6.7)	14(93.3)	1(5.0)	19(95.0)
Maintenance	2(7.4)	25(92.6)	7(10.1)	62(89.9)	9(9.4)	87(90.6)

TABLE 3. Prevalence of risk factors of metabolic syndrome among the government employees (*n*= 659)

Metabolic syndrome definitions	NCEP ATP III	IDF	'Harmonized'
	----------*n* (%)----------		
Abdominal obesity	240(36.4)	520(78.9)	520(78.9)
Blood pressure domain	288(43.7)	288(43.7)	288(43.7)
HDL- cholesterol domain	286(43.4)	286(43.4)	285(43.2)
Triglycerides domain	199(30.2)	199(30.2)	199(30.2)
Glucose domain	62(9.4)	105(15.9)	105(15.9)
Metabolic syndrome	184(27.9)	305(46.3)	322(48.9)

Table 4 shows the prevalence of individual risk factors for metabolic syndrome according to 'Harmonized' definition, which is sex, ethnic and age specific. Abdominal obesity showed the highest prevalence at 78.9%. It was more prevalent in women (79.8%) and increased with age. High blood pressure was higher in the men than in the women (56.5% versus 39.8%) and increased with age.

The metabolic risk factors and ages of the participants according to sex are demonstrated in Table 5. The mean age ± standard deviation of the government employees was 34.97±8.35 years for men and 34.34±8.94 years for women. The waist circumference, systolic blood pressure, diastolic blood pressure, fasting plasma glucose, fasting triglycerides and fasting HDL- cholesterol were significantly different between men and women. Men showed higher values for all parameters except HDL-cholesterol, at a level of significance of 0.05. The majority of the participants (84.5%) had at least one metabolic risk factor as defined by 'Harmonized' criteria.

Table 6 shows the findings of the logistic regression analysis of the association among metabolic syndrome based on 'Harmonized' definition, socio-demographic characteristics and current behavioural stage of physical activity. Generally, there was a significant association between sex, age, current behavioural stage of physical activity and the odds of having metabolic syndrome. The risk of having metabolic syndrome was 54% more likely in men compared to women. The risk of metabolic syndrome increase by 3% for every one year increase in age. Participants in the pre- contemplation stage of physical activity were approximately 17 times more likely to have metabolic syndrome as compared to participants in the maintenance stage.

Discussion

In the present study, the most common risk factor in the 'Harmonized' definition was abdominal obesity. The present study found that government employees in this study had a higher prevalence of abdominal obesity (78.9%) compared with the national study conducted by Wan Nazaimoon et al. (2011) in 2008 (57.4%), which use the 'Harmonized' definition and the national prevalence of abdominal obesity (45.4%) in the general Malaysian population, as well as the population in Putrajaya (41.3%) (Institute for Public Health 2011) which used the similar cut- off points (≥90 cm for men and ≥80 cm for women). These results are in alignment with the increasing prevalence of overweight and obesity from 43.1% in 2006 (Institute for Public Health 2008) to 44.5% (Institute for Public Health 2011). In addition, the National Health and Morbidity Survey 2011 (Institute for Public Health 2011) showed that 35.2% of adults aged ≥18 years old in Malaysia were not active and physical inactivity was the most prevalent in Putrajaya (57.3%).

On the other hand, a higher prevalence of high blood pressure (43.7%) and elevated fasting glucose (15.9%) was observed in the present study using the 'Harmonized' definition, as compared with the National Health and Morbidity Survey 2011 (Institute for Public Health 2011). The prevalence of high blood pressure among the general Malaysian population and the population of Putrajaya were 32.7 and 22.5%, respectively. Furthermore, 15.2% of the general Malaysian population and 8.8% of the population in Putrajaya were reported with high fasting glucose (Institute for Public Health 2011). This result might be because the cut-off points employed in the present study differed from those used in the national survey. With regard to high blood pressure, our study defined systolic blood pressure ≥130 mmHg and diastolic blood pressure ≥85 mmHg or a combination of both, instead of ≥140 mmHg for systolic blood pressure and ≥90 mmHg for diastolic blood pressure. For elevated fasting glucose, ≥5.6 mmol/L was used as the cut-off point instead of ≥6.1 mmol/L, as in the national survey (Institute for Public Health 2011). In addition, venipuncture was performed to obtain the fasting plasma sample instead of the finger-prick method used in the national survey, which might also have caused discrepancies in the findings.

