Metabolic Syndrome and Occupational Risk Factors among Healthcare Workers in Kelantan

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ABSTRACT: Occupational factors such as stress and shift work are found to be risk factors for Coronary Heart Disease (CHD). Several studies have documented increase risk of CHD among individuals with metabolic syndrome. This study was designed to determine the prevalence of metabolic syndrome using the definition by the Third Report of the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP III) and to describe the characteristics of nurses with metabolic syndrome including work related factors. A cross-sectional study was conducted between January to April 2009 among 404 nurses in Hospital Universiti Sains Malaysia (HUSM), Kelantan, Malaysia. All the respondents were female nurses aged 30–56 years. Data was collected using a questionnaire consists of sociodemographic, occupational history and physical activity as well as DASS 42 questions (translated to Malay language and validated). Waist circumference, blood pressure measurement and fasting venous blood for lipid profile and fasting blood sugar were taken from each subject. Data entry and analysis were done using SPSS Version 12.0.1. The prevalence of metabolic syndrome was determined, and factors associated with the metabolic syndrome were analyzed by multiple logistic regression. Majority of the respondents were Malay with mean (SD) age of 42.1 (7.19) years old. The mean (SD) duration of employment was 17.8 (6.33) years. Majority (91.1%) of nurses was physically inactive and 14.1% were having stress. The prevalence of metabolic syndrome was 24.3% (95%CI: 20.1, 28.4). The significant factors associated with metabolic syndrome after statistical adjustments for the confounding factors were total duration of employment (years) and one way commuting time to work (minutes). High prevalence of metabolic syndrome indicates that nurses are occupational risk group for CHD. Further multicentres cross sectional studies or better, a cohort study are needed to plan for an effective intervention programme.

Keywords: Metabolic syndrome, nurses, shift work, occupational

Introduction

This study aims to find potential association between work factors and having a metabolic syndrome. This is because lately there is a move to cluster the risk factors of coronary heart disease to a syndrome known as metabolic syndrome. The syndrome was previously known as syndrome X or insulin resistance syndrome (IDF, 2005;NCEP, 2005). Metabolic syndrome is a medical disorder that increases the risk of CHD and Type-2 diabetes (Tarani *et al.*, 2006). The risk for coronary heart disease events accompanying the metabolic syndrome is approximately doubled compared with an absence of the syndrome, the relative risk was 1.78 and in women the risk was higher (RR 2.63) (Scott, 2008). Work factors possibly related to metabolic syndrome were stress at work, shift work, duration of employment and commuting time to work.

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Methodology

This study is a cross sectional study conducted among female nurses working in a teaching hospital, Universiti Sains Malaysia Hospital, (HUSM) Kelantan. Study settings were all hospital units, including wards, clinics and other diagnostic or rehabilitation units. This study was done from January to April 2009. From the 901 eligible female nurses, 477 have fulfilled the inclusion and exclusion criteria. Since our study needs a sample size of 434 respondents, no sampling method was applied as all of them were included in the study.

Operational definition

A. Metabolic syndrome
A respondent was defined as having metabolic syndrome when there is a presence of three or more of the five criteria based on the ATP III criteria (NCEP, 2005).

a. Central obesity (waist circumference greater than 80 cm (35 inches for Asian women).
b. High blood pressure: ≥ 130/85 mm Hg.
c. Raised fasting blood sugar ≥ 100 mg/dL (5.6 mmol/L) or previously diagnosed type 2 diabetes.
d. Elevated triglycerides ≥ 150 mg/dL (1.7 mmol/L).
e. Reduced high-density lipoprotein (HDL) cholesterol: < 50 mg/dL (1.29 mmol/L) in women.

B. Stress

The prevalence of stress was measured by DASS 42 questionnaire. The questionnaire has been translated to Malay language and validated (Edimansyah *et al.*, 2005). Raw scores for the DASS stress scale were summed and converted into z scores. Based on the z scores, nurses scored less than 0.5 are considered normal; 0.5 to 1.0, mild stress; 1.0 to 2.0, moderate stress; 2.0-3.0, severe stress; and more than 3.0, extremely severe stress (Lovibond and Lovibond, 2002). This study used only the stress score and respondent was defined as having stress when they fall in any of the 4 categories, i.e. from mild to extremely severe.

