Prevalence and distribution of metabolic syndrome in a southern Chinese population

Relation to exercise, smoking, and educational level

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ABSTRACT

الأهداف : دراسة معدل الانتشار والإصابة بمتلازمة الإصابة بالسمنة في سكان المنطقة الجنوبية في الصين، وأثر التمارين، والتدخين ومستوى التعليم في الإصابة بمتلازمة الأيض.

الطريقة: أجريت دراسة مقطعية في مدينة زهاي، الصين خلال الفترة من يونيو حتى أغسطس 2012م. جمعت بيانات عن التمارين الرياضية، والتدخين، والمستوى التعليمي، ومؤشرات القياسات البشرية، وضغط الدم، ومستويات الجلوكوز، والدهون. كما تم تعريف معدل الإصابة بمتلازمة الأيض طبقاً لتعريف الاتحاد الدولي لمرض السكري. كما تم الحصول على البيانات الضرورية لتقييم متلازمة الأيض، والمعلومات الشخصية والحياة اليومية من 4645 شخص تراوحت أعمارهم من 18 حتى 75 عام.

النتائج: ظهرت السمنة لدى 19.8% من عينة البحث. كما كان المعدل المعياري للإصابة بمتلازمة الأيض أقل لدى الذكور بالمقارنة مع الإناث (adjusted odds: 0.75; 95% CI: 0.57-1.01). كما أن المدخنين أكثر عرضة للإصابة بمتلازمة الأيض بالمقارنة مع غير المدخنين (adjusted odds: 1.61; 95% CI: 1.13-2.50). والأشخاص الذين لا يمارسون التمارين أكثر عرضة للإصابة بمتلازمة الأيض بالمقارنة مع الذين يمارسون الرياضة أكثر من 60 دقيقة/اليوم (adjusted odds: 1.51; 95% CI: 1.12-2.23). وبالمقارنة مع غير المتعلمين كلما زاد مستوى التعليم قلت عرضة الإصابة بمتلازمة الأيض بشكل إحصائي مهم (p<0.001).

خاتمة: أظهرت الدراسة أن المدخنين أكثر عرضة للإصابة بمتلازمة الأيض بالمقارنة مع غير المدخنين. بينما يعد ارتفاع النشاط الجسدي وارتفاع مستوى التعليم عوامل محصنة للسكان.

Objectives: To investigate the prevalence and distribution of metabolic syndrome (MetS) and the impact of exercise, smoking, and educational level on the risk of MetS in a southern Chinese population.

Methods: A cross-sectional study was conducted in Zhuhai City, China from June to August 2012. Data on exercise, smoking, and educational level, anthropometric parameters, blood pressure, lipid, and glucose levels were collected. The prevalence of MetS (as defined by the International Diabetes Federation) was determined. Data necessary to evaluate MetS, the socio-economic characteristics, and lifestyle were obtained for 4645 subjects aged 18-75 years old.

Results: A total of 19.8% of the participants had MetS. The adjusted odds of having MetS were lower among males (adjusted odds: 0.75; 95% confidence interval [CI]: 0.57-1.01) compared with females. Those participants who currently smoked had a higher risk of developing MetS compared with non-smokers (adjusted odds: 1.61; 95% CI: 1.13-2.50). Those who had no physical exercise had a higher risk of developing MetS compared with those who physically exercised more than 60 minutes/day (adjusted odds: 1.51; 95% CI: 1.12-2.23;). Compared with those with no education, every category of attained educational level had a lower risk of developing MetS (p<0.001).

Conclusion: The findings in this study revealed that current smokers had a greater risk of developing MetS compared with non-smokers. Increased physical activity and higher levels of education attained served as protective factors for the population.

