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Correlation Between Early Screening of Metabolic Syndrome and Body Composition

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Abstract

Objective: To explore and analyze the relationship between adult body mass index (BMI), waist hip ratio(WHR), waist height ratio(WHtR), body composition and Metabolic syndrome(MetS), and to determine the optimal critical value of relevant indicators, so as to provide basis for early screening of MetS and help to carry out weight intervention and lifestyle guidance.

Method: The subjects were from the adults who had physical examination from March 2018 to June 2019. SPSS 23.0 was used for data analysis. The differences between groups were compared. The odds ratio (OR) and 95% confidence interval (CI) of each influencing factor were estimated by multivariate logistic regression model, and the critical values were calculated.

Result: According to the analysis of 4766 physical examinees, overweight accounted for 31.2%, obesity accounted for 8.0%. The total prevalence of MetS was 28.6%, in which 37.1% of men and 18.9% of women. 14.11% of patients with normal weight and 2% of patients with light weight had MetS. The prevalence of MetS was related to age, postmenopausal women, BMI and body fat rate. The threshold of BMI was 24.19 kg/m^2 for males and 22.59 kg/m^2 for females. The critical value of WHR was 0.9 for both men and women. The critical value of WHtR was 0.5 for both men and women; The threshold for body fat was 23.46 per cent for men and 29.97 per cent for women.

Conclusion: Body composition is closely related to metabolic level. BMI, WHR, WHR and changes of body composition can be used as reliable indicators for early screening of MetS.

Introduction

Metabolic syndrome(MetS) is a clinical syndrome with coronary heart disease risk and closely related to blood lipid, blood pressure and glucose tolerance or diabetes[1].At present, the pathogenesis of Mets is still unclear. Therefore, there are different opinions on the diagnostic criteria of metabolic syndrome.Central obesity and insulin resistance are the main causes[2].The incidence rate of Mets in developed and developing regions is increasing[3].According to the American Heart Association's standard diagnosis, about 35% of American adults and 50% of people over the age of 60 have Mets[4].In China, the incidence rate of Mets is 24.5% among people over 15 years old. And people who live in the city have a higher risk than those in the countryside[5].With the increase of overweight population in the world, Mets has become a real global problem, which brings serious challenges to clinical and public health, and also brings huge economic burden to society.No matter from the perspective of individual or public health, Mets should be identified early to achieve better health through lifestyle changes.

Previous studies have found that overweight, age, race, heredity, postmenopausal status, smoking, low family income, high carbohydrate diet, no alcohol consumption, insufficient exercise and so on[6].International guidelines suggest that central obesity be assessed by waist circumference and waist to hip ratio.However, due to the difference in height, if the same waist circumference standard is used for the same gender, it is inevitable to overestimate central obesity for those with higher height, while it is inevitable to underestimate the shorter height. Waist circumference, waist hip ratio and waist height ratio indicate subcutaneous fat. At the same time, people tend to ignore the fat tissue hidden in the viscera or skeletal muscle. At this time, the detection of human body composition is very important for this part of the easily neglected people.With the increase of age, body composition changes, and body fat rate is a better index to measure obesity [7]. Some studies have shown that visceral fat can increase the risk of MetS; after BMI correction, visceral fat content is still related to Mets, and the correlation is stronger than subcutaneous fat [8].Skeletal muscle mass is often negatively correlated with the incidence rate of MetS. Fat deposition in skeletal muscle can reduce the quality of skeletal muscle[9].In this study, the relationship between adult human body composition and MetS was discussed and analyzed to determine the optimal critical value of relevant body composition indicators. The changes of overweight related measurement indicators and body composition were used as the basis for early screening of MetS.

Materials And Methods

1.1 Research object

This study included adult physical examinees in the health promotion center from March 2018 to June 2019.

Inclusion criteria：Age 18 and above.

Exclusion criteria：(1) Patients with fever in recent 15 days: axillary temperature > 37.0 ℃, oral temperature > 37.2 ℃ or anal temperature > 37.7 ℃; (2) women's pregnancy status; (3) patients wearing cardiac pacemakers or other electronic medical devices; (4) patients with other metal implants.