Men were 54% more likely to have metabolic syndrome compared to women among the government employees that participated in this study. This finding agreed with a local study (Tan et al. 2008) that found men were more likely to have metabolic syndrome than women in Malaysia. This implies that sex is likely to be part of the contributing factors for metabolic syndrome and cardiovascular risk profiles seen among Malaysians, specifically Malaysian employees. Identifying this risk indicator might warrant future intervention studies among this specific population.

In this cross-sectional study among government employees in Putrajaya, Malaysia, the prevalence of metabolic syndrome was 27.9, 46.3 and 48.9% based on the NCEP ATP III, IDF and 'Harmonized' definitions, respectively. This present study demonstrated a much higher prevalence of metabolic syndrome compared with other studies, irrespective of the definition used. The WHO/IASO/IOTF (2000) suggested waist circumference cut-off points for South Asians were employed in the IDF and 'Harmonized' definitions. Our prevalence rate was higher than that was seen in the nationwide survey conducted in 2008 (Wan Nazaimoon et al. 2011) for both IDF (37.1%) and 'Harmonized' (42.5%) definitions. The higher prevalence of metabolic syndrome recorded in this study among the employees as compared to the nationwide survey was not unexpected. In fact, it coincides with the study conducted by Bayan et al. (2012) among employees in Jordan. The authors proposed that the higher metabolic syndrome prevalence among employees may be a result of the higher prevalence of physical inactivity and environmental factors, such as stress related to work condition. The highest prevalence of physical inactivity was in Putrajaya (57.3%) based on the findings of the 2011 National Health and Morbidity Survey (Institute for Public Health 2011). Undoubtedly, there is a great need for developing

TABLE 4. Prevalence of individual risk factors for metabolic syndrome based on 'Harmonized' definition: Overall, sex, ethnic and age specific

Risk factor	Abdominal obesity		[a] High blood pressure		[a] Reduced HDL- cholesterol		[a] Elevated triglycerides		[a] High fasting plasma glucose	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Total	520(78.9)	139(21.1)	288(43.7)	371(56.3)	285(43.2)	374(56.8)	199(30.2)	460(69.8)	105(15.9)	554(84.1)
Sex										
Men	117(76.0)	37(24.0)	87(56.5)	67(43.5)	49(31.8)	105(68.2)	85(55.2)	69(44.8)	33(21.4)	121(78.6)
Women	403(79.8)	102(20.2)	201(39.8)	304(60.2)	236(46.7)	269(53.3)	114(22.6)	391(77.4)	72(14.3)	433(85.7)
Ethnic group										
Malay	471(79.3)	123(20.7)	257(43.3)	337(56.7)	255(42.9)	339(57.1)	178(30.0)	416(70.0)	95(16.0)	499(84.0)
Chinese	10(58.8)	7(41.2)	9(52.9)	8(47.1)	6(35.3)	11(64.7)	7(41.2)	10(58.8)	2(11.8)	15(88.2)
Indian	19(86.4)	3(13.6)	10(45.5)	12(54.5)	10(45.5)	12(54.5)	8(36.4)	14(63.6)	4(18.2)	18(81.8)
Other Bumiputra	14(77.8)	4(22.2)	8(44.4)	10(55.6)	9(50.0)	9(50.0)	5(27.8)	13(72.2)	4(22.2)	14(77.8)
Other Ethnic	6(75.0)	2(25.0)	4(50.0)	4(50.0)	5(62.5)	3(37.5)	1(12.5)	7(87.5)	0(0)	8(100.0)
Education level										
Lower than tertiary education	322(77.6)	93(22.4)	186 (44.8)	229 (55.2)	189(45.5)	226(54.5)	125(30.1)	290(69.9)	72(17.3)	343(82.7)
Tertiary education or above	198(81.1)	46(18.9)	102 (41.8)	142 (58.2)	96(39.3)	148(60.7)	74(30.3)	170(69.7)	33(13.5)	211(86.5)
Grade of position										
Implementer group	360(77.8)	103(22.2)	207 (44.7)	256 (55.3)	214(46.2)	249(53.8)	141(30.5)	322(69.5)	76(16.4)	387(83.6)
Professional and management group	160(81.6)	36(18.4)	81 (41.3)	115 (58.7)	71(36.2)	125(63.8)	58(29.6)	138(70.4)	29(14.8)	167(85.2)
Marital status										
Single/ Divorced/ Widow/ Widower	143(70.8)	59(29.2)	84 (41.6)	118 (58.4)	80(39.6)	122(60.4)	47(23.3)	155(76.7)	31(15.3)	171(84.7)
Married	377(82.5)	80(17.5)	204 (44.6)	253 (55.4)	205(44.9)	252(55.1)	152(33.3)	305(66.7)	74(16.2)	383(83.8)
Age (Years)										
20-<30	173 (72.4)	66 (27.6)	86 (36.0)	153 (64.0)	94 (39.3)	145(60.7)	53 (22.2)	186(77.8)	20 (8.4)	219(91.6)
30-<40	218 (77.9)	62 (22.1)	127(45.4)	153 (54.6)	131 (46.8)	149 53.2)	95 (33.9)	185(66.1)	40 (14.3)	240 85.7)
40-<50	63 (90.0)	7 (10.0)	36 (51.4)	34 (48.6)	31 (44.3)	39 (55.7)	18 (25.7)	52 (74.3)	24 (34.3)	46 (65.7)
≥50	66 (94.3)	4 (5.7)	39 (55.7)	31 (44.3)	29 (41.4)	41 (58.6)	33 (47.1)	37 (52.9)	21 (30.0)	49 (70.0)
Stages of change for physical activity										
Pre- contemplation	60(89.6)	7(10.4)	41(61.2)	26(38.8)	35(52.2)	32(47.8)	25(37.3)	42(62.7)	11(16.4)	56(83.6)
Contemplation	254(83.0)	52(17.0)	149(48.7)	157(51.3)	157(51.3)	149(48.7)	102(33.3)	204(66.7)	54(17.6)	252(82.4)
Preparation	134(78.8)	36(21.2)	82(48.2)	88(51.8)	77(45.3)	93(54.7)	63(37.1)	107(62.9)	27(15.9)	143(84.1)
Action	13(65.0)	7(35.0)	1(5.0)	19(95.0)	4(20.0)	16(80.0)	2(10.0)	18(90.0)	3(15.0)	17(85.0)
Maintenance	59(61.5)	37(38.5)	15(15.6)	81(84.4)	12(12.5)	84(87.5)	7(7.3)	89(92.7)	10(10.4)	86(89.6)