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Metabolic syndrome (MetS) generally refers to a constellation of interrelated cardiac risk factors consisting of insulin resistance (IR) (impaired insulin action), visceral obesity, atherogenic dyslipidemia, endothelial dysfunction, and systemic inflammation.[1] It has been well established that MetS predisposes one to numerous cardiovascular risks. Metabolic syndrome is a combination of medical disorders that increases the risk of diabetes and cardiovascular disease. It is also a risk factor for atherosclerosis, a disorder that could progress to coronary artery disease or result in a cerebrovascular accident. Recently, a large number of studies provided substantial evidence linking MetS to acute coronary syndrome.[2-4] In a health care setting, discerning this role of MetS allows for the potential to reduce the risk of cardiovascular disease in the general population by treating the disease.[5] In addition, MetS may promote the development of several multifactorial urological disorders including nephrolithiasis, erectile dysfunction (ED), male infertility, benign prostatic hyperplasia/lower urinary tract symptoms, female incontinence, and prostate cancer (PCa).[6] Globally, MetS has become a public health concern and is a major cause of morbidity and mortality. Early detection of its prevalence factors will contribute to the formulation of comprehensive preventive strategies targeted at the preclinical stages of MetS. The association between lifestyle behaviors, educational status and MetS has been highlighted recently.[7-9] Some behaviors and lifestyles, specifically habits pertaining to physical activity, cigarette smoking and alcohol consumption, are deemed to be linked with MS via some studies. No conclusion however has been found to be consistently reproducible in all studies.[10-14] Due to the dramatic upturn of the economy and the subsequent changes in lifestyle and diet, China has also found itself burdened with MetS as a heightening health care problem. China is a country with a population of 1.3 billion people, living in a large geographical area, and engulfed by varied demographic characteristics. These demographic characteristics, cultural behaviors and lifestyle habits vary substantially in the different regions. In the last decade, several studies with regards to MetS and its prevalence within China have been conducted.[15-18] However, a large number of these studies focused mainly on the prevalence and distribution of MetS. Only a few studies focused on the relationship between lifestyle behaviors and MetS amongst the Chinese population.[19] Thus, the aim of this study is to investigate the prevalence and distribution of MetS using a door-to-door community cross-sectional screening study of the populace of ZhuHai, one of the leading commercial cities in southern China. We also aim to elucidate the association between lifestyle behaviors and MetS in the target population.

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Methods. *Study design and participants.* This cross-sectional study was conducted in Zhuhai City, a prominent commercial city in south China from June to August 2012. Data was collected from 4645 community residents (1714 males and 2931 females), and 18-75 years of age in the urban districts in Zhuhai. All community residents gave their written informed consent. This study was approved by the Ethics Committee of The Third Affiliated Hospital of Southern Medical University. This study was conducted according to principles of Helsinki Declaration. The sample size was calculated based on the following equation. The inspection level was 0.05. Given the fact that the prevalence of MetS was approximately 10% in a similar population,[15] the sample size was estimated based on this percentage with an error less than 0.02. The sample size consistent with this error was 4156. A multi-stage stratified cluster random sampling method was applied to obtain study subjects: step 1 - 2 communities were randomly selected by simple random sampling method; step 2 - in each of the 2 selected communities, 1000 families were randomly sampled as the target family; and step 3 - all of the residents aged from 18-75 in the selected families were sampled. The exclusion criteria included: missing gender; education status; missing any item of lifestyle information (for example, smoking status, alcohol intake, and physical activity); not being in the fasting state for at least 10 hours; missing any item of waist measurement blood pressure (BP), body mass index (BMI), blood glucose, serum high-density lipoprotein (HDL) cholesterol, and triglyceride (TG) levels information.

Study measurement. Socio-demographic characteristics, personal health history (for example; coronary artery disease, stroke, hypertension, and diabetes), and details regarding lifestyle (for example; smoking status, alcohol intake, and physical activity) were obtained by a questionnaire. Height and weight were measured in a standing position with subjects wearing light clothing and without shoes using an automated height and weight machine. The BMI was calculated accordingly. Subjects were in a standing position with arms on side, legs straight, and knees together, with feet flat pointed outward. Waist circumference was measured was measured in a horizontal plane, midway between the inferior margin of the rib and the superior border of the iliac crest. Central obesity was defined on the basis of ethnic specific values of waist circumference. Blood pressure was measured twice to the nearest 2 mm Hg by a trained nurse using a mercury closed desk-top sphygmomanometer (Model XJ300/40-1, Shanghai, China) after the participants had been seated, and given at least 5 minutes to rest. The first and fourth Korotkoff sounds were used to represent the systolic and diastolic BP. The average value of these 2 measuring points for systolic and diastolic BPs was recorded. Venous blood was collected into serum separating tube after an overnight fast. Blood glucose level was measured with a hexokinase enzyme reference method and serum creatinine with an enzymatic method on an auto-analyzer (Hitachi 7170, Hitachi, Tokyo, Japan). Serum HDL cholesterol and TG levels were determined enzymatically with commercially available reagents.

