Malaysia Shape of the Nation (MySoN): A Primary Care Based Study of Abdominal Obesity In Malaysia

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SUMMARY

Abdominal obesity (AO), measured by waist circumference (WC), is a stronger predictor of subsequent development of cardiovascular disease (CVD) than generalised obesity, which is measured by body mass index (BMI). This study aimed to measure WC and prevalence of AO in Malaysians visiting primary care physicians. 1893 patients between the ages of 18 and 80 attending primary care clinics in Malaysia were recruited over two days for this multi-centre cross-sectional study. Pregnant women were excluded, their medical history, weight, height and WC were examined. The prevalence of co-morbidities were as follows: (1) CVD-4%, lipid disorder-17%, hypertension-26%, diabetes-14% and any of the clinical characteristics of CVD/lipid disorder/hypertension/diabetes-38%. The mean BMI for men and women was 25.62±4.73 kg/m² and 26.63±5.72 kg/m², respectively. Based on WHO criteria for BMI (overweight, 25-29.9 kg/m²; obese, >30 kg/m2), 34.2% were overweight and 20.4% were obese. The mean WC for men and women was 89.03±13.45 cm and 84.26±12.78 cm, respectively. Overall, 55.6% had AO and there was higher prevalence among women (based on International Diabetes Federation criteria: WC ≥90 cm for men and ≥80 cm for women). AO was present in approximately 71% patients with lipid disorder, in 76% with hypertension and in 75% with diabetes. Patients with AO were also at a higher risk of developing co-morbidities. Malaysia has a high prevalence of AO and associated cardiovascular risk factors. This needs to be addressed by public health programs, which should also include routine measurement of WC.

INTRODUCTION

Obesity is a chronic metabolic disorder associated with cardiovascular disease (CVD) as well as increased morbidity and mortality worldwide, in both developed and developing countries. The prevalence of obesity has reached epidemic levels in both first world and developing countries[1]. The 1996 Second National Health and Morbidity Survey (NHMS 2) reported the prevalence of overweight and obesity, according to calculated body mass index (BMI), to be 20.7% and 5.8% respectively [2,3].

Recent conflicting evidence on the association of BMI with cardiovascular (CV) and obesity-related health risk casts doubt on its usefulness [4-5]. It is believed that the global burden of obesity has been substantially underestimated due to reliance on BMI in previous studies [6]. It has also been shown that Asians are prone to diabetes, hypertension, and dyslipidaemia at lower levels of BMI [7-9], and that the same level of BMI connotes a greater degree of obesity in Asians compared with Caucasians [10-12].

Newer evidence suggests that abdominal obesity (AO), which is measured by waist circumference (WC), is a stronger predictor than generalised obesity (defined by elevated BMI) of subsequent major coronary event, vascular mortality, diabetes and the metabolic syndrome [13-16]. Therefore, in recent years, increasing interest has been focused not just on obesity as an individual risk factor, but also on type 2 diabetes, hypertension and dyslipidaemia, all of which together constitute the metabolic syndrome.

NHMS2 findings showed the prevalence of diabetes to be 8.2% (as compared to 6.3% in NHMS1 in 1986) [2]. The WHO has estimated that in 2030, Malaysia would have a total number of 2.48 million diabetics compared to 0.94 million in 2000 – a 164% increase [17]. Patients with diabetes have a two to three fold higher incidence of CVD than non-diabetic patients, and CVD is responsible for the majority of hospital admissions for diabetic individuals [18]. Thus, obesity has become a major clinical and public health problem that threatens to overwhelm already extended healthcare services in Malaysia.

The increasing attention on the epidemic of obesity and its associated health problems has brought into focus the lack of nationally representative cross-sectional data for the Malaysian population. This has become an obstacle to monitoring the magnitude of the current and future obesity problems, and to evaluating the effectiveness of intervention strategies.

The purpose of Malaysia Shape of the Nation (MySoN) study was therefore to estimate the distribution of WC and the prevalence of AO in a population of Malaysian patients visiting primary care physicians. Secondary objectives were to estimate the prevalence of specific CV risk factors (hypertension, diabetes or dyslipidaemia) and to estimate the prevalence of AO in such sub-groups of patients. The study also offered an educational opportunity for physicians to learn about WC measurement, and about CV and metabolic consequences of AO.