[a] or on medication/ treatment

TABLE 5. Mean and standard deviation of metabolic risk factors and age of the government employees by sex

	Sex			
	Men (*n*= 154)	Women (*n*= 505)	*t*- value	[a]*p*- value
Age (Years)	34.97±8.35	34.34±8.94	0.769	0.442
Waist circumference (cm)	94.72±9.79	87.16±10.34	8.045	<0.001
Systolic blood pressure (mmHg)	132.47±14.47	121.16±15.97	8.286	<0.001
Diastolic blood pressure (mmHg)	80.33±11.15	75.20±10.87	5.099	<0.001
Fasting HDL- cholesterol (mmol/ L)	1.11±0.22	1.37±0.29	-11.619	<0.001
Fasting triglycerides (mmol/ L)	2.08±1.28	1.30±0.81	7.148	<0.001
Fasting plasma glucose (mmol/ L)	5.22±1.80	4.83±1.17	2.541	0.012

[a] t- test

TABLE 6. Odds ratio of having metabolic syndrome ('Harmonized' definition) according to demographic characteristics and metabolic risk factors

Variables	Odds Ratio (95% CI)	*p*- value
Sex		
Male	1.5442 (1.0731, 2.2220)	0.019
Female	1.0000	
Ethnicity		
Malay	1.0000	
Chinese	0.7438 (0.2794, 1.9800)	0.553
Indian	1.2750 (0.5425, 2.9965)	0.577
Other Bumiputra	1.3281 (0.5170, 3.4119)	0.556
Other Ethnic	1.7708 (0.4194, 7.4769)	0.437
Education level		
Lower than tertiary education	1.032 (0.752, 1.417)	0.844
Tertiary education or above	1.000	
Grade of position		
Implementer group	1.149 (0.822, 1.605)	0.416
Professional and management group	1.000	
Marital status		
Single/ Divorced/ Widow/ Widower	1.000	
Married	1.247 (0.894, 1.738)	0.193
Age	1.0257 (1.0078, 1.0440)	0.005
Stages of change		
Pre- contemplation	17.319 (7.412, 40.471)	<0.001
Contemplation	12.742 (6.186, 26.247)	<0.001
Preparation	12.244 (5.783, 25.924)	<0.001
Action	0.509 (0.061, 4.259)	0.533
Maintenance	1.000	

an effective intervention program that target employees at high risk to manage the modifiable factors associated with metabolic syndrome prevalence and preventing the consequences associated with it.