1.2 Clinical data

General information: collect basic information, including gender, age, past disease history, medication history, etc.

Observation index:

(1) Physical examination indexes: including height, weight, waist circumference, hip circumference and blood pressure. According to the measurement indexes, body mass index (BMI) = weight (kg) / height square (M^2), waist hip ratio (WHR) = waist circumference (CM) / hip circumference (CM), waist height ratio (WHtR) = waist circumference (CM) / height (CM).

(2) Biochemical indicators: including fasting blood glucose (FBP), total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), glycosylated hemoglobin (HbA1c), etc.

(3) Human body composition: detected by human body composition analyzer inbody 720 (manufacturer: Bass medical devices Trading Co., Ltd.) through bioelectrical impedance technology, all subjects were guided by the same professional trained nutritionist to complete the test. All subjects were tested after fasting, defecating and sitting for at least 10 minutes. According to the test results, the correlation indexes were calculated: skeletal muscle mass index (SMI) = skeletal muscle (kg) / body height square (M^2); fat mass index (FMI) = body fat (kg) / height square (M^2); fat mass index (FMI) = body fat (kg) / height square (M^2); s F ratio = SMI / FMIS; non adipose tissue mass index (FFMI) = fat free weight (kg) / height square (M^2).

Mets diagnostic criteria

According to the Mets diagnostic criteria proposed in 2009 "unified metabolic syndrome: an interim joint statement of the International Diabetes union epidemiology prevention working group, the national cardiopulmonary Blood Institute, the American Heart Association, the world heart Union, the international society of atherosclerosis and the International Association for obesity research [10], adults can be diagnosed if they meet three or more of the following five criteria Cut Mets:

1) Hyperglycemia: fasting blood glucose ≥ 100mg / dl (5.6mmol / L) or previous diagnosis of diabetes.

2) Elevated blood pressure: systolic blood pressure ≥ 130 mmHg and / or diastolic blood pressure ≥ 85 mmHg or previous diagnosis of hypertension.

3) Low HDL-C: male serum HDL-C concentration < 40 mg / dl (1.03 mmol / L), female serum HDL-C concentration < 50 mg / dl (1.29 mmol / L).

4) Triglyceride increased: serum triglyceride concentration ≥ 150 mg / dl (1.70 mmol / L).

5) Abdominal obesity: male waist circumference ≥ 85CM, female waist circumference ≥ 80cm.

1.3 Statistical methods

The database was established by Excel 15.33 software. SPSS 23.0 software was used for statistical analysis of data. Bilateral $P < 0.05$ means the difference is statistically significant. The statistical data obtained were tested by normal distribution. If it was normal distribution, the mean ± standard deviation was used. The significant differences between the two groups were tested by independent sample t test, and the significant differences among three groups and above were analyzed by variance. If the count data were not normally distributed, the median (interquartile interval) was used to express the statistical data, and the Mann Whitney U test was used for the significant difference between groups. The classified data were expressed by numbers and percentages. Chi square test was used for significant differences between the two groups, and Z test was used for significant differences among three groups and above. The odds ratio (or) and 95% confidence interval (CI) of each related factor were obtained by multivariate logistic regression model, and the correlation between body composition and MetS was discussed. Receiver operating curve (ROC) analysis was used to determine the cut-off value, AUC, sensitivity and specificity of each predictor. The critical value of each factor was the value corresponding to the maximum yoden index (sensitivity + specificity-1).

Results

2.1 Prevalence of subjects

As shown in Table 14,766 adults were included in this study, including 2,535 males and 2,231 females. The average age of the included patients was 47.8 ± 10.2 years (age range: 18-89 years). 15.2% of men and 33.6% of women had Mets, 37.1% of men and 18.9% of women had MetS. The prevalence of MetS was higher in men (69.1%) than in women (30.9%). 4.2% were underweight, 56.7% were normal weight, 31.2% were overweight and 8.0% were obese. Among them, male accounted for 68.7% and female accounted for 31.3% of overweight population, while male accounted for 79.7% and female accounted for 20.3%. In general, 1,362 out of 4,766 people can be diagnosed with MetS, accounting for 28.6% of the total number. Among them, men are higher than women, older people are higher than younger ones, overweight people are higher than normal weight.As shown in Figure 1A, all patients were grouped by age. The prevalence of MetS was different among different age groups. The prevalence of MetS increased with age. The statistical differences were mainly before and after 50 years old ($P < 0.05$).As shown in Figure 1B, all patients were grouped by BMI, and the prevalence of MetS was different among different weight groups. The prevalence of MetS increased with weight gain, and the difference between any two groups was statistically significant ($P < 0.05$).