MATERIALS AND METHODS

This multi-centre cross-sectional study was conducted at 93 primary care clinics in Malaysia. The study was conducted in accordance with the principles laid by the 18th World Medical Assembly (Helsinki, 1964) and all subsequent amendments and as per the guidelines for Good Epidemiology Practice[19]. The study proposal was approved by the Medical and Research Ethics Committee of the Malaysian Ministry of Health. Data release consent was obtained from all the subjects included in the study.

Study Population and Sampling

The study population consisted of adult men and women (age >18 and <80 years) attending primary care clinics in both the public and private sectors across the country on the 22nd and 23rd June 2005. Pregnant women were excluded from the study.

The sampling frame for the public primary care clinics was obtained from the National Medicines Use Survey of the Ministry of Health and for the private clinics from IMS[20]. Public primary care clinics were stratified by 14 states in Malaysia. For each state, a quota of clinics was selected based on the size of the population in that state. Figures for the population were obtained from the National Population and Housing Census of 2000[21].

A total of 93 clinics were selected by simple random sampling. Each patient satisfying the selection criteria and visiting a physician's office during these predefined half-days was asked to participate in the study.

Study Assessment

The relevant data were obtained from patients' medical records, by face-to-face interviews and direct measurements. The socio-demographic variables such as age, gender, ethnicity, education level, occupation, smoking as well as medical history (CVD, lipid disorders, hypertension, diabetes, post-menopause, and hormonal replacement therapy) were also collected.

Body weight, height and WC were measured by the attending physician. Body weight (without shoes in light indoor clothing) was measured using a bathroom spring balance to the nearest 0.1 kg. Height (without shoes) was measured using a measuring tape attached to a rigid wall to the nearest 0.1 cm. WC was measured using a measuring tape in a horizontal plane at a mid-point between the lower rib and the iliac crest. Measurement was made at the end of normal expiration with the tape parallel to the floor and the tape snug but not compressing the skin. All physicians attended centralised training on standardised protocol for body weight, height and WC measurement. A standardised measuring tape was provided to all physicians.

Study Definitions

BMI is defined as the ratio of weight in kilograms to square of height in meters. For the purpose of this analysis, BMI was categorised according to the classification system recommended by the WHO Technical Report Series[1] as follows:

- Underweight, <18.5 kg/m^2
- Normal, 18.5-24.9 kg/m^2
- Overweight, 25-29.9 kg/m^2
- Obese, ≥30 kg/m^2

Abdominal obesity was defined according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria of WC ≥102 cm for men and WC ≥88 cm for women 22, as well as in accordance with the WHO and International Diabetes Federation (IDF) criteria for Asians, i.e., WC ≥90 cm for men and WC ≥80 cm for women[23-24].

Statistical Methods

In order to provide sufficiently precise estimates, the sample size calculation took into consideration the expected prevalence of AO among patients visiting a primary care physician and the precision that we were willing to accept. Using prevalence from previous studies, which ranged from 20%-50%, and 95% confidence intervals of 17.6%-22.6% and 46.8%-53.1% respectively, it was calculated that we would require a sample size of 1000 subjects. All statistical tests were performed at the 5% level of significance using 2-sided tests.

Continuous variables were described by summary statistics such as mean, median, standard deviation and cumulative percent. Categorical (nominal/ordinal) variables are summarized by the frequencies of each category.

RESULTS

Baseline Characteristics

A total of 1,893 subjects (47.5% women) were enrolled in the study. About 56% were provided by public primary care clinics (29 centres) and 44% by private practitioners (64 centres). The demographic characteristics of enrolled subjects are shown in Table I.

The mean age was 44 + 14 years. About 49% of the sample was of Malay ethnic origin and the majority (about 78%) had attained less than tertiary education. This was as expected from a sample that is representative of the Malaysian middle-aged population. More than 68% had never smoked. However, 4% of the study population had existing CVD, while 17% had lipid disorder, 26% hypertension and 14% diabetes. About 38% had one of the clinical characteristics of CVD / lipid disorder / hypertension / diabetes. Clearly, this is more typical of a population attending outpatient clinics rather than the general Malaysian population.

Mean Body Mass Index and Waist Circumference

The mean BMI and WC by gender, ethnicity and age are presented in Table II.

The mean BMI for men was 25.62 $\pm$ 4.73 kg/m^2, while for women it was 26.63 $\pm$ 5.72 kg/m^2. Women had higher mean BMI than men among all groups (except for Chinese) and in all age groups till the seventh decade, after which the mean BMI values of the two sexes converged. Among women, Indians had the highest BMI, followed by Malays and Chinese. Among men, Chinese had the highest BMI followed by Indians, Malays and others.