C. Shift Work

In this study, shift work is defined as working in an eight hour rotating shift schedule. Work schedule commonly practised by the working population of hospital nurses is an eight hour rotating shift and currently in HUSM Kubang Kerian, it is a fast forward rotating shift of two days morning shift, followed by two days evening shift and two days night shift. Then they will have two days off.

D. Total duration of employment

Total duration of employment was the total years of employment as a nurse including either in current setting or in other previous hospitals or health clinics.

E. One way commuting time

To get the duration of one way commuting time, respondents were asked to give the average or common duration usually taken by them either to work or from home to work. Not to consider days with traffic congestion or other events that will delay them to work.

Lifestyle factors

Self-reported smoking frequency and physical exercise were estimated from the questionnaire. In this study, any respondent answering "yes" to either current or former smoking was considered as a smoker and answering "no" to those questions was considered as a non smoker. A respondent was considered to be physically inactive when she answered "no" to the question "Do you exercise or have any physical activity?", or when she answered "yes" but the amount of exercise was less than 30 minutes per session and less than 3 days in a week (MOH, 2004b;MOH, 2004a).

Anthropometric measurements

The anthropometric examinations were done following the WHO Standard Physical Examination (WHO, 1995). Body weight was measured in light working clothing, with shoes off and recorded to the nearest 0.5 kg, using a calibrated Seca 761 weighing scale. Height was measured to the nearest 0.1 cm without shoes, using a portable mechanical Seca 208 bodymeter. The scale was attached to a wall using a double sided tape. Waist circumference measurement was done by a trained female research assistant following the WHO recommended methods (MOH, 2004a), and measurements were taken to the nearest 0.1 cm.

Cardiovascular risk factors

Systolic and diastolic blood pressures were measured three times on the day of interview using an adult cuff with size 88*14 cm and a standard mercury sphygmomanometer and a stethoscope. The method of measurement follows a standardized protocol (WHO) STEPS Surveillance. Blood pressure was measured using participant's right and left arms in the sitting position after a five min rest (Karlsson *et al.*, 2003). Three measurements were taken, and the highest reading was taken as the recorded systemic blood pressure (MOH, 2008).

A 10 hours overnight- fasting (MOH, 2004b) venous blood was taken from antecubital vein amounting to 6 ml. Four ml blood for Fasting Lipid Profile was collected in a plain vacutainer with clot activator (BD Vacutainer) and the remaining 2 ml blood for Fasting Blood Sugar was collected in a vacutainer with Potassium Oxalate 4 mg and Sodium Fluoride 5 mg. Storage and transportation of samples were maintained at temperature between 4^{o}C to 25^{o}C and those samples were sent to laboratory on the same day of blood sampling. Blood for Fasting Lipid Profile and Fasting Blood Sugar were analyzed at a private, certified laboratory.

Statistical analysis

Statistical analyses were conducted using the statistical software, SPSS Version 12.0.1 (SPSS Inc, 2003). Continuous variables which are component of metabolic syndrome such as waist circumference, blood pressure, fasting glucose level, triglyceride level and HDL cholesterol level were converted

into categorical variables according to the cut off point from the NCEP ATP III criteria.

Multiple logistic regression analysis was performed to examine the determinants of the metabolic syndrome among demographic, lifestyle factors, and occupational factors. Covariates included age, ethnic, number of children, marital status, education level, income (RM), physical exercise, family history of CHD, current OCP use, total duration of employment (years), one way commuting time (minutes), type of work and stress. The adjusted odds ratio was estimated with 95% confidence interval (CI). Findings were presented with crude and adjusted OR, 95% CI and *p* value. The level of significant for all analysis was set at 5% (α= 0.05, two tailed).

Results

The mean (SD) age was 42.2 (7.19) years. Majority of respondents were Malay women and were married. The mean (SD) number of children was 3.6 (1.70). **TABLE 1** shows the sociodemographic characteristics of the respondents.