The risk of metabolic syndrome increase by 3% for every one year increase in age. This study produced results which corroborate the findings of Nazaimoon et al. (2011). They had demonstrated that the prevalence of metabolic syndrome was increased with age. Bayan et al. (2012) had also demonstrated that employees aged between 45 to 54 years were 3 times more likely to have metabolic syndrome than employees in younger age groups. On the other hand,

pre-contemplators were approximately 17 times more likely to have metabolic syndrome as compared with participants in the maintenance stage. Effective physical activity intervention is warranted for stage progression among individuals with metabolic syndrome, explicitly among the pre- contemplators.

The 'Harmonized' definition, which suggested that abdominal obesity should not be a mandatory criterion of metabolic syndrome, is appropriate for estimating the prevalence of metabolic syndrome among Malaysians because Asians could have metabolic syndrome even without large waist circumference (Grundy et al. 2004). However, the present study supported the theory (D'Agostino et al. 2008) that risk should be considered using a combination of risk factors to prevent overlooking high-risk individuals and over treating individuals with a single, isolated high-risk factor. The high proportion of government employees (84.5%) found to have at least one metabolic risk factor in this study supported recommendations by the World Health Organization and World Economic Forum (2008), which recognised that workplace interventions is warranted to reduce non-communicable diseases on a global scale.

A limitation in this study was the population sample, which was predominantly comprised of Malays and could not represent all races in the government agencies. Future studies that involve a more ethnically diverse population of employees are essential to investigate further the prevalence of metabolic syndrome among employees in Malaysia.

Conclusion

Among the government employees that participated in this study, the percentage of metabolic syndrome based on the 'Harmonized' definition (48.9%) was higher than in the Malaysian population; furthermore, 84.5% of the government employees had at least one metabolic risk factor. Men were 54% more likely to have metabolic syndrome than women. Employees were likely to report metabolic syndrome by 3% for every one year increase in age while pre- contemplators for physical activity were approximately 17 times more likely to have metabolic syndrome as compared to participants in the maintenance stage. There is a pressing need to commence intervention programs in the workplace to identify and manage government employees at high risk for cardiovascular disease and diabetes.

References

Alberti, K.G.M.M., Eckel, R.H., Grundy, S.M., Zimmet, P.Z., Cleeman, J.I., Donato, K.A., Fruchart, J.C., James, W.P.T., Loria, C.M. & Smith, S.C. 2009. Harmonizing the metabolic syndrome. A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung and Blood Institute; American Heart Association; World Heart Federation; International Diabetes Atherosclerosis Society; and International Association for the Study of Obesity. *Circulation* 120: 1640-1645.

Alberti, K.G., Zimmet, P., Shaw, J. & IDF Epidemiology Task Force Consensus Group. 2005. The metabolic syndrome: A new worldwide definition. *Lancet*. 366: 1059-1062.

Alberti, K.G. & Zimmet, P.Z. 1998. Definition, diagnosis and classification of diabetes mellitus, and its complications, part I: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet. Med*. 15: 539-553.

Alegria, E., Cordero, A., Laclaustra, M., Grima, A., Leon, M., Casasnovoas, J.A., Luengo, E., del Rio, A., Ferreira, I. & Investigadores del registro MESYAS. 2005. Prevalence of metabolic syndrome in the Spanish working population: MESYAS Registry. *Rev. Esp. Cadriol*. 58: 797-806.

Bayan, A.O., Eslam, K.A.A., Khalid, K.A. & Yousef, S.K. 2012. Predictors of metabolic syndrome among employees: A study from Jordan. *Food and Nutrition Sciences* 3: 669- 677.