Determination of MetS. According to the definition of the International Diabetes Federation (IDF),[21] MetS can be diagnosed should central obesity (waist circumference >90 cm for men, or >80 cm for women) be accompanied by any 2 of the following 4 factors: 1) a TG level of 1.7 mmol/L or greater; 2) a HDL cholesterol level lower than 1.03 mmol/L for men, or lower than 1.29 mmol/L for women; 3) a BP of 130/85 mm Hg or higher, or receiving treatment for previously diagnosed hypertension; and 4) fasting blood glucose (FBG) of 5.6 mmol/L or higher, or with previously diagnosed type 2 diabetes.

Socioeconomic factors. The socioeconomic factors employed in this study hinged on attained education level. Education status was classified into 4 categories: 1) No - 0 years of schooling; 2) primary school - one to 5 years of schooling; 3) middle/high school - 6 to 10 years of schooling; and 4) college or university education - diploma.

Health behavior factors. Alcohol consumption was evaluated based on the frequency of alcohol intake as recorded on the health interview questionnaire. Residents were classified into 4 groups: 1) non-drinker; 2) less than one time a week: 3) 1-4 times a week; and 4) more than 5 times a week. For physical exercise, the subjects were placed into 4 groups: 1) no physical exercise; 2) less than 30 minutes/day; 3) 30-60 minutes/day; and 4) more than 60 minutes/day. Both group 3 and group 4 were tagged as regular physical activity. The grouping for smoking were as follows: 1) former smokers, quit smoking prior to the survey; 2) current smokers; and 3) non-smokers.

Statistical analysis. All analyses and calculations were carried out using statistical analysis software SAS version 9.1 (SAS Institute Inc, Cary, NC, USA). Mean± standard deviation (SD) was reported for numerical variable age. Proportions were reported for categorical variables such as gender, components of MetS, and so forth. The unadjusted odds ratio (OR) between gender, or socioeconomic factors, or health behavior factors and MetS was determined by univariate logistic regress models, and then adjustments were made for gender, socioeconomic factors, and health behavior factors by multivariate logistic regression models. All statistical tests were 2-sided, and $p<0.05$ was considered statistically significant.

Results. A total of 4645 records were included in the final analysis. The data indicates that out of the total participants, 1714 (36.9%) were males, and 2931 (63.1%) were females. A distinct profile of MetS components among the study participants is shown in **Figure 1**. A total of 21.0% of the participants had no risk factor for MetS, while 2.3% had 5 or more risk factors, 28.8% had one risk factor, 23.7% had 2 risk factors, 16.1% had 3 risk factors and 8.1% had 4 risk factors of MetS. **Table 1** shows the age- and gender- specific percentages of individual components of MetS. Of the total participants, 20.5% had BMI over 25. Compared with males, females had higher prevalence rates of BMI over 25 (59.9% versus 40.1%). A total of 40.8% of the