2.2 The prevalence of MetS and diagnostic criteria was compared among different ages and genders.

Table 2 shows the prevalence of MetS and diagnostic criteria among different ages and genders. In general, the 5 abnormal Mets indicators were: waist circumference accounted for 51.8%, triglyceride accounted for 32.5%, HDL-C accounted for 37.0%, blood pressure accounted for 35.4%, blood glucose accounted for 12.0%. Under 60 years old, men's waist circumference and triglyceride exceeding standard rates were higher than those of women, and there were significant differences, but over 60 years old, the difference was not statistically significant; although the difference of blood pressure between men and women in different age groups was statistically significant, but under 60 years old, the over standard rate of men was higher than that of women, for over 60 years old, the incidence of hypertension in women gradually exceeded that of men under the age of 30, there was no significant difference in the rate of exceeding the standard between men and women, 30-60 years old, men were higher than women, and the difference was statistically significant.

2.3 Comparison of age and body composition between different genders

According to the comparison of body composition with and without Mets by gender (see Table 3), it can be concluded that body mass index (BMI), waist hip ratio (WHR), waist height ratio (WHtR), body fat rate (PBF), basal metabolic rate (BMR), visceral fat area (VAT), skeletal muscle mass index (SMI), fat mass index (FMI), fat mass index (FMI) and non adipose tissue of people with MetS compared with those without MetS The quality index (FFMI) was higher, SF ratio was lower, and the difference was statistically significant.

2.4 OR and 95% CI of MetS related indicators

Table 4 shows the OR value and 95% CI of each influencing factor related to Mets obtained by logistic regression model. The relationship between MetS and overweight related measurement indexes and body composition was similar in different genders. With the increase of body mass index, waist hip ratio, waist height ratio, body fat rate, basal metabolic rate, visceral fat area, skeletal muscle mass index, fat mass index and non adipose tissue mass index, the risk of MetS in men and women increased, while the risk of MetS decreased with the increase of SF ratio.

2.5 Critical values of body composition indices related to Mets

The area under ROC curve (AUC), critical value, and corresponding sensitivity and specificity of each influencing factor related to MetS in different genders are shown in Table 5. The AUC of most influencing factors was greater than 0.7, and the sensitivity of most critical values was greater than 0.7.

Discussion

Our study found that overweight accounted for 31.2% and obesity accounted for 8.0%. Among them, male accounted for 68.7% of overweight population and 79.7% of obese population. The prevalence of MetS was 28.6%, of which 69.1% was male. The prevalence of MetS and its diagnostic criteria was higher in men than in women, which may be related to the larger proportion of men in overweight and obese population.Our study confirmed that the incidence of MetS increased with the increase of BMI. Mets accounted for 47.7% in overweight people, 70.4% in obese people, 14.11% in normal weight group and 2% in light weight group. This is consistent with the findings of the third national health and nutrition survey of the United States: 22% of overweight people have Mets, while the prevalence of MetS in obese people is as high as 60%, but 5% of normal weight people have Mets [11]. Therefore, only using BMI as an indicator and overweight as the basis for screening Mets will make the patients with normal weight or weight loss Miss screening.It was also found that the prevalence of MetS in men was higher than that in women before the age of 60, while the prevalence of MetS in women was higher than that in men after the age of 60.The difference of MetS prevalence between male and female may be related to the change of female hormone. Estrogen has a protective effect on the body. As women enter perimenopause and postmenopausal period, estrogen secretion decreases and weight gradually increases, and the prevalence of MetS also increases [12-13].

