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Body Mass Index versus the Metabolic Syndrome in Relation to Cardiovascular Risk in the Chinese Elderly

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Running title: BMI and Metabolic Syndrome in CVD risk in China

Yao He, MD, PhD [1,2] ; Bin Jiang, MD, PhD [3] ; Jie Wang, MD, PhD [4] ; Kang Feng, MD[1] ; Qing Chang, MD [1] ; Shanxiang Zhu, MPH [1]; Li Fan, MD[5] ; Xiaoying Li, MD [5] ; Frank B. Hu, MD, PhD [2]

Author Affiliations:
[1] Institute of Geriatrics, Chinese PLA General Hospital, China
[2] Nutrition, Harvard School of Public Health, USA
[3] Acupuncture, Chinese PLA General Hospital, China
[4] Clinic of PLA Communication, China
[5] Geriatric Cardiology, Chinese PLA General Hospital, China

Corresponding Author:
Dr. Yao He, Institute of Geriatrics, Chinese PLA General Hospital, 28 Fuxing Road, Beijing 100853, China. (yhe301@sina.com) or Dr. Frank Hu, Nutrition, Harvard, Boston (frank.hu@channing.harvard.edu)

ABSTRACT

OBJECTIVE: To evaluate the associations of body mass index (BMI) versus metabolic syndrome (MS) with cardiovascular diseases (CVD) in Chinese elderly.

RESEACH DESIGN AND METHODS: We conducted a population-based cross-sectional study in an urban elderly sample of 2,334 subjects (943 men and 1,391 women). Subjects were classified by BMI (≤ 18.5 kg/m^2, < 24 kg/m^2, < 28 kg/m^2, and ≥ 28 kg/m^2), and the presence or absence of MS, which was defined by International Diabetes Federation (IDF) criteria. CVD included clinically diagnosed coronary heart disease (CHD), stroke, and peripheral arterial disease (PAD).

RESULTS: The prevalence of overweight (BMI≥25) and metabolic syndrome according to the IDF criteria was 56.3% (53.9% in men, 57.9% in women) and 46.3% (34.8% in men, 54.1% in women), respectively. Increasing BMI was strongly associated with a higher risk of CHD, stroke, and PAD even after adjusting for MS and other CVD risk factors. Stratified analysis of participants with or without metabolic syndrome showed that BMI was independently associated with CHD, stroke, and PAD.

CONCLUSIONS: Both overweight and MS are highly prevalent in this elderly Chinese population. BMI, as a measure of overall adiposity, is strongly associated with increased prevalence of CVD independent of MS.

China is experiencing rapid economic growth and ageing of its population. Resulting changes in lifestyle and longer life expectancy have led to an increased burden of cardiovascular diseases (CVD) and other chronic diseases (1-2). A nationwide study from China indicates that more than 30% of adults are overweight, and the prevalence of metabolic syndrome (MS) is 13.7% (3). Obesity and MS frequently coexist, and both are associated with CVD risk (4-9). In our recent report in Chinese urban elderly, the prevalence of MS by the NCEP (10) and new IDF (11) criteria were 30.5% and 46.3%, and the individuals with MS defined by either criteria were at significantly elevated risks for CVD (12). However, the role of obesity as an independent etiologic factor for CVD remains controversial (13-14). Previous studies have suggested that the association between body mass index (BMI) and risk of CVD became non-significant after adjusting for MS (14). In this study, we examined the relative associations of BMI versus MS with the prevalence of CVD in a population-based survey of elderly Chinese in Beijing, China.

RESEACH DESIGN AND METHODS

This study was a population-based cross-sectional survey of individuals 60 years of age or older living in the Wanshoulu Community of Haidian District, a metropolitan area of the geographic and economic characteristics in Beijing, China. Two-stage stratified sampling method was used. First, 9 residential communities or streets (about 300-600 households) was randomly selected from a total of 94 residential communities in the Wanshoulu Area in Beijing. Second, all households were chosen from the selected streets, but only one eligible participant was randomly selected from each household. Between April 2001 and March 2002, 2,680 people aged 60 -95 years were selected and invited for screening. 2,334 subjects (943 men and 1,391 women) attended five clinics where detailed health evaluations were completed, yielding a response rate of 87.1% (83.5% in men and 89.7% in women), and they accounted for 11.4% of elderly residents in the Wanshoulu Area.