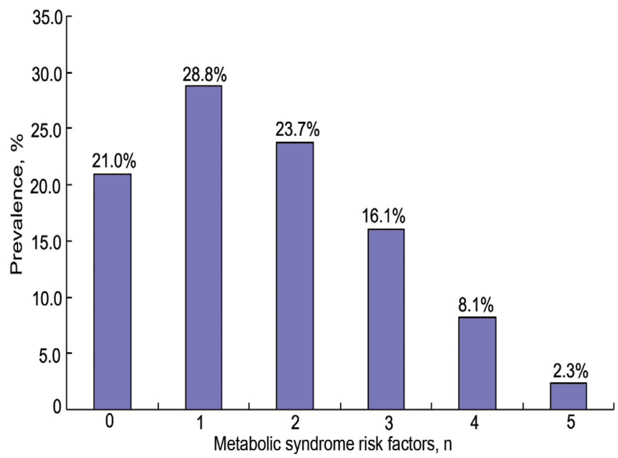

Figure 1 - Pattern of appearance of metabolic syndrome components among participants in a study conducted at Zhuhai City, China.

Table 1 - Age and gender specific prevalence of individual components of metabolic syndrome among participants included in a study at Zhuhai City, China (N=4645).

Variables	Total population	Men	Women	*P*-value
		n (%)		
Number, n (%)		1714 (36.9)	2931 (63.1)	
Age, mean ± SD	47.0 ± 14.7	47.3 ± 15.7	46.8 ± 14.1	0.231
BMI	952 (20.5)	382 (22.3)	570 (19.4)	0.115
Central obesity	1315 (28.3)	309 (18.0)	1006 (34.3)	<0.0001
Raised TG	1658 (35.7)	733 (42.8)	925 (31.6)	<0.0001
Reduced HDL cholesterol	1742 (37.5)	533 (31.1)	1209 (41.2)	<0.0001
Raised BP	1893 (40.8)	892 (52.0)	1001 (34.2)	<0.0001
Raised plasma fasting glucose	1201 (25.9)	498 (29.1)	703 (24.0)	<0.001

SD - standard deviation. Normal values: body mass index (BMI) - (≥25 kg/m²), central obesity - waist circumference >90 cm for men, or >80 cm for women; raised triglycerides (TG) - ≥150 mg/dL (1.70 mmol/L); reduced high density lipoprotein (HDL) cholesterol - <40 mg/dL (1.03 mmol/L) in men, <50 mg/dL (1.29 mmol/L) in women; raised blood pressure (BP) - ≥130/85 mm Hg; and raised plasma fasting glucose - ≥5.6 mmol/L

Table 2 - Age and gender specific prevalence of individual components of metabolic syndrome among participants less than 40 years old included in a study at Zhuhai City, China.

Variables	Total population	Men	Women	*P*-value
		n (%)		
Age, <40 years	1524 (32.8)	606 (39.8)	918 (60.2)	
BMI	147 (9.6)	73 (12.0)	74 (8.7)	0.01
Central obesity	165 (10.8)	42 (6.9)	123 (13.4)	<0.0001
Raised TG	383 (25.1)	208 (34.3)	175 (19.1)	<0.0001
Reduced HDL cholesterol	593 (38.9)	199 (32.8)	394 (4.3)	<0.0001
Raised BP	211 (13.9)	141 (23.3)	70 (7.6)	<0.0001
Raised plasma fasting glucose	236 (15.5)	126 (20.8)	110 (12.0)	<0.0001

Normal values: body mass index (BMI) - (≥25 kg/m²), central obesity - waist circumference >90 cm for men, or >80 cm for women; raised triglycerides (TG) - ≥150 mg/dL (1.70 mmol/L); reduced high density lipoprotein (HDL) cholesterol - <40 mg/dL (1.03 mmol/L) in men, <50 mg/dL (1.29 mmol/L) in women; raised blood pressure (BP) - ≥130/85 mm Hg; and raised plasma fasting glucose - ≥5.6 mmol/L

