

Waist-hip ratio to identify the cardiovascular risk factors among people in the South Dagon Township, Yangon, Myanmar

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A cross-sectional community-based descriptive study was conducted in South Dagon Township, Myanmar during March, 2001. The objective of this study was to determine the frequency of some cardiovascular risk factors in people categorized by various levels of waist-hip ratio. A total of 294 men and 329 women aged 40-60 years were studied. A waist-hip ratio exceeding 0.94 in men and 0.91 in women correctly identified subjects with body mass index of $\geq 27.8 \text{ kg/m}^2$ and body fat percent of ≥ 20 in men and those of ≥ 27.3 and ≥ 30 , respectively in women with sensitivities of $\geq 86\%$ for men and $\geq 52\%$ for women, and specificities of $\geq 64\%$ and $\geq 49\%$ respectively. Men and women with at least one cardiovascular risk factor (total cholesterol $\geq 250 \text{ mg/dL}$, systolic blood pressure $\geq 160 \text{ mmHg}$, diastolic blood pressure $\geq 95 \text{ mmHg}$) were identified with sensitivities of 57% for both sexes and specificities of 70% and 53% respectively. Compared with those with lower waist-hip ratio levels, age and life style (physical activity, cigarette smoking) adjusted odds ratios for having at least one risk factor were 2.2 in men with a waist-hip ratio of 0.95-1.00 and 1.5 in women with a waist-hip ratio of 0.92-0.97. In men and women with larger waist-hip ratios, these age and life style adjusted odds ratios were 2.4 and 3.0 respectively. In conclusion, larger waist-hip ratio identifies people at South Dagon Township at increased cardiovascular risks especially in men.

INTRODUCTION

In Myanmar, ischaemic heart disease (IHD) is an important priority health problem identified in National Health Plan (1996-2001). Elimination or reduction of one or more risk factors of IHD may cause a corresponding decrease in the probability of contracting IHD.

Among the modifiable risk factors, obesity and elevated blood lipids are the important risk factors in association with IHD. Obesity is defined as a body mass index (BMI) in excess of 30 kg/m^2 , with being overweight as having a BMI between 25 and 30. BMI values above 27.8 for men and 27.3 for women are associated with an increased incidence of high blood pressure, Diabetes Mellitus, and IHD [1]. However, BMI has

limitations. The numerator of the BMI equation is affected by factors other than excess body fat, such as bone and muscle mass. Most people cannot readily calculate their index to establish their own risk or need for weight management.

Based on data from physically active young adults, it is probably desirable to consider as average a body fat content of 15% for men and about 25% for women. The determination of body fat percent calculated from measured skin fold thicknesses needs special instrument, technical skills and computations which general public cannot easily make. Moreover, the equations used to calculate body fat percent are "population specific": they are most accurate with subjects similar to those from whom the equations were derived.

Body fat distribution, independent of total body fat, alters the health risks of obesity. More specifically, ratios of waist- to- hip girth that exceed 0.80 for women and 0.95 for men are associated with an increased risk of coronary artery disease [2], hypercholesterolemia, hypertension, atherosclerosis and other illnesses [3].

The major metabolic cardiovascular risk factors (plasma lipids, high blood pressure, insulin resistance) all aggregate independently with both body mass index and waist - hip ratio and improve with weight loss [4, 5]. Weight loss and accompanying body fat reduction generally normalize cholesterol and triglyceride levels and have a beneficial effect on blood pressure and adult-onset diabetes.

In this study waist-hip ratio was used as a simple predictor of health risk from being overweight and its relationship with some cardiovascular risk factors was determined.

General objective

To determine cardiovascular risk factors in people in the South Dagon Township categorized by various levels of waist-hip ratio.

Specific objectives

1. To identify the waist-hip ratio levels of people aged forty to sixty years in South Dagon Township.
2. To find out the waist-hip ratio as a simple predictor of health risk from being overweight or having high body fat percent.
3. To determine the relationship between waist-hip ratio and cardiovascular risk factors.

MATERIALS AND METHODS

Study design

A cross-sectional community-based descriptive study.

Study population

Both male and female of 40 to 60 years old living in South Dagon Township.

Sample size determination and sampling procedure

In South Dagon Township, 12 wards were randomly selected for the study. From each ward 60 subjects of both sexes, 40 to 60 years old were selected by simple random sampling method. A total of 623 male and female were included in this study. Those taking drugs that can affect blood cholesterol level and those who are acutely ill were not included.

Data collection methods:

- (1) Proper history taking was done according to the proforma.
- (2) Body weight, body height, blood pressure, skin fold thicknesses were measured according to standard methods.
- (3) Waist and hip circumferences were measured by a steel measuring tape. Waist and hip circumferences were operationally defined [6] with slight modification. Waist circumference was measured around the waist, over the abdomen where the girth is largest while standing relaxed, not pulling in the stomach. Hip circumference was measured around the hip, over the buttocks where the girth is largest.
- (4) Fasting serum total cholesterol level was measured by using Cholesterol RTU test kit based on an enzymatic method [7].