The mean (SD) total duration of employment was 17.8 (6.33) years, and ranged from 2.0 to 33.0 years in which 177 (43.8%) of them doing day work. The mean (SD) one way commuting time to work was 20.8 (11.38), and ranged from 5 to 60 minutes. All of the respondents were non-smoker, majority were physically inactive, only 14.4% were currently on OCP and 28.2% with family history of CHD.

Prevalence of the metabolic syndrome

The prevalence of metabolic syndrome among nurses working in HUSM was 24.3% (95%CI: 20.0, 28.4). Sociodemographic variable that was significantly associated with metabolic syndrome was age. The mean (SD) aged of workers with metabolic syndrome was higher, 44.6 (SD 6.27) years compared to non-metabolic syndrome. Other variables were not significant.

Occupational characteristic significantly associated with metabolic syndrome was total duration of employment and one way commuting time was marginally significant. Participants with metabolic syndrome had a longer mean (SD) duration of employment of 18.3 (6.18) compared to non-metabolic syndrome.

Multiple logistic regression analysis was used to identify the independent associated factors for metabolic syndrome. Sociodemographic variables were included in the analysis as possible confounders. The independent variables that were statistically significant as predictors towards the metabolic syndrome were total duration of employment (years) and one way commuting time (minutes). There were no significant interaction terms and multicolinearity problems noted in the preliminary final model.

TABLE 1- Sociodemographic characteristics of the respondents (n= 404)

Variables	Frequency (%)	Mean (SD)
Age (years)		42.2 (7.19)
Number of children		3.6 (1.70)
Income per month (RM)		2879.1 (585.73)
Ethnic		
Malay	379 (93.8)	
Chinese	21 (5.2)	
Indian	2 (0.5)	
Others	2 (0.5)	
Nursing Education		
Certificate in Nursing	127 (31.4)	
Diploma in Nursing	248 (61.4)	
Degree	29 (7.2)	
Marital status		
Single	13 (3.2)	
Married	376 (93.1)	
Divorced	2 (0.5)	
Widowed	13 (3.2)	

Note: SD- standard deviation

TABLE 2- Simple logistic regression analysis to determine factors associated with metabolic syndrome

Factors	Crude [a]OR	95% [b]CI for Exp(B)		*p* value
		Lower	Upper	
Age	1.07	1.03	1.10	<0.001
No. of children	1.12	0.98	1.27	.089
Income (RM)	1.00	1.00	1.00	.100
Ethnic				
Others	1			
Melayu	1.30	0.48	3.56	.609
Nursing Education				
Certificate or Diploma	1			
Degree	0.99	0.41	2.40	.988
Marital status				
Unmarried	1			
Married	2.82	0.83	9.54	.096
Total duration of employment (years)	1.08	1.04	1.12	<0.001
One way commuting time (min.)	1.02	1.00	1.04	.054
Duration of job experience (years)	1.01	0.97	1.04	.777
Type of work				
Day work	1			
Shift work	.68	0.43	1.08	.099
Family history of CHD				
No	1			
Yes	1.22	0.75	2.01	.425
OCP				
No	1			
Yes	0.89	0.46	1.72	.723
Physically inactive				
No	1			
Yes	0.78	0.36	1.69	.534
Stress				
No	1			
Yes	1.17	0.62	2.22	.635

[a] OR = Odds Ratio based on Exp. Beta,
[b] CI = Confidence Interval,
p value = *p* value of Wald test

TABLE 3- Associated factors for metabolic syndrome by multiple logistic regressions

Variables	Adjusted [a]OR	95% [b] CI for Exp(B)		*p* value
		Lower	Upper	
Total duration of employment (years)	1.08	1.04	1.12	<0.001
One way commuting time (min.)	1.02	1.00	1.04	0.039

[a] OR = Odds Ratio,
[b] CI = Confidence Interval,
p value = *p* value of Wald test (Multiple logistic regression)
Hosmer and Lemeshow Test P-Value = 0.157
Receiver Operating Characteristics (ROC) curve = 0.662
No outlier by Cook's test and Leverage value