Our study found that: regardless of male or female, the BMI, WHR, WHR, body fat rate, basal metabolic rate, visceral fat area, skeletal muscle mass index, fat mass index and non adipose tissue mass index of people with MetS were higher than those without Mets, while SF ratio was just the opposite. This result is consistent with that of Huaqi Zhang et al. [14].The results showed that the AUC and sensitivity of most indexes were greater than 0.70, which indicated that Mets had good predictability. In this study, the critical value of BMI in men is about 24 kg / m^2, and the risk of MetS increases by 45% for every 1kg / m^2 increase, while the critical value of BMI for women is about 22.6 kg / m^2, and the risk of MetS increases by 49% for every 1kg / m^2 increase. The critical values of waist hip ratio and waist height ratio of male and female are 0.9 and 0.51 respectively, which are consistent with the current international standard of 0.5 [15]. The cut-off value of body fat rate for men was 23.46%, and that for women was 29.97%, which was significantly lower than the obesity standard defined by current research according to body fat rate [16]. The critical value of visceral fat area in male was 72.53 cm2 and that in female was 78.24 cm2, which was also lower than the reference standard (< 80 cm2) .The critical value of SF ratio was 1.82 for male and 1.19 for female. Female is lower than male, which is related to higher body fat rate.Since body fat and skeletal muscle increase with weight, we believe that SF ratio is more predictive of MetS than skeletal muscle mass or body fat fat.

Mets, as a chronic overweight related disease, is on the rise. In the national health and nutrition survey of the United States, more than one third of adults have Mets, and about 40% of adults over the age of 40 have Mets [17]. According to the national representative sampling survey in China, the prevalence of MetS among the 35-74 year-old population is 9.8% in men and 17.8% in women [18]. Studies have found that the incidence rate of MetS is three times of diabetes, and the number of MetS can be estimated [19].The risk of cardiovascular disease in patients with MetS is about twice that of patients without Mets, and the risk of type 2 diabetes is 5 times or even higher [20]. Worryingly, patients with MetS are basically asymptomatic, but according to the Framingham risk score, the risk of their first cardiovascular event in the next 10 years is 16%-18%, which is almost as high as that of patients who have experienced coronary events [21].Therefore, early detection and treatment of MetS can effectively reduce the incidence of cardiovascular disease and reduce the economic burden of patients.Although weight gain is a major risk factor for MetS, individuals with normal body weight may also have metabolic disorders.At present, some studies believe that the occurrence of MetS is not only related to the increase of BMI and waist circumference, but also related to the change of human body composition [22,23].The results showed that body mass index, waist hip ratio, waist height ratio, body fat rate, basal metabolic rate, visceral fat area, skeletal muscle mass index, fat mass index, non adipose tissue mass index and SF ratio were correlated with the occurrence of MetS. Therefore, overweight related measurement indicators combined with body composition changes can be used as the basis for early screening of MetS, and weight management can be carried out through active lifestyle intervention, so as to reduce BMI and related body composition, and improve the development of MetS.Increased visceral adipose tissue is considered to be a risk factor for MetS, leading to an increased risk of type 2 diabetes and cardiovascular disease[24].In obese people, fat is also deposited in skeletal muscle.However, people with normal weight may also have visceral fat or bone fat deposition. Therefore, through our study, we recommend that weight combined with body composition analysis is more conducive to the early detection of MetS. Only early detection can early intervention reduce the incidence of cardiovascular events.

There are some limitations in our study: first of all, the real prevalence of MetS may be underestimated due to the exclusion of metal implantation and pregnancy. Second, the study did not collect factors that might affect the incidence rate of MetS, such as nationality, smoking history, drinking history, family income, dietary structure, exercise and so on. Thirdly, the research object of this study does not include minors under 18 years old. In the future, we can further study the prevalence and influencing factors of MetS in children and adolescents.

Conclusion

Body mass index, waist hip ratio, waist height ratio, body fat rate, basal metabolic rate, visceral fat area, skeletal muscle mass index, fat mass index, non adipose tissue mass index and SF ratio were all correlated with the occurrence of MetS. Overweight related measurement indexes combined with body composition changes can be used as the basis for early screening of MetS.