RESULTS

Physical and metabolic characteristics of 294 men and 329 women are shown in table 1. Mean age, body mass index, waist-hip ratio were similar in men and women. Men had higher blood pressure and lower waist and hip circumferences, total serum cholesterol concentration and body fat percent.

Table 1. Physical and metabolic characteristics of 294 men and 329 women

Characteristics	Men		Women	
	Mean	SD	Mean	SD
Age (years)	49.9	6.1	49.0	5.6
Weight (kg)	57.3	12.2	52.4	12.4
Height (cm)	162.4	5.7	151.5	5.7
Body mass index (kg/m ²)	21.7	4.2	22.8	4.7
Waist circumference (cm)	82.2	12.1	85.1	10.8
Hip circumference (cm)	88.5	8.0	93.2	10.6
Waist-hip ratio	0.93	0.06	0.91	0.05
Total cholesterol (mg/dL)	206.9	47.1	224.3	51.8
Body fat percent	14.1	6.0	27.8	6.5
Systolic blood pressure (mmHg)	128	21	123	20
Diastolic blood pressure (mmHg)	88	13	84	12

Table 2 and Table 3 show prevalence, positive and negative predictions, and sensitivity and specificity of high cholesterol concentration (≥ 250 mg/dL) and hypertension (systolic pressure ≥ 160 mmHg or diastolic pressure ≥ 95 mmHg) in men and in women, respectively by different levels of waist-hip ratio. Sensitivity and specificity for identifying risk factors from waist-hip ratio (≥ 0.95 in men and ≥ 0.92 in women) were between 57% and 70% in men and 57% and 53% in women, respectively with positive 25% prediction varying between 25% and 38% in men and 21% and 32%, respectively in women for individual risk factors. Positive prediction increased to 53% in men and 43% in women who had one or more risk factors. Negative prediction was much higher, 73% varying between 73% and 92%.

In Table 4, odds ratio of men and women having high cholesterol concentration and hypertension in different categories of waist-hip ratio adjusted for age, cigarette smoking and physical activity by logistic regression are shown. Compared with those with lower waist-hip ratio levels, age and lifestyle adjusted odds ratios for having at least one cardiovascular risk factor were 2.2 in men with a waist-hip ratio of 0.95-1.00

and 1.5 (statistically not significant) in women with a waist-hip ratio of 0.92-0.97. In men and women with larger waist-hip ratios, these age and lifestyle adjusted odds ratios were 2.4 and 3.0 respectively.

Table 4. Odds ratio of high cholesterol concentration (≥ 250 mg/dL) and hypertension (systolic pressure ≥ 160 mmHg or diastolic pressure ≥ 95 mmHg) in different categories of waist-hip ratio adjusted for age, cigarette smoking and physical activity in men and women

Waist-hip ratio	Odds Ratio		
	High total cholesterol	Hypertension	One or more risk factor
Men (n=294)			
<0.95	1.00	1.00	1.00
0.95-1.00	2.85	2.16	2.16
>1.00	5.77	2.43	2.43
Women (n=329)			
<0.92	1.00	1.00	1.00
0.92-0.97	1.16	1.54	1.54
>0.97	1.49	3.02	3.02

DISCUSSION

In South Dagon Township, mean waist-hip ratios in men and women are 0.93 and 0.91 respectively. Prospective studies suggest cut offs of waist-hip ratio, 0.95 in men and 0.80 in women as values above which health risk increases appreciably. In our study, 40% of the men (117 out of 294) (data not shown) had waist-hip ratios above this figure. For the women, the mean value of waist-hip ratio, 0.91 is very much higher than cut off value, 0.80; and 99.1% of women (326 out of 329) (data not shown) had waist-hip ratios above this figure. It means that waist-hip ratio cut off value, 0.80 could not be applied to the women in our study population.

With high sensitivity (95.24%) and specificity (64.47%) (data not shown), waist-hip ratio ≥ 0.95 in men identifies people with BMI ≥ 27.8 kg/m² which is associated with an increased incidence of

Table 2. Prevalence, positive and negative predictions, and sensitivity and specificity of high cholesterol concentration (≥ 250 mg/dL) and hypertension (systolic pressure ≥ 160 mmHg or diastolic pressure ≥ 95 mmHg) in 294 men by different levels of waist-hip ratio