The details of data collection had been reported elsewhere (12). Height was measured in meters (without shoes) and weight in kilograms (with heavy clothing removed and 1 kg deducted for remaining garments). Waist circumference was measured while subjects were standing with a soft tape midway between the lowest rib and the iliac crest. Two blood pressure recordings were obtained from the right arms of patients in a sitting position after 30 minutes of rest; measurements were taken in 5-minute intervals, and mean values were calculated. We also performed other physical examinations and tests [including ECG, an ankle-arm systolic blood pressure index (AAI), and typical symptoms] to diagnose coronary heart disease (CHD) and peripheral artery disease (PAD).

Classification of BMI

BMI was calculated as body weight in kilograms divided by the square of the height in meters (kg/m^2). According to World Health Organization (WHO) criteria (4), overweight was defined as a BMI ≥ 25.0 kg/m^2. However, WHO-recommended cut-points for BMI may be inappropriate for Asian populations (e.g., Chinese). In the present study, BMI was classified into four categories: ≤18.5, 18.5-23.9, 24.0-27.9, and ≥ 28.0. These categories are based on the criteria of the Cooperative Meta-Analysis Group of the Working Group on Obesity in China (15).

Definition of MS

We used the 2005 International Diabetes Federation (IDF) definition of MS. It includes central obesity (≥ 90 and ≥ 80 cm in Chinese men and women, respectively) plus any two of the following four factors: 1) high blood pressure; ≥ 130/85 mmHg or known treatment for hypertension; 2) hypertriglyceridemia; fasting plasma triglycerides ≥ 1.7 mmol/L; 3) fasting HDL-cholesterol < 1.0 mmol/L in men and < 1.3 mmol/L in women; 4) hyperglycemia; fasting glucose level of ≥ 5.6 mmol/L (≥ 100 mg/dl) or known treatment for diabetes (11).

Diagnosis of CVD

Hypertension was defined as diastolic blood pressure of ≥ 90 mmHg, systolic blood pressure of ≥ 140 mmHg, or current medication for hypertension. CHD and stroke were defined using the WHO MONICA criteria (16). Major CHD events include myocardial infarction (n=68) and confirmed angina (n=715). Myocardial infarction was diagnosed by a representative set of ECG, cardiac enzyme values, and typical symptoms. Angina was defined as use of nitroglycerine, experience of typical chest pain and ECG changes compatible with ischemic heart disease (58% of the cases were validated against by exercise test or B-mode ultrasonography, but were not randomly selected).There were 365 cases of stroke (235 ischemic, 70 hemorrhagic and 60 other types). Strokes were defined as events requiring hospitalization; this information was verified from local hospital records and 83% of the cases were confirmed by computed tomography (CT) and magnetic resonance imaging (MRI). Subjects with a fasting plasma glucose ≥7.0 mmol/L and/or a 2-h plasma glucose ≥11.1 mmol/L during an oral glucose tolerance test and/or who were receiving antidiabetic medications were diagnosed with diabetes mellitus. PAD was assessed as positive intermittent claudication by WHO/Rose questionnaire or an ankle-arm systolic blood pressure index < 0.9 (17).

Statistical Analysis

Data were entered (double entry) and managed by Microsoft Access (Microsoft Corp., Redmond, Washington). We calculated gender-specific prevalence of overweight and MS. We used logistic regression to calculate odds ratios (OR) and their 95% confidence intervals (CI). We also conducted both stratified analyses and the multiple logistic regression analyses to examine the independent and combined effects of BMI and the metabolic syndrome. The statistical package was SPSS (version 11; SPSS Ins., Chicago, Illinois). We adjusted for potential confounders (age, marital status, years of education, smoking and alcohol drinking, physical exercise, and family histories of CHD or stroke).