participants had raised plasma BP, 37.5% had reduced HDL levels, and 35.7% had raised TGs. However, 69.4% of the total female population had reduced HDL levels. In the total female population, 76.5% had waist circumference >80 cm. **Table 2** depicts the age- (less than 40 years) and gender- specific component of MetS. In all, 32.8% of the populations were less than 40 years old among whom 39.8% were males, and 60.2% were females. Approximately 38.9% of the population less than 40 years of age had reduced HDL levels, with 66.5% females, and 33.5% males ($p<0.0001$). The p-values were significant for all components, suggesting there existed significant differences between males and females with respect to the components of MetS. **Table 3** represents the age and gender specific distributions of components of MetS, pertaining to those older than 40 years of age. Of the total population, 67.2% were 40-year-olds and above, among whom 54.8% had reduced HDL levels, in which 55.5% were females and 44.5% were males ($p<0.0001$). A total of 40.9% of the population aged 40 years and above had raised TG levels, of which 58.8% were females and 41.2% were males ($p<0.0001$). All the results were statistically significant at 5% significance level ($p<0.05$) except that of raised plasma fasting glucose ($p<0.148$), and BMI >25 ($p<0.341$). The associations between demographics, education level, alcohol consumption, physical exercise and smoking status with regards to MetS is presented in **Table 4**. Of the total participants, 19.8% (95% CI: 18.7-20.9) had MetS. The adjusted odds (AO) of having MetS were lower among males (AO: 0.8; 95% CI: 0.6-1.0) compared to females. Current smokers had a higher risk of developing MetS compared to non-smokers (AO: 1.6; 95% CI: 1.1-2.5), and was significant ($p=0.012$). Compared to non-smokers, former smokers had no higher risk of developing MetS (AO: 0.8; 95% CI: 0.6-1.2). Those participants who did no physical exercise had a higher risk of developing MetS as compared with those who physically exercised more than 60 minutes/day (AO: 1.5; 95% CI: 1.1-2.2), and was significant ($p=0.048$). Compared to those with

Table 3 - Age and gender specific prevalence of individual components of metabolic syndrome among participants more than 40 years old included in a study at Zhuhai City, China.

Variables	Total population	Men	Women	*P*-value
		n (%)		
Age, >40 years	3121 (67.2)	1150 (36.9)	1971 (63.1)	
BMI	803 (25.7)	308 (26.8)	495 (25.1)	0.341
Central obesity	1147 (36.9)	266 (23.1)	881 (44.7)	<0.0001
Raised TG	1277 (40.9)	526 (45.7)	751 (38.1)	<0.0001
Reduced HDL cholesterol	1148 (36.9)	334 (29.0)	814 (41.3)	<0.0001
Raised BP	1710 (54.8)	761 (66.2)	949 (48.1)	<0.0001
Raised plasma fasting glucose	966 (40.0)	372 (32.3)	594 (30.1)	0.148

Normal values: body mass index (BMI) - (≥25 kg/m²), central obesity - waist circumference >90 cm for men, or >80 cm for women; raised triglycerides (TG) - ≥150 mg/dL (1.70 mmol/L); reduced high density lipoprotein (HDL) cholesterol - <40 mg/dL (1.03 mmol/L) in men, <50 mg/dL (1.29 mmol/L) in women; raised blood pressure (BP) - ≥130/85 mm Hg; and raised plasma fasting glucose - ≥5.6 mmol/L

Table 4 - Univariate and multivariable logistic regression analysis of factors associated with metabolic syndrome (MetS) in a study at Zhuhai City, China.