Mean WC for men was 89.03 $\pm$ 13.45cm, while for women it was 84.26 $\pm$ 12.78cm. It was higher in men than in women for all ethnic groups. In all ethnic-gender groups, BMI and WC rose with increasing age till fifth or sixth decade, thereafter it declined. The rise in BMI with age was steeper for women than for men.

Table I: Baseline Characteristics of Patients Enrolled in the Study

Baseline Characteristics	Men N= 899	Women N= 993	All* N=1893
Age in Years (Mean + SD)	44 ± 14	44 ± 14	44 ± 14
Ethnicity [Number (%)]			
Malay	425	505	930 (49.1)
Chinese	263	291	555* (29.3)
Indian	174	159	333 (17.6)
Others	26	32	58 (3.1)
Missing	11	6	17 (0.9)
Mean Body Weight in Kg (Mean + SD)	71.9 ± 14.4	63.9 ± 14.2	67.7 ± 14.8
Primary Care Clinic [Number (%)]			
Public	534	526	1060 (56)
Private	365	467	832 (44)
Level of Education [Number (%)]			
Less than High school	279	382	661 (34.9)
High school	415	399	814 (43)
Tertiary	204	207	412*(21.8)
Missing	1	5	6 (0.3)
Occupational Status [Number (%)]			
Employed	726	545	1271 (67.2)
Unemployed	63	366	429 (22.7)
Retired	92	47	139 (7.3)
Incapacitated for work	3	12	15 (0.8)
Missing	15	23	38 (2)
Smoking Status [Number (%)]			
Never	356	948	1304 (68.9)
Former	153	17	170 (9)
Current	388	24	412 (21.8)
Missing	2	4	6 (0.3)
Known Cardiovascular Disease (CVD) [Number (%)]	48 (5.3)	31 (3.1)	79 (4.2)
Known Lipid Disorder [Number (%)]	163 (18.1)	162 (16.3)	325 (17.2)
Known Hypertension [Number (%)]	240 (26.7)	259 (26.1)	499 (26.4)
Known Diabetes Mellitus [Number (%)]	124 (13.8)	136 (13.7)	260 (13.7)
Known Post-menopausal [Number (%)]	NA	282 (28.4)	282 (14.9)
CVD / Lipid Disorder / Hypertension / Diabetes Mellitus (any of the clinical characteristics) [Number (%)]	357 (39.7)	369 (37.2)	726 (38.4)

SD = standard deviation

* Information on gender missing for one Chinese patient

Table II: Mean Body Mass Index and Waist Circumference by Socio-Demography Factors

Characteristics	Body Mass Index (kg/m^2)		Waist Circumference (cm)	
	Mean	SD	Mean	SD
Age				
15-19	22.78	5.09	75.79	13.04
20-24	23.20	5.00	76.21	11.95
25-29	25.06	6.13	81.29	13.60
30-34	25.80	5.00	85.26	12.99
35-39	26.98	5.42	88.12	14.44
40-44	26.60	5.11	87.02	11.34
45-49	27.16	5.01	89.83	13.46
50-54	27.33	4.84	89.76	11.82
55-59	27.61	5.40	92.29	12.48
60-64	25.80	4.43	87.76	10.55
65-69	25.75	4.47	88.73	11.13
70-74	25.39	4.94	88.19	12.81
75+	23.83	4.16	82.61	10.27
Gender				
Male	25.62	4.73	89.03	13.45
Female	26.63	5.72	84.26	12.78
Ethnicity				
Malay	26.78	5.82	86.21	13.82
Chinese	24.86	4.42	85.20	12.86
Indian	26.54	4.89	89.89	12.44
Others	25.21	3.91	83.22	10.93

SD = standard deviation

Table III: Distribution of Body Mass Index by Socio-Demography Factors and Patient Diagnosis Status