List Of Abbreviations

body mass index (BMI), waist hip ratio(WHR), waist height ratio(WHtR), Metabolic syndrome(MetS), body fat rate (PBF), basal metabolic rate (BMR), visceral fat area (VAT), skeletal muscle mass index (SMI), fat mass index (FMI).

Declarations

1. Ethics approval and consent to participate: The research received the approval of Sir Run Run Shaw Hospital.
2. Consent for publication: yes
3. Availability of data and materials: The data can be searched by contacting the authors.
4. Competing interests: NONE
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Tables

Table 1
Prevalence of MetS on demographic characteristics

Demographic characteristics	Number	0 items satisfied	1 items satisfied	2 items satisfied	3 items satisfied	4 items satisfied	5 items satisfied	MetS	P
Gender									< 0.0001
Male	2535(53.2%)	385(15.2%)	557(22.0%)	652(25.7%)	588(23.2%)	290(11.4%)	63(2.5%)	941(37.1%)	
Female	2231(46.8%)	750(33.6%)	641(28.7%)	419(18.8%)	256(11.5%)	125(5.6%)	40(1.8%)	421(18.9%)	
Age*									< 0.0001
18–29	167(3.5%)	78(46.7%)	43(25.7%)	20(12.0%)	19(11.4%)	6(3.6%)	1(0.6%)	26(15.6%)	
30–39	845(17.7%)	324(38.3%)	228(27.0%)	144(17.0%)	99(11.7%)	41(4.9%)	9(1.1%)	149(17.6%)	
40–49	1712(35.9%)	453(26.5%)	454(26.5%)	377(22.0%)	269(15.7%)	136(7.9%)	23(1.3%)	428(25.0%)	
50–59	1396(29.3%)	226(16.2%)	327(23.4%)	344(24.6%)	302(21.6%)	150(10.7%)	47(3.4%)	499(35.7%)	
60–69	568(11.9%)	49(8.6%)	130(22.9%)	162(28.5%)	141(24.8%)	67(11.8%)	19(3.3%)	227(40.0%)	
70-	78(1.6%)	5(6.4%)	16(20.5%)	24(30.8%)	14(17.9%)	15(19.2%)	4(5.1%)	33(42.3%)	
BMI #									< 0.0001
	200(4.2%)	124(62.0%)	61(30.5%)	11(5.5%)	4(2.0%)	0(0.0%)	0(0.0%)	4(2.0%)	
Normal weight	2700(56.7%)	960(35.6%)	840(31.1%)	519(19.2%)	273(10.1%)	91(3.4%)	17(0.6%)	381(14.1%)	
Overweight	1487(31.2%)	51(3.4%)	275(18.5%)	451(30.3%)	433(29.1%)	222(14.9%)	55(3.7%)	710(47.7%)	
Obesity	379(8.0%)	0(0.0%)	22(5.8%)	90(23.7%)	134(35.4%)	102(26.9%)	31(8.2%)	267(70.4%)	
Total	4766(100%)	1135(23.8%)	1198(25.1%)	1071(22.5%)	844(17.7%)	415(8.7%)	103(2.2%)	1362(28.6%)	

Note: *: according to the 10-year-old group, there are only 2 people in the 18-19-year-old group, and only 6 people in the 80-89-year-old group. In order to avoid the statistical meaningless results caused by too small expectation value, the 18-19-year-old group is classified into the 18-29-year-old group, and the 80-89-year-old group is classified into the 70-year-old group and above group. #BMI < 18.5 kg / m2 was defined as light weight, 18.5 ≤ BMI < 24 kg / m2 was normal weight range, 24 ≤ BMI < 28 kg / m2 was overweight, BMI ≥ 28 kg / m2 was obesity. The value of P was determined by chi square test.