Dallongeville, J., Cottel, D., Ferrieres, J., Arveiler, D., Bingham, A., Ruidavets, J.B., Hass, B., Ducimetiere, P. & Amouyel, P. 2005. Household income is associated with the risk of metabolic syndrome in a sex- specific manner. *Diabetes Care* 28: 409-415.

D' Agostino Sr, R.B., Vasan, R.S., Pencina, M.J., Wof, P.A., Cobain, M., Massaro, J. & Kannel, W.B. 2008. General cardiovascular risk profile for use in primary care: The Framingham heart study. *Circulation* 117: 743-753.

Davila, E.P., Florez, H., Fleming, L.E., Lee, D.J., Goodman, E., LeBlanc, G., Caban- Martinez, A.J., Arheart, K.L., McCollister, K.E., Christ, S.L., Clark III, J.C. & Clarke, T. 2010. Prevalence of the metabolic syndrome among US workers. *Diabetes Care* 33(11): 2390-2395.

Department of Statistics. Labour Force Statistics, Malaysia, December 2012. Malaysia: Department of Statistics, 2013.

Freak-Poli, R., Wolfe, R. & Peeters, A. 2010. Risk of cardiovascular disease and diabetes in a working population with sedentary occupations. *American College of Occupational and Environmental Medicine* 52: 1132-1137.

Gami, A.S., Witt, B.J., Howard, D.E., Erwin, P.J., Gami, L.A., Somers, V.K. & Montori, V.M. 2007. Metabolic syndrome and risk of incident cardiovascular events and death: A systematic review and meta-analysis of longitudinal studies. *J. Am. Coll. Cardiol*. 49: 403-414.

Grundy, S.M. 2007. Metabolic syndrome: A multiplex cardiovascular risk factor. *J. Clin. Endocrinol. Metab*. 92: 399-404.

Grundy, S.M., Hansen, B., Smith Jr, S.C., Cleeman, J.I. & Kahn, R.A. 2004. Clinical management of metabolic syndrome: Report of the American Heart Association/ National Heart, Lung and Blood Institute/ American Diabetes Association conference on scientific issues related to management. *Arterioscler Thromb. Vasc. Biol*. 24: e19-e24.

Institute for Public Health. The Third National Health and Morbidity Survey 2011. Malaysia: Ministry of Health, 2011.

Institute for Public Health. The Third National Health and Morbidity Survey 2006. Malaysia: Ministry of Health, 2008.

Johnson, L.W. & Weinstock, R.S. 2006. The metabolic syndrome: Concepts and controversy. *Mayo Clin. Proc*. 81: 1615-1620.

Johnson, R.R. & Kuby, P. 2008. Chapter 9. Inferences involving one population. In *Elementary Statistics*. USA: Thomson Learning Inc. pp. 472-542.

Khunti, K. & Davies, M. 2005. Metabolic syndrome. *British Medical Journal* 33(7526): 1153-1154.

Li, C.Y. & Sung, F.C. 1999. A review of the healthy worker effect in occupational epidemiology. *Occup. Med. (London)* 49: 225-229.

Lin, Y.C., Hsiao, T.J. & Chen, P.C. 2009. Persistent rotating shift- work exposure accelerates development of metabolic syndrome among middle-aged female employees: A five-year follow-up. *Chronobiology International* 26(4): 740-755.

Marcus, B.H., Rossi, J.S., Selby, V.C., Niaura, R.S. & Abrams, D.B. 1992. The stages and processes of exercise adoption and maintenance in a worksite sample. *Health Psychology* 11: 386-395.

Ministry of Health. 2011. *Country Health Plan*. 10th Malaysia Plan 2011- 2015. Putrajaya: Ministry of Health.

Ministry of Health. 2010. *National Strategic Plan for Non-Communicable Disease. Medium Term Strategic Plan to Further Strengthen the Cardiovascular Diseases & Diabetes Prevention & Control Program in Malaysia* (2010- 2014). Putrajaya: Ministry of Health.

Ministry of Health. 2006a. *MyNCDS-1 Malaysia NCD Surveillance- 1 2005/ 2006. NCD Risk Factors in Malaysia*. Putrajaya: Ministry of Health, Disease Control Division, Non-communicable Disease Section.

Ministry of Health. 2006. *Malaysia's Health*. Putrajaya: Ministry of Health.

Murphy, M.H., Murtagh, E.M., Breham, C.A.G., Hare, L.G. & Nevill, A.M. 2006. The effect of a worksite based walking programme on cardiovascular risk in previously sedentary civil servants. *BMC Public Health* 6: 136-143.

