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Framingham Risk Scores and Anthropometric Measurements in Predicting Cardiovascular Risks among Malay Men

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ABSTRACT

Framingham Risk Scores is an established method to predict an individual's 10-year risk for coronary heart disease (CHD). It provides a more precise delineation of risk which might lead to appropriate selection of therapy and opportunities for patient education and motivation. A Healthy Lifestyle Project was initiated to decrease the modifiable risk factors for CHD in a worksite in Kuala Lumpur. The participants were Malay men (n=186) working as security guards in a public university. Their mean age was 46.6 $\pm$ 6.6 years. The majority had secondary education and were married. The participants' 10-year risks based on the Framingham Risk Scores were 55.4%, 39.8% and 4.8% respectively for categories of low (< 10%), intermediate (10 to 20%) and high (>20%) risk. Their Framingham Risk Scores were then correlated with anthropometric measurements such as the Body Mass Index (BMI), waist circumference and waist-hip-ratio (WHR). All the anthropometric measurements had weak but significant correlation with the Framingham Risk Scores (WHR: r=0.26; waist circumference: r=0.23; BMI: r=0.16). In conclusion, 44.6% of our participants had more than 10% risk in developing CHD in the coming ten years. Hence, they are suitable target candidates for the promotion of a healthy lifestyle such as smoking cessation, weight control, healthy dietary patterns and increased physical activities. Indicators of abdominal obesity like WHR or waist circumference may be used to complement the Framingham Risk Scores for the prediction of CHD risk in this population.

INTRODUCTION

Malaysia has developed from an agriculture-based economy to one that emphasises manufacturing. The nation's health status has also improved significantly with infant mortality rate decreasing from 19.7 per 1000 live births in 1981 to 6.6 per 1000 live births in 2006, while the life expectancy of males and females in the same year was 71.8 and 76.3 years respectively (Statistics Department, 2006). These improvements

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may be attributed to socio-economic growth and better health services. Similarly, the disease pattern has also shifted from communicable to non-communicable diseases.

In 2006, heart disease and diseases of pulmonary circulation were the second leading cause of death in the Ministry of Health hospitals in Malaysia, while diseases of the circulatory system were the fourth leading cause of hospitalisation in the same year (MOH, 2006). Cardiovascular disease (CVD) was also the leading cause of medically certified and inspected deaths in the same year (Statistics Department, 2006).

It is a matter of concern that people may not be aware of their personal risk to CVD. Therefore it is crucial that the adult population be screened periodically for cardiovascular risks. Screening of lipid profile can be used alone to determine the risk of CVD and need for treatment or it can be combined with information on other risk factors. However, strategies that explicitly consider a person's other coronary heart disease (CHD) risk factors in addition to the lipid profile are more accurate than those that measure only lipid profiles (Wilson *et al.*, 1998). Grover, Coupal & Hu (1995) found that a Framingham-based coronary risk model was the best predictor of CHD mortality as this model helped to define the quantitative and additive nature of cardiovascular risk factors. These cardiovascular risk factors included cigarette smoking, hypertension, high serum cholesterol and various cholesterol fractions, low levels of high density lipoprotein (HDL) cholesterol and advancing age (Grover *et al.*, 1995).

Framingham Risk Scores emanating from the above model provide a realistic picture of an individual's 10-year cardiovascular risks. It is helpful in tailoring a plan for risk factor management, particularly in primary prevention to modify risk factors or prevent their development. This will delay or prevent new-onset of CHD. These scores provide a more precise delineation of absolute risk, which might lead to a more precise selection of appropriate therapy as well as patient education and motivation. While patients with low risk scores can be reassured, those with higher scores should be counselled to adopt risk-reducing lifestyle habits (such as smoking cessation, dietary change, weight control and exercise).

In a Healthy Lifestyle Project initiated in Kuala Lumpur, participants' cardiovascular risks were assessed using the Framingham Risk Scores. Anthropometric measurements such as body mass index (BMI), waist circumference and waist hip ratio (WHR) were also used to evaluate their relationship with the Framingham Risk Scores.

MATERIALS AND METHODS

This project involved a cross-sectional survey on security guards working in the campus and the hospital of a public university in Kuala Lumpur. Approval was obtained from the Medical Ethics Committee of the university and the management of both the security units. All security guards (n=210) were invited to participate and informed consent was obtained from all respondents. The majority of the security staff were men and of Malay ethnicity (>95%); women and participants of other ethnicity groups were excluded from the analysis.

Anthropometric measurements which included weight, height, waist and hip circumferences were taken. Height was taken to the nearest 0.1cm using the microtoise which was mounted to the wall; subjects were asked to remove their shoes

before measurement was taken. Weight was taken using the SECA digital scale and the machine was calibrated regularly with known weight. Weight was measured to the nearest 0.1kg with shoes, hand phone, coins and wallets removed. Waist and hip circumferences were taken following the WHO (1995) procedure. Both measurements were taken to the nearest 0.1cm. Body mass index (BMI) was calculated using the formula of weight (kg) divided by height^2 (m^2). Waist hip ratio (WHR) was calculated by dividing waist circumference with hip circumference.