RESULTS

According to the WHO definition for overweight (BMI ≥ 25.0 kg/m^2) and the IDF criteria for MS, prevalence rates for overweight and MS in this elderly Chinese population were 56.3% (53.9% in men and 57.9% in women) and 46.3% (34.8% in men and 54.1% in women), respectively.

General characteristics of the 2,334 subjects (943 men and 1,391 women) categorized by BMI are shown in Table 1. We found a clear increasing trend in risk factors of CVD and clinical outcomes from subjects with lower BMI to those with higher BMI. The Pearson correlation coefficient between BMI and waist circumference was 0.78 (P < 0.0001).

Table 2 shows that the proportion of MS components (i.e., hyperglycemia, high blood pressure, hypertriglyceridemia, low HDL-cholesterol, central obesity) and the number of components in the four BMI groups (i.e., ≤ 18.5, < 24, < 28 and ≥ 28).

Table 3 shows the ORs for the subjects with BMI ≤ 18.5, < 24, < 28 and ≥ 28 for CHD, stroke, PAD, and total CVD (CHD, stroke, PAD). Increasing BMI was strongly associated with increased the risk of CHD, stroke, PAD, and total CVD, and these associations were somewhat attenuated but remained statistical significant even after adjusting for the presence or absence of MS.

Table 4 shows the result of stratified analysis of the relative association of BMI versus metabolic status on CHD, stroke, PAD, and total CVD. Both elevated BMI and the MS were associated with increased risk of CVD. Among those who were obese (BMI≥28.0), the risk of CHD and CVD was similar between those with and without MS. Interestingly, the ORs of stroke and PAD in those underweight with MS were highest in all groups and of being 2.10 (0.21-21.26) and 2.79(0.37-21.15).

The interactions between BMI and MS in CHD, stroke, PAD and CVD were tested in multivariate logistic models by adjusting for gender, age, marital status, education, and other covariates. None of interaction terms were statistically significant (P values were 0.09, 0.70, 0.73, and 0.16, respectively).

Figure 1 describes the multivariate adjusted ORs of CHD, stroke, PAD, and CVD in subjects in all BMI groups (i.e., < 18.5, < 24, < 28 and ≥ 28) with or without MS, and their 95% CIs were showed in Table 4. There was a significant dose-response relation between the increasing categories of BMI and risk of CHD, PAD and CVD in subjects without MS.

CONLUSIONS

Overweight and obesity are a rapidly growing threat to the public health worldwide (4), especially in economically developing countries such as China. In the past two decades, the prevalence of overweight and obesity in China has increased dramatically (6), which has led to increased prevalence of chronic diseases especially type 2 diabetes and CVD in Chinese populations.

According to the WHO definition of overweight and the IDF criteria of MS, prevalence rates of overweight and MS in this study were 56.3% and 46.3%, respectively. These figures are lower than those in the same age group in the U.S (18, 19), but higher than those seen in other studies conducted in Chinese populations (3, 6, 20-22). The relative high prevalence of CHD (32% in men and 35% in women) and stroke (17% in men and 15% in women) in this population is probably due to higher average age of our participants (69 years in men and 67 years in women) and our selection of urban elderly in Beijing.

Because the WHO-recommended BMI cut-points may be inappropriate for the Chinese population, we used the BMI cut-point criteria of the Cooperative Meta-Analysis Group of the Working Group on Obesity in China (i.e., ≤ 18.5, underweight; 18.5-23.9, normal weight; 24.0-27.9, overweight; and ≥ 28.0, obese) (15). The respective corresponding prevalence rates of overweight and obesity in this study were 46.4% and 22.2%. As expected, there was a strong positive correlation between increasing BMI and the prevalence of MS (Table 2).