Nair, C.V. 2010. Metabolic syndrome: An occupational perspective. *Indian Journal of Community Medicine* 35(1): 122-124.

National Cholesterol Education Program (NCEP). 2002. Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult Treatment Panel III) final report. *Circulation* 106: 3143- 3421.

Nestel, P., Lyu, R., Low, L.P., Sheu, W.H., Nitiyanant, W., Saito, I. & Tan, C.E. 2007. Metabolic syndrome: Recent prevalence in East and Southeast Asian populations. *Asia Pac. J. Clin. Nutr.* 16: 362- 367.

Puig- Ribera, A., McKenna, J., Gilson, N. & Brown, W.J. 2008. Change in work day step counts, wellbeing and job performance in Catalan university employees: A randomized controlled trial. *Promotion & Education* 15: 11-16.

Rakugi, H. & Ogihara, T. 2005. The metabolic syndrome in the Asian population. *Curr. Hypertens. Rep.* 7: 103-109.

Salsberry, P.J., Corwin, E. & Reagan, P.B. 2007. A complex web of risks for metabolic syndrome: Race/ ethnicity, economics and gender. *Am. J. Prev. Med.* 33: 114-120.

Sanchez-Chapparo, M.A., Calvo-Bonacho, E., Gonzalez-Quintela, A., Fernandez-Labandera, C., Cabrera, M., Sainz, J.C., Fernandez-Meseguer, A., Banegas, J.R., Ruilope, L.M., Valdivielso, P. & Roman-Garcia, J. 2008. Occupational-related differences in the prevalence of metabolic syndrome. *Diabetes Care* 31: 1884-1885.

Sundstrom, J., Riserus, U., Byberg, L., Zethelius, B., Lithell, H. & Lind, L. 2006. Clinical values of the metabolic syndrome for long term prediction of total and cardiovascular mortality: Prospective, population based cohort study. *BMJ* 332: 878-882.

Tan, B.Y., Kumar, K.H. & Rajbans, S. 2008. Prevalence of metabolic syndrome among Malaysians using the International Diabetes Federation, National Cholesterol Education Program and modified World Health Organization definitions. *Mal. J. Nutr.* 14(1): 65-77.

Wan Nazaimoon, W.W., Aziz, A.I., Amir, S., Ikram, S.I., Kamarul, I.M., Khalid, A.K., Nor Azmi, K., Nor Azwany, Y., Norlaila, M., Osman, A., Siti, H. & Wan Mohamad, W.B. 2011. Prevalence of metabolic syndrome and its risk factors in adult Malaysians: Results of a nationwide survey. *Diabetes Research and Clinical Practice* 91(2): 239-245.

Wilson, P.W.F., D'Agostino, R.B., Parise, H., Sullivan, L. & Meigs, J.B. 2005. Metabolic syndrome as a precursor of cardiovascular disease and type 2 diabetes mellitus. *Circulation* 112: 3066-3072.

World Health Organization (WHO). 2009. Global health risks: Mortality and burden of disease attributable to selected major risks. Geneva: WHO Press.

World Health Organization and World Economic Forum. 2008. Preventing non- communicable diseases in the workplace through diet and physical activity: WHO/ World economic forum report of a joint event. Geneva, Switzerland: World Health Organization.

WHO/IASO/IOTF. 2000. The Asia- pacific perspective: Redefining obesity and its treatment. Melbourne: Health Communications Australia.

World Health Organization (WHO). 1997. MONICA Manual. Part III: Population Survey. Section 1: Population survey data component by WHO MONICA Project, http://www.thl.fi/publications/monica/manual/part3/iii-1.htm, URN: NBN: fi-fe19981151. Accessed 8th February 2013.

Chee, H.P., Hazizi, A.S.*, Barakatun Nisak,
M.Y. & Mohd Nasir, M.T.
Department of Nutrition and Dietetics
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
43400 Serdang, Selangor Darul Ehsan
Malaysia

Hazizi, A.S.*
Sports Academy
Universiti Putra Malaysia
43400 Serdang, Selangor Darul Ehsan
Malaysia

*Corresponding author; email: hazizi@upm.edu.my

Received: 28 October 2013
Accepted: 10 December 2013