Table 2

Prevalence of MetS and its components in different age groups and genders

Age	Gender	Waist	P	TG	P	HDL-C	P	BP	P	FBG	P	MetS
18–29	Male Female	43(48.3%) 5(6.4%)	< 0.0001	33(37.1%) 3(3.8%)	< 0.0001	28(31.5%) 25(32.1%)	1.000	23(25.8%) 5(5.1%)	< 0.0001	3(3.4%) 2(2.6%)	1.000	22(24. 4(5.1%
30–39	Male Female	266(59.8%) 53(13.3%)	< 0.0001	210(47.2%) 23(5.8%)	< 0.0001	159(35.7%) 142(35.5%)	1.000	119(26.7%) 14(3.5%)	< 0.0001	30(6.7%) 6(1.5%)	< 0.0001	139(31 10(2.5
40–49	Male Female	616(67.2%) 212(26.6%)	< 0.0001	448(48.9%) 137(17.2%)	< 0.0001	331(36.1%) 330(41.5%)	0.025	323(35.3%) 145(18.2%)	< 0.0001	104(11.4%) 28(3.5%)	< 0.0001	338(36 90(11.3
50–59	Male Female	520(71.3%) 329(49.3%)	< 0.0001	330(45.3%) 169(25.3%)	< 0.0001	242(33.2%) 277(41.5%)	0.001	370(50.8%) 281(42.1%)	0.001	158(21.7%) 80(12.0%)	< 0.0001	312(42 187(28
60–69	Male Female	217(68.7%) 162(64.3%)	0.283	86(27.2%) 87(34.5%)	0.067	84(26.6%) 119(47.2%)	< 0.0001	180(57.0%) 169(67.1%)	0.015	85(26.9%) 51(20.2%)	0.075	114(36 113(44
70-	Male Female	26(65.0%) 22(57.9%)	0.642	10(25.0%) 13(34.2%)	0.459	14(35.0%) 14(36.8%)	1.000	27(67.5%) 34(89.5%)	0.027	15(37.5%) 11(28.9%)	0.477	16(40. 17(44.7
Total	Male Female	1688(66.6%) 783(35.1%)	< 0.0001	1117(44.1%) 432(19.4%)	< 0.0001	858(33.8%) 907(40.7%)	< 0.0001	1042(41.1%) 647(29.0%)	< 0.0001	395(15.6%) 178(8.0%)	< 0.0001	941(37 421(18

Note: *P* value according to Chi square test, < 0.05 means statistical significance.

Table 3

Comparison of age and body composition between men and women with or without Mets

	Male			Female		
	MetS	Non-MetS	P*	MetS	Non-MetS	P*
Age	48.91 ± 9.78	47.24 ± 10.60	< 0.0001	54.90 ± 8.47	46.00 ± 9.74	< 0.0001
PBF(%)	26.27 ± 4.77	21.98 ± 5.28	< 0.0001	33.10 ± 5.03	28.72 ± 5.41	< 0.0001
BMI(kg/m^2)	26.20 ± 2.96	23.25 ± 2.75	< 0.0001	24.70 ± 2.74	21.71 ± 2.54	< 0.0001
BMR(KJ/h)	1579.16 ± 133.77	1504.59 ± 129.42	< 0.0001	1261.83 ± 101.98	1211.38 ± 86.20	< 0.0001
VAT(cm^2)	89.46 ± 28.02	65.49 ± 24.09	< 0.0001	100.48 ± 31.83	73.11 ± 26.07	< 0.0001
SMI(kg/m^2)	10.79 ± 0.96	10.08 ± 0.95	< 0.0001	8.91 ± 0.78	8.29 ± 0.73	< 0.0001
FMI(kg/m^2)	6.98 ± 1.95	5.21 ± 1.73	< 0.0001	8.28 ± 2.03	6.34 ± 1.84	< 0.0001
SF ratio	1.65 ± 0.43	2.17 ± 0.87	< 0.0001	1.14 ± 0.29	1.41 ± 0.41	< 0.0001
FFMI(kg/m^2)	19.22 ± 1.54	18.04 ± 1.53	< 0.0001	16.42 ± 1.23	15.37 ± 1.19	< 0.0001
WHR	0.93 ± 0.05	0.89 ± 0.05	< 0.0001	0.91 ± 0.05	0.87 ± 0.04	< 0.0001
WHtR	0.54 ± 0.05	0.50 ± 0.05	< 0.0001	0.54 ± 0.05	0.49 ± 0.04	< 0.0001