The relation of BMI to MS and its role as an independent risk factor for CVD have been recent topics of debate (9, 13). In 2004, the WISE study reported that MS, but not BMI, predicted future cardiovascular risk in women referred for coronary angiography (14). Other epidemiological studies, however, have reported that obesity and MS are independent cardiovascular risk factors (4-9). The present study shows that both BMI and the metabolic syndrome are independently associated with CHD, stroke, PAD, and total CVD. In particular, among those who did not meet the diagnostic criteria for the metabolic syndrome, there was a dose-response relationship between increasing BMI and higher prevalence of CVD. Interestingly, among those who were obese (BMI≥28.0), the risk of CHD and CVD was similar between those with and without the diagnosis of the MS (Table 4). These data suggest assessment of CVD risk cannot completely depend on the diagnosis of the MS. For obese subjects who do not meet the criteria for the MS, they should be evaluated and managed as aggressively as those who have the MS for CVD risk assessment and reduction. The positive association between BMI and CVD was weaker among those with the MS, and this is probably due to fact that BMI and waist circumference are highly correlated and the effects of waist circumference were already taken into account in the definition of the MS. This pattern of BMI as an independent risk factor for both CHD and stroke in Chinese adults is consistent with other Chinese prospective studies data (23-25).

BMI is a measure of overall adiposity, whereas waist circumference is a marker of central obesity. In our and other studies, there was a strong correlation between

BMI and waist circumference. However, BMI was strongly correlated the MS in our population, which was not completely accounted for by waist circumference. It has been suggested that waist circumference may be more strongly correlated with insulin resistance and chronic inflammation, the underlying mechanism for the MS (26). This has served the rationale for including waist circumference instead of BMI as one of the diagnostic criteria for the MS. However, the measures of BMI and waist circumference do not completely overlap (r=0.78). Numerous epidemiologic studies have shown that BMI and fat distribution independently predict various metabolic disorders (27). Our data suggest that BMI can provide additional predictive value on CVD risk beyond the MS. Therefore, in clinical practice, both BMI and waist circumference should be measured and monitored for CVD risk assessment, especially in high risk populations.

To the best our knowledge, this report is the first to evaluate the relative effects of body weight versus MS on CVD in a population-based study in China. As an independent risk factor of CVD, BMI is easier to measure in primary intervention settings than the diagnosis of MS, and thus, is of clinical importance. It is also easily accepted by the clinicians and the general public. It is well-suited for use in health education and promotion in primary care settings.

The cross-sectional nature of this study does not allow us to assess the temporal relationship between the MS and CVD and thus limits causal inference. However, the temporal associations of BMI and MS with CVD have been well-established in previous studies. The higher OR of stroke and PAD in underweight subjects with MS might be due to the fact that the elderly with MS were more likely to lose weight. This was a random cluster-selected sample with a relatively high response rate. Approximately 13% of eligible subjects dropped out of the study (e.g., left original residence, did not complete interviews or examinations), but no statistically significant differences in demographic characteristics such as age, sex, education, and marital status were detected between responders and nonresponders. Because our study population might not be a representative sample, the prevalence of MS may not generalize to other parts of China

In conclusion, the present study indicates that both overweight and MS are highly prevalent in urban China. Our findings support a strong association of MS and CVD, as well as an independent role of BMI in predicting the risk of CVD in elderly Chinese. BMI can be more easily applied in clinical practice than the diagnosis of MS. Developing effective public health strategies for the prevention and treatment of overweight and MS should be an urgent priority to reduce the social and public health burden of CVD in China.