Variables	MetS present (N=920)	MetS absent (N=3725)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio* (95% CI)	*P*-value
Gender					
Female	650 (22.7)	2216 (77.3)	1	1	
Male	270 (15.2)	1509 (84.8)	0.7 (0.6-0.9)	0.8 (0.6-1.0)	0.231
Education status					
College or university education	210 (22.8)	1356 (36.4)	0.3 (0.2-0.4)	0.3 (0.2-0.4)	<0.0001
Middle/High school	434 (47.2)	1731 (46.5)	0.4 (0.3-0.6)	0.4 (0.3-0.6)	
Primary school	184 (20.0)	495 (13.3)	0.6 (0.4-0.9)	0.6 (0.4-0.9)	
No	92 (10.0)	143 (3.8)	1	1	
Alcohol consumption					
No drinking	33 (3.6)	156 (4.2)	1	1	0.614
Less than one time a week	59 (6.4)	257 (6.9)	1.1 (0.6-2.1)	1.2 (0.6-2.2)	
1-4 times a week	132 (14.4)	596 (16.0)	1.1 (0.6-1.9)	1.0 (0.6-1.9)	
More than 5 times a week	696 (75.6)	2716 (72.9)	1.3 (0.8-2.1)	0.9 (0.5-1.6)	
Physical exercise					
No physical exercise	464 (50.4)	1661 (44.6)	1.6 (1.1-2.4)	1.5 (1.1-2.2)	0.048
Less than 30 minutes/day	228 (24.8)	901 (24.2)	1.5 (1.0-2.3)	1.5 (1.0-2.3)	
30-60 minutes/day	171 (18.6)	835 (22.4)	1.2 (0.8-1.8)	1.2 (0.8-1.8)	
More than 60 minutes/day	57 (6.2)	328 (8.8)	1	1	
Smoking status					
Former smokers	100 (10.9)	589 (15.8)	0.7 (0.5-0.9)	0.8 (0.6-1.2)	
Current smokers	65 (7.1)	186 (5.0)	1.3 (0.9-1.9)	1.6 (1.1-2.5)	0.012
Non-smoking	755 (82.0)	2950 (79.2)	1	1	

CI - confidence interval, *adjusted for age, gender, education level, alcohol consumption, physical exercise, and smoking status

no education, every category of attained educational level had a lower risk of developing MetS ($p<0.001$). Alcohol consumption was statistically insignificant at the multivariate regression.

Discussion. According to our study, the prevalence rates of MetS is based on the International Diabetes Federation (IDF) criteria, which is 19.8% among the population in south China, that is lower than that of the United States (35-39%),[22] Korea (21%),[23] and that of Portugal (31.8%).[24] Compared with other developing countries, the prevalence of MetS in our study is higher than the Philippines (19%),[25] and lower than Malaysia (24.2%), India (28.8%), Turkey (33.4%), Iran (33.7%), Venezuela (31.2%), and Brazil (25.4%).[25] Aside from the methodological differences in our study and that of other studies, that is based on the different approaches to define and diagnose MetS, the variability of the prevalence of MetS between populations could be explained by demographic, epidemiological, and nutritional transitions,[26] as well as environmental and social influences,[27] and ethnic differences.[28]

In China, the prevalence of MetS has taken on an upward trend. Gu et al[15] reported the age-standardized prevalence of MetS as 9.8% for men, and 17.8% for women using the modified National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III definition of a nationwide sample. In the InterASIA study, Yang et al[29] compared the prevalence rates of both the NCEP ATP III and IDF definitions, and found that of the IDF to be higher than that of the NCEP ATP III (23.3% versus 16.5%). Recently, a study by Hui et al[30] postulated that 17% of women met the ATPIII criteria. The prevalence rate of MetS deduced from our study is higher than that obtained via nationwide sampling, and is similar to the study of Hui et al.[30] This may be attributed to the marked advancements in economical and social development prominent in Zhuhai, a city that has reaped substantial benefits from the wave of economic reforms over the last several years. This culminates in distinct changes in lifestyle and behavioral mannerisms, which bring its associated changes in lifestyles.[31]

The World Health Organization reported that diseases and ailments associated with smoking, renders tobacco use as one of the leading causes of death in the world, accounting for approximately 5 million deaths annually, which is equivalent to one in 10 adults globally.[32] Smoking is widely regarded as an undeniably significant risk factor for cardiovascular disease.[31] Several studies have also shown that there is an association between smoking and metabolic abnormalities, that is, it invariably increases the risk of developing MetS. Kawada et al[33] found current smokers had a higher risk of developing MetS compared with non-smokers, independent of age, BMI, IR, uric acid, and other lifestyle factors. A study by Chang et al[7] also claimed that current smokers whose total smoking was more than 20 cigarettes daily were positively associated with MetS. Kwasniewska et al[34] reported that having smoked in the past automatically gave a person higher odds of developing MetS regardless of postmenopausal or premenopausal state. Our study also indicated that current smokers had a greater risk of developing MetS, as opposed to non-smokers with AO of 1.6 (1.1-2.5). The positive association between smoking cessation and weight gain, which is one of the most vital components of MetS is well known.[35] The results of our study inferred that compared with non-smokers, former smokers had no significant risk of developing MetS with AO of 0.8 (0.6-1.2). This is in consistent with Kwasniewska research,[34] as the harmful effect of smoking on one's health remains undeniable, and the benefits of quitting smoking at any point in time has been well documented.