Discussion

This study documented a high prevalence of metabolic syndrome among nurses working in a teaching hospital. This was higher than the prevalence of metabolic syndrome among municipal workers in Turkey which was 17.8% (Demiral *et al.*, 2006). This result was also higher compared to the prevalence of metabolic syndrome among the general population in Malaysia which was 16.5% (Tan *et al.*, 2008). We also noted that the prevalence of metabolic syndrome in this study was higher than findings among female population in Thailand and Singapore which was 11.7% and 12.3%, respectively (Scott, 2008). All prevalences from studies mentioned above used the NCEP ATP III criteria for the definition of metabolic syndrome.

Occupational factors associated with metabolic syndrome

The factors which significantly associated with metabolic syndrome in this study were total duration of employment and one way commuting time to work (minutes). One way commuting time to work was included in this study as an event that could explain sedentary lifestyle or lead to physical inactivity due to no extra time after work for one to engage in recreational activity or exercise. In the multivariable analysis, one way commuting time to

work was one of the independent variables that can predict the outcome of metabolic syndrome with OR 1.02 (95%CI: 1.00-1.04). We found that, workers taking a longer travelling time of 10 minutes to work compared to others, were 20% more likely to have metabolic syndrome.

Another occupational factor which significantly associates with metabolic syndrome in this study was total duration of employment. In the multivariable analysis, total duration of employment can predict the outcome of metabolic syndrome with OR 1.08 (95%CI: 1.04-1.12). This mean that those workers who worked 10 years more compared to others, were two times more likely to have metabolic syndrome. Our finding was similar to a study in Turkey which found metabolic syndrome was significantly higher among workers who had been working for more than 10 years (p= 0.009) (Demiral *et al.*, 2006).

Other occupational factors such as duration of current job experience and stress were not associated with metabolic syndrome in our study. In this study, stress was neither associated with shift working (p= 0.468) nor with metabolic syndrome (p= 0.890). This finding is in agreement with a study among workers in Turkey which reported no significant association between job strain and metabolic syndrome (OR 1.5, 95%CI: 0.9, 2.5) (Demiral *et al.*, 2006). Our finding, however contradicted to the result of a cohort study in London which reported a double risk of metabolic syndrome among workers with chronic work stress compared to those without work stress (Tarani *et al.*, 2006).

Our study design limits the ability to draw a true causal-effect relationship because the exposures and outcome were measures simultaneously. Thus these study findings were inferior to the findings from prospective cohort studies (Bacquer, 2009;Tarani *et al.*, 2006). Nevertheless, our study design was similar to other studies (Ghiasvand *et al.*, 2006;Demiral *et al.*, 2006;Karlsson *et al.*, 2003). Other limitations include generalization of the findings. Our result is limited to nurses in the teaching hospital in HUSM, Kelantan. However, our findings may be relevant to other similar population such as among nurses in Hospital Selayang, Selangor which showed similar characteristics (Fauziah *et al.*, 2006) or other goverment hospitals in Malaysia. Our study was also subjected to recall bias. Personal information, occupational, medical and recreational histories were based on self-reports questionnaire. Validation of self reported condition would be better with observation or cross reference. This bias however was minimized by giving the participants enough time (one week) to answer those questions.

Conclusion

High prevalence of metabolic syndrome among nurses working in a teaching hospital in Kelantan indicates that they are occupational risk group for metabolic syndrome. There is significant relationship observed in this study between metabolic syndrome and occupational factors such as total duration of employment (years) and one way commuting time to work (minutes). This study finding shows that occupational factors play an important role in the development of metabolic syndrome. Since duration of employment and commuting time to work are non-modifiable factors, prevention and control strategies at the work place are needed to change the unhealthy lifestyle especially lack of physical activity hence to reduce obesity. Further multicentres cross sectional studies or better, a cohort study are needed to determine other possible factors associated with metabolic syndrome in our country and will be a base for an effective intervention program.

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