Socio-Demography Factors or Patient Diagnosis Status	Body Mass Index (kg/m²)*			
	Underweight n (%)	Normal n (%)	Overweight n (%)	Obese n (%)
Age				
15-19	7 (20.59)	18 (52.94)	6 (17.65)	3 (8.82)
20-24	16 (10.74)	94 (63.09)	26 (17.45)	13 (8.72)
25-29	14 (7.18)	100 (51.28)	46 (23.59)	35 (17.95)
30-34	10 (5.24)	77 (40.31)	66 (34.55)	38 (19.90)
35-39	7 (3.52)	68 (34.17)	78 (39.20)	46 (23.12)
40-44	9 (4.07)	87 (39.37)	75 (33.94)	50 (22.62)
45-49	4 (1.75)	83 (36.40)	86 (37.72)	55 (24.12)
50-54	6 (2.58)	66 (28.33)	106 (45.49)	55 (23.61)
55-59	3 (1.74)	52 (30.23)	62 (36.05)	55 (31.98)
60-64	5 (4.76)	44 (41.90)	40 (38.10)	16 (15.24)
65-69	3 (3.66)	39 (47.56)	28 (34.15)	12 (14.63)
70-74	4 (9.52)	17 (40.48)	16 (38.10)	5 (11.90)
75+	4 (10.53)	20 (52.63)	11 (28.95)	3 (7.89)
Gender	92 (4.87)	765† (40.50)	646 (34.20)	386 (20.43)
Male	47 (5.23)	375 (41.76)	327 (36.41)	149 (16.59)
Female	45 (4.55)	389 (39.29)	319 (32.22)	237 (23.94)
Ethnicity				
Malay	49 (5.27)	334 (35.95)	312 (33.58)	234 (25.19)
Chinese	32 (5.77)	268 (48.29)	191 (34.41)	64 (11.53)
Indian	11 (3.32)	129 (38.97)	118 (35.65)	73 (22.05)
Others	0	30 (52.63)	19 (33.33)	8 (14.04)
Known Cardiovascular Disease (CVD)				
Yes	2 (2.53)	34 (43.04)	26 (32.91)	17 (21.52)
No	89 (4.94)	727 (40.39)	618 (34.33)	366 (20.33)
Known Lipid Disorder				
Yes	5 (1.54)	94 (29.01)	136 (41.98)	89 (27.47)
No	86 (5.54)	666 (42.88)	506 (32.58)	295 (19)
Known Hypertension				
Yes	7 (1.4)	119 (23.85)	199 (39.88)	174 (34.87)
No	85 (6.14)	643 (46.42)	445 (32.13)	212 (15.31)
Known Diabetes				
Yes	3 (1.16)	76 (29.34)	109 (42.09)	71 (27.41)
No	88 (5.41)	687 (42.25)	537 (33.03)	314 (19.31)
Post-menopause				
Yes	10 (3.53)	97 (34.29)	106 (37.46)	70 (24.73)
No	34 (5.01)	281 (41.38)	204 (30.04)	160 (23.56)
CVD / Lipid Disorder / Hypertension / Diabetes Mellitus (any of the clinical characteristics)				
Yes	13 (1.79)	204 (28.14)	290 (40)	218 (30.07)
No	79 (6.79)	561 (48.2)	356 (30.58)	168 (14.43)

*Body mass index classification based on WHO Technical Report Series, 2000:
Underweight, <18.5 kg/m²
Normal, 18.5-24.9 kg/m²
Overweight, 25-29.9 kg/m²
Obese, >30 kg/m²

†Information on gender missing for one patient

Prevalence of Obesity

The percent distribution of BMI according to WHO classification[1] is presented in Table III. Overall, 34.2% subjects had BMI in the overweight group, 20.4% in the obese group, and 40.5% in the normal group, while 4.9% subjects were underweight. Both overweight and underweight were more common among men than women, but obesity was more common among women. Indians had the highest prevalence of overweight, followed by Chinese, Malays and other indigenous groups. However, Malays had the highest prevalence of obesity.

Table IV presents the percent distribution of WC according to the classification of AO by the WHO and IDF[23-24]. Overall 55.6% of the population had AO, with a higher prevalence among women. Indians had the highest prevalence of AO, followed by Malays, Chinese and other indigenous groups.

There was high prevalence of obesity and AO in sub-groups of patients with co-morbid conditions such as hypertension, diabetes or dyslipidemia (Tables III and IV). Based on measurement of WC, a very high percentage of patients were at increased CV risk in each sub-group: AO was present in approximately 71% with lipid disorder, in 76% with hypertension and in 75% with diabetes. In fact, patients with AO were also at a higher risk of developing co-morbidities (Figure 1).

DISCUSSION

Abdominal obesity poses a major challenge to health worldwide and is associated with CV risk. There have been few studies on obesity in the Malaysian population[25-27]. The MySoN study provides valuable data about the prevalence of AO and associated CV risk factors such as hypertension, diabetes or dyslipidemia in Malaysia.