It has been fully elucidated that exercise plays a crucial role in reducing fat-induced inflammation, BP, and improving muscular metabolism.[8] Olsen et al[36] reported that reduced daily physical activity in healthy young adults is associated with negative metabolic consequences, such as decreased insulin sensitivity and increased abdominal fat.[36] Our study found that the populace who did not physically exercise had a higher risk of suffering from MetS compared with those who physically exercised more than 60 minutes/day with AO of 1.5 (1.1-22). Therefore, increased physical activity is likely to be the innate biological and evolutionary favored pathway designed to prevent or halt the progression of MetS.

Studies on the association between alcohol consumption and prevalence of MetS have yielded conflicting results. Data from The Third National Health and Nutrition Examination Survey (NHANES III) showed that mild to moderate alcohol consumption is associated with a lower prevalence of the MetS.[37] A study by Kim et al[9] postulated that groups of drinkers at a baseline level had a higher risk of incurring MetS compared to non-drinkers, independent of potential risk factors. The risk of developing MetS increased with the amount of alcohol consumed in a dose-response manner. Furthermore, compared to non-drinkers, regular alcohol consumers were exposed to increasing risks of developing MetS. Santos et al[38] did not find any association between alcohol consumption and MetS prevalence rates in either men or women. As with Santos et al[38] research, our study revealed that alcohol consumption had no association with MetS. This may be attributed to the differential classification of each category and methods employed in this study. We put the population into 4 categories based on the frequency of alcohol intake, not factoring in the potential influence of the amount of alcohol consumption and the different kinds of alcohol.

Our study identified education as a protective factor in developing MetS. Compared with uneducated subjects, those with primary school, middle/high school or college/university education had lower risks of developing MetS, and this is consistent with other studies.[39,40] This can be explained by the fact that educated persons tend to have an increased awareness of the health risks and are more willing to utilize available health resources. Our study revealed that compared with females, males had a lower risk of developing Mets. This finding contradicts previous studies[41] that assumed a higher prevalence rate of MetS among men, and likewise consistent with studies emanating from America.[42] This finding may partly be explained by our study employing a larger waist circumference cut-off figure used in defining abdominal obesity for men. The diagnostic components making up MetS vary at the rates, with which they occur in different populations.[43,44] According to the NHANES 1988-1994 and NHANES 1999-2000 studies, BP, waist circumference, and TG levels of US adults were the most prevalent components.[43] Given our present study, we found that adiposity and high BP were the most common components of MetS within the specified population. This finding indicates that it is imperative that government focuses on curtailing high adiposity and BP levels within the populace. Low HDL levels were found to be relatively common for women aged both over and under 40 years of age. The high prevalence of low HDL levels among women may be due to the higher incidence of central obesity per women as compared to men. Another explanation may be the more stringent cut-off criteria for women adopted in the study.

The most likely limitations of our study is related to the nature of cross-sectional studies, including the potential for survival bias and temporal ambiguity. We did not assess associations between MetS and alcohol consumption, in relation to the amount of alcohol consumed and the different kind/types of alcohol consumed. We also did not assess associations between MetS and dietary habits.

In conclusion, our study revealed that 19.8% of the targeted Chinese population had MetS. Adiposity and high BP stood out as the most common components of MetS in the specified population. Current smokers had a greater risk of developing MetS, as opposed to non-smokers. Increased physical activity and educational background served as protective factors for the population. Our study will lay the foundations for further research regarding the relationship between MetS and cardiovascular diseases, or several multifactorial urological disorders in southern China. Meanwhile, our study contributed to the formulation of comprehensive preventive public health strategies by the local government.

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