Clinical and biochemical indicators, which included blood pressure, fasting blood glucose and full lipid profile (i.e. total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides) were determined. Blood pressure was measured using a digital automatic blood pressure monitor (Omron HEM – 907 model). The subjects were required to be seated while two measurements were taken using the subject's left arm with a one-minute interval; the mean was recorded.

Venous blood was drawn for screening of full lipid profile and fasting blood glucose. Each subject was required to fast for at least 8 – 10 hours prior to drawing blood. Fasting blood glucose was measured using the advantage blood glucose monitor on the spot. Total cholesterol, HDL cholesterol and triglycerides were analysed using the Dimension ® clinical chemistry system (an in-vitro diagnostic test); while the LDL-cholesterol was calculated using the Friedewald formula (Friedewald, Levy & Fredrickson 1972).

Socio-demographic data, medical history, family history of CVD and lifestyle practices of the participants were collected through a set of pre-tested self-administered questionnaire. The questionnaire was in the Malay language.

The Framingham Risk Scores (FRS) was computed based on the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III procedures (NCEP, 2002). The participants' cardiovascular risk was assessed via a 2-step procedure. First, the participants' major risk factors for CVD (such as smoking, hypertension with blood pressure >140 / 90 mmHg or on treatment, males aged 45 years and above, with a family history of CHD and low HDL-cholesterol which was less than 1.01mmol / l) were counted. Their 10-year CHD risk was calculated using the Framingham scoring which was based on age, total cholesterol, HDL-cholesterol, blood pressure and cigarette smoking. Framingham scoring categorises persons with multiple risk factors into those with 10-year risk for CHD of >20% (high risk), 10 to 20% (moderate risk) and <10% (low risk).

All data was entered and analysed using the SPSS for Windows version 11.0. Data was cleaned and checked for discrepancies before analysis. Pearson correlation was used to correlate two quantitative variables. Significance level was preset at 0.05.

RESULTS

A total of 186 subjects participated, giving a response rate of 88.6%. Table 1 shows the socio-demographic and clinical characteristics of the participants. The participants had a mean age of 46.6 $\pm$ 6.6 years and the majority were married with secondary education. Self-reported diseases such as diabetes mellitus, hypertension and coronary heart disease (CHD) as well as their family history of premature CHD are shown in Table 1.

Participants' anthropometric measurements are shown in Table 2. Their mean BMI was 26.36 $\pm$ 3.63 kg / m^2 while the

Table 1. Socio-demographic and clinical characteristics of participants

		n (%)
Education :	No formal education	3 (1.6)
	Primary	2 (12.4)
	Secondary	160 (86.0)
Marital status	Single/ divorced	13 (7.0)
	Married	173 (93.0)
Family history of CHD		23 (12.4)
Medical history:	Diabetes	36 (19.4)
	Hypertension	37 (19.9)
	CHD	4 (2.2)
Age (years) (mean ± s.d.)		46.6 ± 6.6

Table 2. Participants' anthropometric measurements

	Mean ± s.d.
Height (cm)	167.5 ± 5.1
Weight (kg)	74.0 ± 11.2
Waist circumference (cm)	91.5 ± 9.1
Hip circumference (cm)	101.6 ± 7.1
BMI (kg/m^2)	26.36 ± 3.63
WHR	0.90 ± 0.05

Table 3. Proportion of participants with cardiovascular risk factors

Risk factor	*n (%)*
Cigarette smoking	70 (37.6)
Hypertension	59 (31.7)
Low HDL cholesterol	65 (34.9)
Family history of premature CHD	23 (12.4)
Age (≥ 45 years)	110 (59.1)

Table 4. Correlation of Framingham Risk Scores to anthropometric measurements

	Pearson correlation coefficient, r	*p*
BMI	0.163	0.026
Waist circumference	0.233	0.001
WHR	0.257	<0.001