Note：**P* was determined by Mann Whitney U test

Table 4
OR and 95% CI of MetS related indicators

	Male		Female	
	OR	95%CI	OR	95%CI
BMI(kg/m^2)	1.455	1.403–1.510	1.493	1.425–1.564
WHR	1.382	0.237–8.079	1.624	1.101–2.397
WHtR	1.031	1.260–8.431	3.545	2.609–4.817
PBF(%)	1.183	1.161–1.205	1.167	1.142–1.193
BMR(KJ/h)	1.004	1.004–1.005	1.006	1.005–1.007
VAT(cm^2)	1.039	1.034–1.043	1.030	1.027–1.034
SMI(kg/m^2)	2.185	1.986–2.403	2.937	2.517–3.428
FMI(kg/m^2)	1.711	1.619–1.808	1.620	1.523–1.720
SF□□	0.197	0.162–0.240	0.080	0.053–0.120
FFMI(kg/m^2)	1.653	1.557–1.755	2.002	1.818–2.204

Table 5
The sensitivity, purposefulness and AUC of each predictive value of MetS

Index		Critical value	Sensitivity	Specificity	AUC	95%CI
BMI(kg/m^2)	Male	24.19	0.758	0.337	0.774	0.756–0.792
	Female	22.59	0.803	0.322	0.801	0.779–0.823
WHR	Male	0.90	0.710	0.393	0.704	0.684–0.724
	Female	0.90	0.608	0.228	0.751	0.726–0.777
WHtR	Male	0.51	0.776	0.391	0.762	0.743–0.780
	Female	0.51	0.751	0.288	0.802	0.780–0.824
PBF(%)	Male	23.46	0.724	0.383	0.725	0.705–0.745
	Female	29.97	0.751	0.409	0.727	0.701–0.753
BMR(KJ/h)	Male	1539.50	0.601	0.364	0.656	0.635–0.678
	Female	1258.50	0.511	0.270	0.647	0.617–0.677
VAT(cm^2)	Male	72.53	0.738	0.332	0.757	0.739–0.776
	Female	78.24	0.736	0.330	0.759	0.734–0.784
SMI(kg/m^2)	Male	10.54	0.596	0.306	0.701	0.680–0.721
	Female	8.49	0.708	0.369	0.723	0.697–0.749
FMI(kg/m^2)	Male	5.54	0.773	0.383	0.759	0.741–0.778
	Female	6.96	0.751	0.324	0.771	0.749–0.795
SF□□	Male	1.82	0.285	0.615	0.720	0.700–0.740
	Female	1.19	0.331	0.667	0.720	0.693–0.746
FFMI(kg/m^2)	Male	18.54	0.664	0.360	0.707	0.687–0.728
	Female	15.65	0.743	0.385	0.733	0.708–0.758