Risk factor	Prevalence*	Percentage (95% confidence interval)			
		Positive prediction	Negative prediction	Sensitivity	Specificity
<i>Waist-hip ratio (≥ 0.95)</i>					
High total cholesterol	14.97	24.8 (17.5 to 33.8)	91.5 (86.2 to 95.0)	65.9 (50.0 to 79.1)	64.8 (58.5 to 70.6)
Hypertension	26.53	37.6 (29.0 to 47.1)	80.8 (74.1 to 86.2)	56.4 (44.7 to 67.4)	66.2 (59.4 to 72.4)
One or more risk factor	36.73	53.0 (43.6 to 62.2)	74.0 (66.8 to 80.2)	57.4 (47.5 to 66.8)	70.4 (63.2 to 76.8)
<i>Waist-hip ratio (≥ 1.00)</i>					
High total cholesterol	14.97	30.4 (18.2 to 45.9)	87.9 (83.0 to 91.6)	31.8 (19.1 to 47.7)	87.2 (82.3 to 91.0)
Hypertension	26.53	41.3 (27.3 to 56.7)	76.2 (70.3 to 81.3)	24.4 (15.7 to 35.6)	87.5 (82.2 to 91.5)
One or more risk factor	36.73	60.9 (45.4 to 74.5)	67.7 (61.5 to 73.4)	25.9 (18.2 to 35.4)	90.3 (84.9 to 94.0)

*Prevalence of risk factors in total population

Table 3. Prevalence, positive and negative predictions, and sensitivity and specificity of high cholesterol concentration (≥ 250 mg/dL) and hypertension (systolic pressure ≥ 160 mmHg or diastolic pressure ≥ 95 mmHg) in 329 women by different levels of waist-hip ratio

Risk factor	Prevalence*	Percentage (95% confidence interval)			
		Positive prediction	Negative prediction	Sensitivity	Specificity
<i>Waist-hip ratio (≥ 0.92)</i>					
High total cholesterol	29.18	31.5 (24.7 to 39.2)	73.3 (65.6 to 79.8)	55.2 (44.7 to 65.3)	50.6 (44.1 to 57.2)
Hypertension	17.63	21.4 (15.6 to 28.6)	86.3 (79.8 to 91.1)	62.1 (48.3 to 74.2)	51.3 (45.2 to 57.4)
One or more risk factor	38.60	42.9 (35.3 to 50.7)	65.8 (57.9 to 73.0)	56.7 (47.6 to 65.4)	52.5 (45.4 to 59.5)
<i>Waist-hip ratio (≥ 0.97)</i>					
High total cholesterol	29.18	40.9 (26.7 to 56.7)	72.6 (67.0 to 77.6)	18.8 (11.8 to 28.3)	88.8 (83.9 to 92.4)
Hypertension	17.63	25.0 (13.7 to 40.6)	83.5 (78.6 to 87.5)	19.0 (10.3 to 31.8)	87.8 (83.2 to 91.4)
One or more risk factor	38.60	50.0 (34.8 to 65.2)	63.2 (57.2 to 68.7)	17.3 (11.4 to 25.3)	89.1 (83.8 to 92.9)

*Prevalence of risk factors in total population

IHD, high blood pressure and Diabetes Mellitus [1]. Similarly, it identifies the people with high body fat percent ($\geq 20\%$) with high sensitivity (85.71%) and specificity (72.73%) (data not shown). Therefore, waist-hip ratio exceeding 0.94 in men correctly identified subjects with body mass index of ≥ 27.8 kg/m² and body fat

percent of ≥ 20 with sensitivities of $\geq 86\%$ and specificities of $\geq 64\%$, respectively. Because waist-hip ratio cut off point, 0.80 could not be applied to the study women population, an arbitrary cut off point, 0.92 which is close to the mean value was used to identify those with high BMI (≥ 27.3 kg/m²) or high body fat percent

(≥30%). Even this cut off point could only identify women with sensitivities (51.85% and 61.11%, respectively) (data not shown) and specificities (49.09% and 56.76%, respectively) (data not shown). The smaller the cut off point value, the more increase sensitivity becomes while specificity is decreased, and the reverse is true for the larger cut off point. So the power to identify those with high body mass index or high body fat percent by various waist-hip ratio levels in women is weak in study population.

The study shows the close relation between waist-hip ratio and cardiovascular risk factors. The mean serum total cholesterol concentration in men, systolic and diastolic blood pressures of men and women increased significantly with waist-hip ratio (results not shown). In addition to that, waist-hip ratio significantly correlated similarly to body mass index and body fat percent with these cardiovascular risk factors (results not shown). Moreover, men and women with at least one cardiovascular risk factor (total cholesterol ≥250mg/dL, systolic blood pressure ≥160mmHg, diastolic blood pressure ≥95mmHg) were identified with sensitivities of 57 % for both sexes and specificities of 70% and 53%, respectively (Table 2 and 3). Finally, waist-hip ratio cut off measurement identified cardiovascular risk factors at one and a half times to twice the prevalence in the whole population at waist-hip ratio 0.95 in men and 0.92 in women, and two and a half to three times at waist-hip ratio 1.00 in men and 0.97 in women (Table 4). These results suggest that different levels based on waist-hip ratio may provide a valuable, simple method for alerting people in the South Dagon Township at increased risk of cardiovascular disease.

In conclusion, larger waist-hip ratio identified people at South Dagon Township at increased cardiovascular risks especially in men. Different levels of waist-hip ratio might be used to identify general population

at high risk of chronic disease from high total serum cholesterol concentration and hypertension who might benefit from weight management.

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