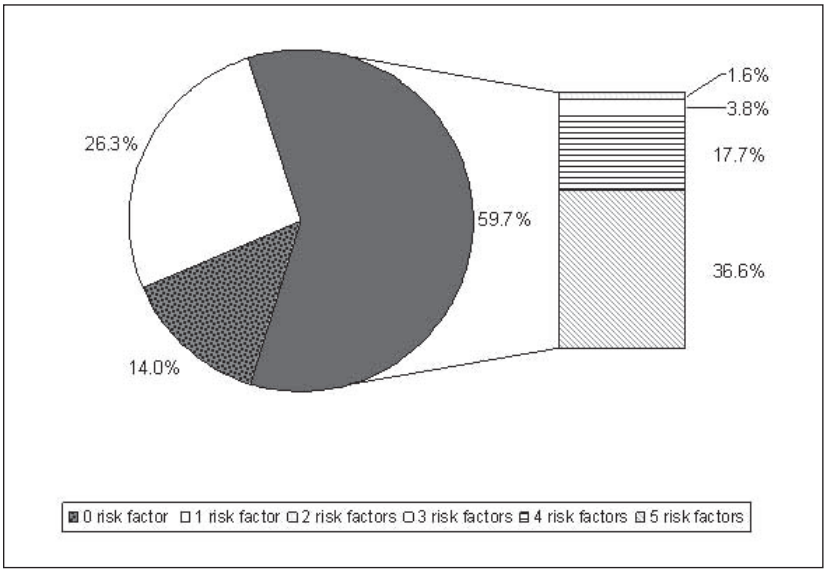

Figure 1. CVD risk factors among the participants

abdominal obesity indicators such as waist circumference and WHR were 91.5 ± 9.1cm and 0.90 ± 0.05 respectively.

Cardiovascular risk factors such as cigarette smoking, hypertension (blood pressure more than 140/90 mmHg or on medication for hypertension), low HDL cholesterol (<1.01 mmol/l), a family history of premature CHD and number of those aged 45 years and more are reported in Table 3. Approximately 60% of the participants were aged more than 45 years and about one-third of them were smokers, had hypertension and low HDL-cholesterol.

When the above risk factors were calculated for each participant, it was found that approximately 60% of them had two or more of the above risk factors (Figure 1). The Framingham Risk Scores showed that about 55% had low risk (<10%), 40% moderate risk (10 to 20%) while 5% would be exposed to high risk (>20%) in the next 10 years.

When the Framingham Risk Scores were correlated with BMI, waist circumference and WHR, the following results were obtained (Table 4). All the measurements had significant but weak correlation with Framingham Risk Scores.

DISCUSSION

This cross-sectional questionnaire survey shows that 45% of the participants had moderate to high 10-year risk for CHD using the Framingham risk scoring. The Framingham risk scoring system considers an individual's other CHD risk factors in addition to the lipid profile. It predicts more accurately for CHD mortality (Wilson *et al.*, 1998). The 10-year risk categories for CHD provide opportunities for primary prevention of CHD. This could be carried out through patient education and motivation.

Appropriate prediction of CHD risk is crucial in patient education and motivation. Periodic monitoring is needed to assess whether the risk status has changed. Low absolute risk particularly among young adults does not ensure a lifetime of low risk because the number and severity of metabolic risk factors worsen with aging. Therefore,

the risk reduction message should also be conveyed to low-risk persons in the general population. Any single risk factor if untreated for long periods can produce major cardiovascular events. For example, years of cigarette smoking predisposes to lung cancer and atherosclerotic cardiovascular disease (Eliasson *et al.*, 2001; Rylander and Axelsson, 2006), while untreated hypertension can cause stroke, CHD and renal failure (Cuddy, 2005; Staessen *et al.*, 2005; Walsh *et al.*, 2006).

Anthropometric measurements such as BMI, waist circumference and WHR are easily measured and monitored. The significant correlation observed between these measurements with Framingham Risk Scores provides additional indicators for identifying individuals at increased CVD risks. In this survey, BMI had the lowest correlation with FRS, while WHR had the strongest with the Framingham Risk Scores for CVD. Similar results were demonstrated by Esmaillzadeh, Mirmiran & Azizi (2004) among Tehranian adult men and Megnien *et al* (1999) among the French population. However, different results were found for females (Mosca *et al.*, 2006; Esmaillzadeh, Mirmiran & Azizi, 2006) and males of other ethnic groups (Smith, Ness & Herbert, 2005). In the studies carried out by Mosca *et al.* (2006) and Esmaillzadeh *et al.* (2006), waist circumference performed better than WHR among the females in predicting CVD risk; Smith *et al* (2005) found that waist circumference was a better predictor among Caucasian males. A study with a bigger sample size of both Malay males and females should be undertaken for further analysis of the above.

Although FRS is a valuable tool in predicting CHD risk, it has some limitations. The scoring system was derived from the Framingham Heart Study of participants that differed in geographic and ethnic groups from our local scenario. Furthermore, the FRS did not take into account all known risk factors for CHD such as obesity, levels of triglyceride, homocysteine etc. However, an advantages of using FRS is that it suggests priorities for instituting primary prevention strategies and identifies factors deserving increased emphasis and those needing less attention. It also stipulates that the healthcare professionals need to look at the patient as a whole and to recognise the cumulative nature of risk factors. This multifactorial approach to risk reduction offers the best opportunity for saving patients at high risk and preventing development of high risk status in the first place.

CONCLUSION & RECOMMENDATIONS

In conclusion, the simple assessment of waist and hip circumferences may be an additional and valuable tool to predict CVD risk alongside the Framingham Risk Scores of Malay males. Malaysian CHD predictors should be developed by following up multiracial cohorts since different ethnic groups might have different risk factors. Evaluation of indicators on adiposity (waist circumference and WHR) should also be carried out on larger cohorts

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