Figures

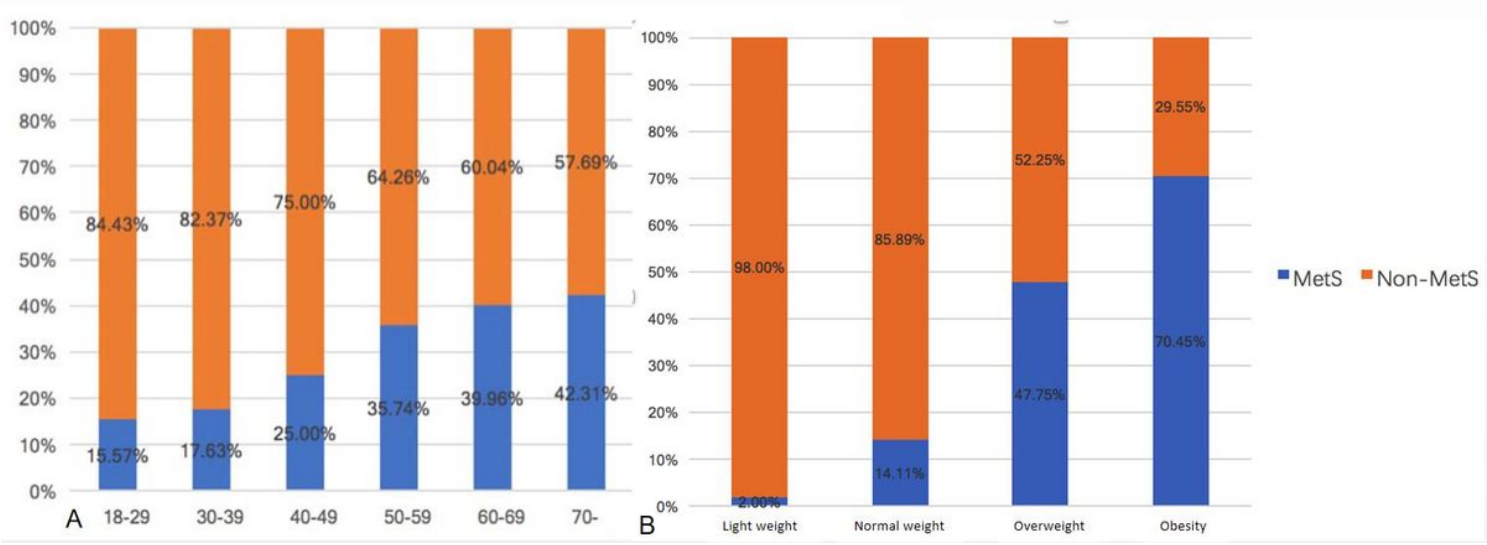


Figure 1

Prevalence of MetS A：Prevalence of MetS among different age groups. B：Prevalence of MetS among different weight groups.

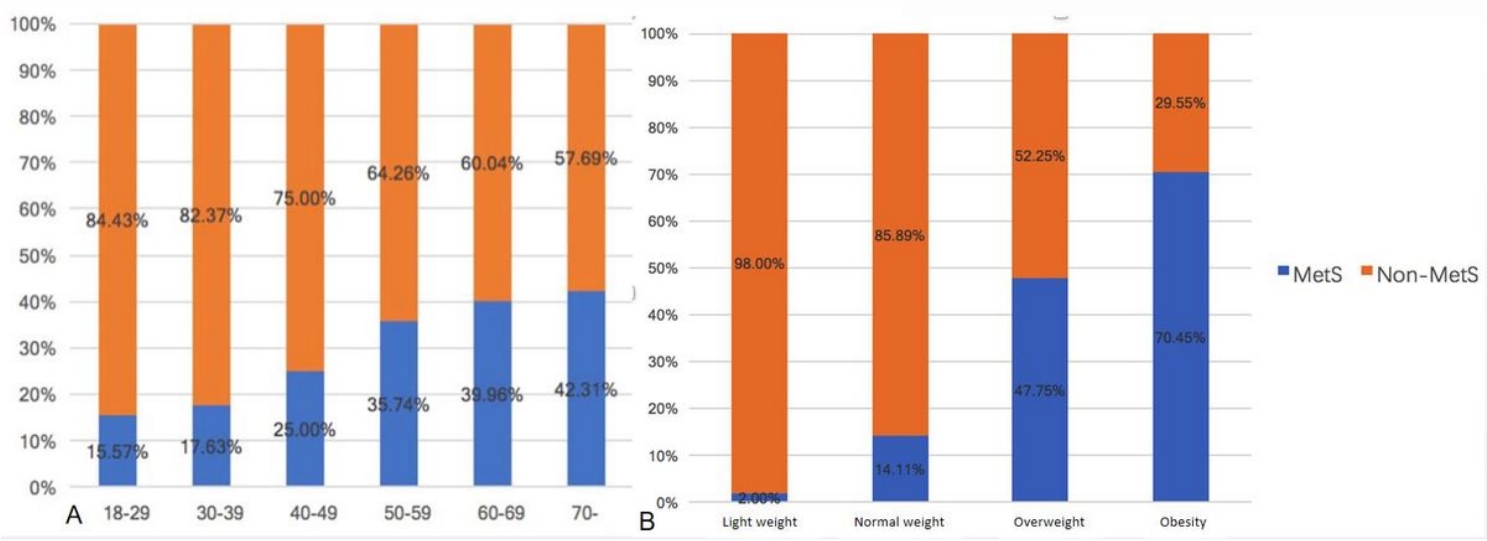


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