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Table 1. Clinical and metabolic characteristics in subjects with BMI ≤18.5, <24, <28, and ≥28

Characteristics	BMI (kg/m^2)				Total	P for trend
	(≤18.5)	(18.6-23.9)	(24.0-27.9)	(≥28.0)		
n (F/M)	118(71/47)	614(357/257)	1081(628/453)	518(334/184)	2334(1391/943)	
Mean (SD)						
Age (years)	70.7 (7.6)	67.8 (6.0)	67.3 (5.7)	67.5 (5.7)	67.6 (6.0)	<0.001
Systolic blood pressure (mmHg)	130.6 (22.6)	134.0 (20.6)	136.1 (20.2)	143.6 (22.1)	136.9 (21.1)	<0.001
Diastolic blood pressure (mmHg）	72.4 (11.5)	75.3 (10.3)	77.6 (10.5)	79.3 (9.4)	77.1 (10.4)	<0.001
Waist circumference (cm)	71.9 (6.3)	80.6 (6.5)	88.6 (6.1)	97.2 (7.1)	87.6 (9.4)	<0.001
Total cholesterol (mmol/L)	5.11 (0.96)	5.36 (2.39)	5.34 (1.42)	5.37 (1.01)	5.34 (1.65)	0.363
Triglyceride (mmol/L)	1.07 (0.66)	1.37 (1.13)	1.63 (1.07)	1.68 (0.87)	1.55 (1.04)	<0.001
HDL- cholesterol (mmol/L)	1.61 (0.40)	1.46 (0.33)	1.35 (0.47)	1.31 (0.29)	1.38 (0.40)	<0.001
LDL- cholesterol (mmol/L)	2.93 (0.85)	3.23 (0.88)	3.29 (0.79)	3.40 (1.45)	3.28 (1.01)	<0.001
Fasting glucose (mmol/L)	5.52 (1.77)	6.01 (2.05)	6.15 (1.80)	6.37 (1.96)	6.13 (1.91)	<0.001
Number (%)						
Current smoking						
Men	18 (38.3)	72 (28.0)	106 (23.4)	37 (20.1)	233 (24.7)	0.007
Women	14 (19.7)	32 (9.0)	51 (8.1)	23 (6.9)	120 (8.6)	0.003
Current drinking						
Men	13 (27.7)	87 (33.9)	137 (30.2)	46 (25.0)	283 (30.0)	0.135
Women	3 (4.2)	20 (5.6)	36 (5.7)	12 (3.6)	71 (5.1)	0.409
Coronary heart disease						
Men	11 (23.4)	63 (24.5)	144 (31.8)	73 (39.7)	291 (31.9)	<0.001
Women	16 (22.5)	111 (31.1)	236 (37.6)	129 (38.7)	492 (35.4)	0.002
Stroke						
Men	11 (23.4)	37 (14.4)	73 (16.1)	41 (22.3)	162 (17.2)	0.245
Women	9 (12.7)	40 (11.2)	102 (16.3)	52 (15.6)	203 (14.6)	0.100
Peripheral arterial disease						
Men	3 (6.4)	33 (12.8)	71 (15.7)	32 (17.4)	139 (14.7)	0.042
Women	15 (21.1)	73 (20.4)	144 (22.9)	90 (26.9)	322 (23.1)	0.053
Family histories of CHD or stroke	30 (25.4)	205 (33.4)	406 (37.6)	195 (37.6)	836 (35.8)	0.010

Table 2. Prevalence of individual metabolic syndrome (MS) components and component numbers in subjects with BMI ≤18.5, <24, <28 and ≥28