Table IV: Distribution of Central Obesity by Socio-Demography Factors and Patient Diagnosis Status

Socio-Demography Factors or Patient Diagnosis Status	Waist Circumference (cm)*	
	Normal n (%)	At Risk n (%)
Age		
• 15-19	27 (79.41)	7 (20.59)
• 20-24	120 (80.54)	29 (19.46)
• 25-29	126 (64.62)	69 (35.38)
• 30-34	92 (48.17)	99 (51.83)
• 35-39	80 (39.80)	121 (60.20)
• 40-44	99 (44.80)	122 (55.20)
• 45-49	78 (34.06)	151 (65.94)
• 50-54	66 (28.33)	167 (71.67)
• 55-59	45 (26.16)	127 (73.84)
• 60-64	41 (39.05)	64 (60.95)
• 65-69	32 (39.02)	50 (60.98)
• 70-74	17 (40.48)	25 (59.52)
• 75+	17 (44.74)	21 (55.26)
Gender	840 (44.40)	1052 (55.60)
• Male	467 (51.95)	432 (48.05)
• Female	373 (37.56)	620 (62.44)
Ethnicity		
• Malay	418 (44.95)	512 (55.05)
• Chinese	271 (48.92)	283 (51.08)
• Indian	115 (34.53)	218 (65.47)
• Others	30 (51.72)	28 (48.28)
Known Cardiovascular Disease (CVD)		
Yes	30 (37.97)	49 (62.03)
No	805 (44.65)	998 (55.35)
Known Lipid Disorder		
Yes	95 (29.23)	230 (70.77)
No	739 (47.52)	816 (52.48)
Known Hypertension		
Yes	122 (24.45)	377 (75.55)
No	716 (51.59)	672 (48.41)
Known Diabetes		
Yes	66 (25.38)	194 (74.62)
No	771 (47.36)	857 (52.64)
Post-menopause		
Yes	71 (25)	213 (75)
No	286 (42.06)	394 (57.94)
CVD / Lipid Disorder / Hypertension / Diabetes Mellitus (any of the clinical characteristics)		
Yes	201 (27.69)	525 (72.31)
No	639 (54.8)	527 (45.2)

*Waist circumference specific values based on International Diabetes Federation consensus worldwide.
Abdominal obesity is defined as WC ≥90 cm for men and WC ≥80 cm for women

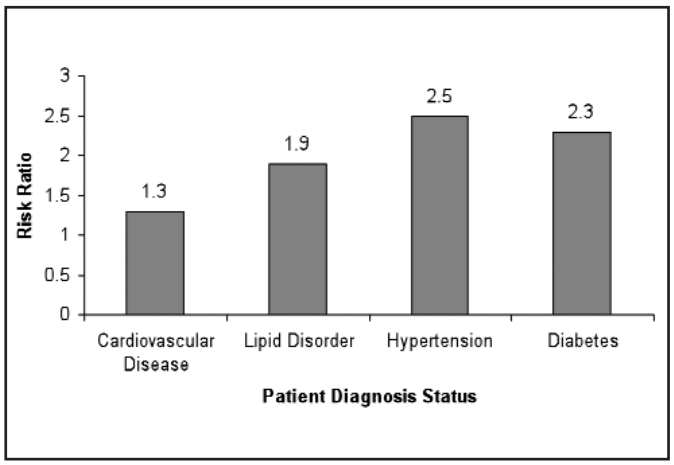

Fig. 1: Risk ratio of co-morbidities in Malaysian patients with abdominal obesity

In the MySoN study, the average value of WC was 89.03 cm for men and 84.26 cm for women. By the IDF criteria of WC for AO (≥90 cm in men and ≥80 cm in women), the prevalence of AO was found to be very high (55.6%), being even higher in the female population. While AO has reached epidemic proportions worldwide, we found the prevalence of AO in Malaysia was even greater than the prevalence in western countries such as the United States of America [28], Belgium [29] and France [30] or in Asian countries such as South Korea [31], Singapore [32] and Hong Kong [33].

Even when based on BMI, the prevalence of overweight (34.2%) and obesity (20.4%) in MySoN study was higher than that observed in the NHMS 2 and previous Malaysian studies. In these studies, the prevalence of overweight ranged from 20.7%-37.4%, while that of obesity ranged from 4.5%-10% [2,25-26,34]. A national survey on the prevalence of obesity among 16,127 Malaysians found that the overall national prevalence of obesity among Malaysians >15 years was 11.7%. The

prevalence of obesity amongst those aged >18 years has markedly increased by 280% since NHMS 2 [27].

This extraordinary increase in the prevalence of obesity corroborates with the greatly increased rates of CVD in low- and middle-income countries, which now bear about 80% of the global burden of CVD [35]. Moreover, even in the rural Malaysian population that is conventionally thought of as low-risk for CVD, there is high prevalence of overweight or obesity (45%), and other CV risk factors such as hypertension, smoking, lipid disorder and diabetes [36]. At the total Malaysian population level, this high prevalence of obesity probably results from a complex interaction between an inherited metabolic predisposition to fatness and changes in the population's lifestyle (i.e., higher energy and fat consumption and reduced physical activity) [37].

The high prevalence of overweight and obesity in Malaysia is associated with adverse lipid and glucose metabolism as well as poor blood pressure control [26]. Even in our study, there was high prevalence of lipid disorder (17%), hypertension (26%), diabetes (14%) and any of the clinical characteristics of CVD / lipid disorder / hypertension and diabetes (38%). In our study, AO was more prevalent in individuals with CVD (62%) than in those without CVD (55.4%). The prevalence patterns for AO observed among patients with and without lipid disorder (70.8% vs 52.5%), hypertension (75.6% vs 48.4%) or diabetes (74.6% vs 52.6%) were similar. In fact, patients with AO were also at a higher risk of developing co-morbidities, with a risk ratio of 1.9 for lipid disorder, 2.5 for hypertension and 2.3 for diabetes.

Overweight has already been shown to play an important role in the clustering of CV risk factors in western populations [38-39]. It has also been shown to be an independent risk factor for CVD in populations from China [40] and South Korea [41]. This clustering is significant because people with both diabetes and hypertension have approximately twice the risk of CVD [42]. In Malaysia, both diabetes mellitus and hypertension are associated with significantly higher BMIs [25]. In an earlier Malaysian study, subjects with diabetes were more obese (38.4%) than normal subjects (24.1%), and also had a higher prevalence of hypertension and hypercholesterolemia [43]. The prevalence of dyslipidemia was also high in Malaysian type 2 diabetes patients [44]. Moreover, the control of hypertension and diabetes in Malaysia is very poor [17, 45-46]. Hence, unless it is addressed urgently, the rate of CVD and diabetes in Malaysia is expected to increase sharply in the near future as a consequence of the high prevalence of overweight and obesity [47].

Considering the significant associations between clustering of CVD risk factors and WC, the present study suggests that high prevalence of overweight and AO may have important implications for the health care system. Because overweight significantly increases the prevalence of associated risk factors, especially hypertension, it should be considered as a major CV risk determinant [48].

The MySoN study was conducted in primary care, as this was a feasible way of recruiting large numbers of individuals. Results cannot be extrapolated to the general Malaysian population, but only to the population consulting primary care physicians. We also assessed whether the relationships between AO and CV risk factors differed across ethnic groups in Malaysia. The MySoN questionnaire did not distinguish between type 1 and type 2 diabetes. As the majority of patients with diabetes (85% to 95%) have type 2 diabetes, the observed relationships between diabetes and obesity would be primarily driven by type 2 diabetes.

An important strength of MySoN study was the physicians' training to measure WC using a standardized approach [49]. In this study, we chose to use WC as a measure of AO because a close relationship between WC and the amount of intra-abdominal fat has been observed using CT scans [50]. Since Asians may require a lower cut-off level of WC to define AO [23,32], we used the WC cut-off for Asians. Also, since WC requires only a single measurement, it is easier, less time consuming and less subject to error than combining measurements of waist and hip for the waist:hip ratio. However, intra- and inter-physician variability in measuring WC was not formally assessed.

The MySoN study highlights the magnitude of the problem of obesity in Malaysia. It shows that AO is more frequent in patients with CVD, lipid disorder, hypertension and diabetes, and also increases the risk of developing these co-morbid conditions. Serious note should be taken of these findings and national guidelines must be formulated for the identification and optimal management of AO and the associated CV risk factors in Malaysia.

While the MySoN study has increased awareness of AO among primary care physicians, the importance of this risk factor remains inadequately recognized. Routine measurement of WC – a convenient and inexpensive measure in primary care – provides a clinical marker for risk of CVD and other co-morbidities. The rise in adiposity in Malaysia is likely to contribute to major increases in CV morbidity and mortality, unless adequately addressed by public health programs.

CONFLICT OF INTEREST

None.

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