Metabolic status	BMI (kg/m^2) (≤18.5)			(18.6-23.9)			(24.0-27.9)			(≥28.0)			P for Trend		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Individual component															
High blood pressure (%)	57.4	56.3	56.8	67.3	64.7	65.8	72.8	75.3	74.3	88.0	82.6	84.6	<0.001	<0.001	<0.001
Hyperglycemia (%)	21.3	32.4	28.0	40.9	44.7	43.1	57.4	54.6	55.8	64.1	61.4	62.4	<0.001	<0.001	<0.001
Hypertriglyceridemia (%)	4.3	11.3	8.5	12.1	25.8	20.1	26.9	36.1	32.3	31.5	43.7	39.4	<0.001	<0.001	<0.001
Low HDL-cholesterol (%)	4.3	16.9	11.9	7.8	27.8	19.4	18.8	40.4	31.4	25.5	41.9	36.1	<0.001	<0.001	<0.001
Central obesity (%)	2.1	8.5	5.9	12.5	44.8	31.4	61.1	91.9	79.0	97.8	100	99.2	<0.001	<0.001	<0.001
Metabolic syndrome (%)	0	1.6	0.9	7.5	24.4	17.3	38.9	64.8	53.9	71.7	76.0	74.5	<0.001	<0.001	<0.001
Numbers of components															
One or more	68.1	77.5	73.7	79.2	88.5	84.6	94.7	98.4	96.9	100	100	100	<0.001	<0.001	<0.001
Two or more	17.0	35.2	28.0	42.4	68.5	57.8	77.0	90.1	84.6	96.2	95.2	95.6	<0.001	<0.001	<0.001
Three or more	4.3	9.9	7.6	13.3	33.4	25.0	46.4	65.8	57.6	72.8	76.0	74.9	<0.001	<0.001	<0.001
Four or more	0	2.8	1.7	4.3	14.6	10.3	16.6	33.4	26.4	29.9	43.4	38.6	<0.001	<0.001	<0.001
Five	0	0	0	0	2.5	1.5	2.4	10.7	7.2	8.2	15.0	12.5	<0.001	<0.001	<0.001

Table 3. Odds ratios of coronary heart disease (CHD), stroke, peripheral arterial disease (PAD) and total vascular diseases (CVD) according to BMI categories

	BMI (kg/m^2)				P for trend
	(≤18.5)	(18.6-23.9)	(24.0-27.9)	(≥28.0)	
CHD					
OR[1] (95%CI)	0.63 (0.39-1.02)	1.00 (Ref)	1.42 (1.14-1.77)	1.63 (1.27-2.10)	<0.001
OR[2](95%CI)	0.64 (0.40-1.04)	1.00 (Ref)	1.42 (1.14-1.77)	1.62 (1.25-2.09)	<0.001
OR[3] (95%CI)	0.68(0.42-1.10)	1.00 (Ref)	1.26(1.00-1.59)	1.33(1.01-1.77)	0.005
Stroke					
OR[1] (95%CI)	1.20 (0.70-2.08)	1.00 (Ref)	1.40 (1.04-1.87)	1.57 (1.13-2.18)	0.049
OR[2](95%CI)	1.17 (0.67-2.02)	1.00 (Ref)	1.34 (1.00-1.80)	1.45 (1.04-2.03)	0.139
OR[3] (95%CI)	1.21(0.69-2.10)	1.00 (Ref)	1.20(0.88-1.64)	1.16(0.80-1.67)	0.014
PAD					
OR[1] (95%CI)	0.67 (0.38-1.18)	1.00 (Ref)	1.25 (0.96-1.62)	1.47 (1.09-1.98)	0.01
OR[2](95%CI)	0.62 (0.35-1.09)	1.00 (Ref)	1.24 (0.95-1.62)	1.46 (1.08-1.97)	0.007
OR[3] (95%CI)	0.65(0.37-1.14)	1.00 (Ref)	1.13(0.86-1.50)	1.27(0.92-1.77)	0.030
CVD					
OR[1] (95%CI)	0.70 (0.46-1.07)	1.00 (Ref)	1.53 (1.25-1.88)	1.99 (1.56-2.53)	<0.001
OR[2](95%CI)	0.69 (0.45-1.05)	1.00 (Ref)	1.51 (1.23-1.86)	1.93 (1.51-2.47)	<0.001
OR[3] (95%CI)	0.73(0.48-1.11)	1.00 (Ref)	1.36(1.10-1.70)	1.62(1.23-2.11)	<0.001

[1]Adjusted for gender and age (years).
[2] Adjusted for gender, age (years), marital status, education (years: ≤6, 7-12, ≥13), exercise (hours/day: <1, 1-3, ≥ 4), alcohol drinking (current drinkers vs. non current drinkers), cigarette smoking (never, current, former) and family histories of coronary heart disease or stroke.
[3] Adjusted for gender, age (years), marital status, education (years: ≤6, 7-12, ≥13), exercise (hours/day: <1, 1-3, ≥ 4), alcohol drinking (current drinkers vs. non current drinkers), cigarette smoking (never, current, former), family histories of coronary heart disease or stroke, and metabolic syndrome (yes/no).

Table 4. Stratified analysis of the OR of coronary heart disease (CHD), stroke, peripheral arterial disease (PAD), and total vascular diseases in subjects with BMI ≤ 18.5, < 24, < 28, and ≥ 28 with or without metabolic syndrome (MS)

	BMI (kg/m^2)								P for Trend
	(≤18.5)		(18.6-23.9)		(24.0-27.9)		(≥28.0)		
	MS(-)	MS(+)	MS(-)	MS(+)	MS(-)	MS(+)	MS(-)	MS(+)	
CHD									
OR[1] (95%CI)	0.72 (0.44-1.17)	0.63 (0.06-6.27)	1.00 (Ref)	1.70 (1.09-2.66)	1.18 (0.89-1.56)	2.04 (1.57-2.66)	1.97 (1.31-2.95)	1.81 (1.36-2.42)	<0.001
OR[2](95%CI)	0.74 (0.45-1.21)	0.65 (0.06-5.89)	1.00 (Ref)	1.74 (1.11-2.73)	1.18 (0.89-1.57)	2.04 (1.56-2.66)	2.01 (1.33-3.04)	1.79 (1.34-2.41)	<0.001
Stroke									
OR[1] (95%CI)	1.30 (0.74-2.31)	2.02(0.20-20.42)	1.00 (Ref)	1.52 (0.84-2.75)	1.12 (0.76-1.63)	1.92 (1.36-2.72)	1.45 (0.83-2.51)	1.82 (1.25-2.66)	0.005
OR[2](95%CI)	1.25 (0.70-2.31)	2.10(0.21-21.26)	1.00 (Ref)	1.45 (0.80-2.64)	1.08 (0.73-1.59)	1.81 (1.28-2.57)	1.39 (0.79-2.42)	1.66 (1.13-2.42)	0.022
PAD									
OR[1] (95%CI)	0.64 (0.35-1.16)	2.67(0.35-20.23)	1.00 (Ref)	1.18 (0.69-2.00)	1.04 (0.74-1.47)	1.48 (1.09-2.03)	1.57 (0.97-2.53)	1.50 (1.07-2.10)	0.012
OR[2](95%CI)	0.58 (0.32-1.06)	2.79(0.37-21.15)	1.00 (Ref)	1.15 (0.68-1.97)	1.03 (0.73-1.46)	1.47 (1.08-2.01)	1.57 (0.97-2.54)	1.47 (1.04-2.08)	0.009
CVD									
OR[1] (95%CI)	0.74 (0.48-1.14)	2.41(0.24-24.28)	1.00 (Ref)	1.53 (0.99-2.36)	1.24 (0.96-1.60)	2.17 (1.69-2.79)	2.47 (1.65-3.69)	2.09 (1.58-2.75)	<0.001
OR[2](95%CI)	0.73 (0.47-1.13)	2.79(0.22-22.89)	1.00 (Ref)	1.54 (1.00-2.38)	1.23 (0.95-1.59)	2.14 (1.66-2.75)	2.44 (1.63-3.65)	2.02 (1.53-2.67)	<0.001

[1]Adjusted for gender and age (years).
[2]Adjusted for gender, age (years), marital status, education (years: ≤6, 7-12, ≥13), exercise (hours/day: <1, 1-3, ≥ 4), alcohol drinking (current drinkers vs. non current drinkers), cigarette smoking (never, current, former) and family histories of coronary heart disease or stroke.

FIG 1. The Multivariate Adjusted Odds Ratio of CHD, Stroke, PAD and CVD (CHD/Stroke/PAD) in the subjects of BMI < 18.5, <24, <28 and ≥28 with or without the metabolic syndrome (MS)