Comparing the Metabolic Syndrome Frequency and Components among Inactive College Students Using Standard and Asian Definitions of Body Mass Index

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Abstract

Objective: Metabolic syndrome (MetS) is a combination of some risk factors including obesity which can be assessed by body mass index (BMI). The purpose of the present study was to determine the accuracy of Standard BMI Cut-off points (SBC) and Asian BMI Cut-off points (ABC), to categorize the young people with MetS.

Materials and Methods: In this cross-sectional study, 198 inactive college students (66 female (33.33%) and 132 male (66.66%)) participated. The prevalence of MetS was diagnosed according to the modified NCEP-ATPIII guidelines10, with exception of ≥2 risk factors. All required data were collected through blood sampling, blood pressure and anthropometric measurements.

Results: The prevalence rate of MetS and its components within the normal category of MetS was divided into two categories of normal and overweight according ABC with no significant differences between those categories. The high frequency of MetS and its components were observed in both genders even among underweight students. Among MetS risk factors, low level of HDL-C (female; 45.45%, male; 43.18%) which included underweight students was most prevalent. The lowest incidence belonged to the impaired fasting plasma glucose (FPG).

Conclusion: The ABC more accurately categorize the inactive students. Despite the high frequency of MetS among the young inactive students, the low incidence of elevated FPG indicates that some MetS definitions may not precisely diagnose the susceptible students. Therefore, redefining the MetS criteria for more precise identification the young people at risk seems to be essential.

Keywords: Metabolic syndrome, Body mass index, Physical activity, College students Seasons

Introduction

Obesity and overweight, defined as a weight gain due to accumulation of adipose tissue, have a relationship to diabetes mellitus and are considered as a risk factor for metabolic syndrome (MetS) (1). MetS is a group of metabolic disturbances that has been known as a strong predictor for developing diabetes and cardiovascular

disease (CVD) (2) and 20–30% of adult population in most countries have MetS (3). Many experts in the human health related fields participated in a workshop to unify a definition for Mets (2). According to NCEP ATP III, MetS consists of several components including hyperglycemia, hypertension, dyslipidemia, and central or abdominal obesity (waist circumference). MetS may be diagnosed in a person who has three or more of those components (4).

The prevalence of obesity has nearly doubled since 1980.Non-communicable disease such as type 2 diabetes, CVD and some cancers are the consequences of obesity. The mortality rate is higher in overweight and obese people (5). In addition, overweight and obesity have adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance (6).

Based on the fat distribution, obesity is considered as general or central which can be assessed by different anthropometric measurements including body mass index (BMI), waist circumference (WC), waist to hip ratio (WHR), waist to stature ratio (WSR) and body fat percentage (BFP) (7). Both BMI and WC are associated with type 2 diabetes, MetS and CVD (8). Based on the WHO definition, the Standard BMI Cut-off points (SBC) has been classified in 4 categories, (BMI) underweight< 18.5, normal range 18.5-24.99, overweight range 25- 29.99, and obese≥ 30 kg/m^2 (9). Based on this classification, the high prevalence of type 2 diabetes and increased CVD risk factors in some Asian populations with normal BMI, and also, different associations between BMI and some obesity indices across those populations, made a strong suggestion in which SBC should be set differently (10). In this regard, the Asian BMI Cut-off points (ABC) were suggested for many populations as underweight< 18.5, normal range 18·5– 22.99, overweight range 23– 24.99, and obese≥ 25 kg/m^2 (11).

It is well established that the early detection of MetS is a key point for preventing or reducing the development of diabetes and consequently morbidity and mortality. Accordingly, some studies have reported the incidence of MetS among college students (12-14). To our knowledge, despite the impact of overweight and obesity on type 2 diabetes and CVDs (5), the accuracy of the WHO and Asian classifications of BMI to categorize the individuals at risk of MetS, has not been compared, especially, among college students. Therefore, the purpose of the present study was to evaluate how inactive students with MetS are categorized by WHO and Asian classifications of BMI.

Materials and Methods

This study with the cross-sectional design was approved by the research vice president of Sharif University of Technology and was conducted on physically inactive students of the University. All volunteers were informed adequately about the study's procedures and completed a questionnaire related to lifestyle attitudes including demographic characteristics, and physical activity level. The questionnaire (24 questions in total) included the questions to assess the physical activity of each person at 4 levels (Vigorous, moderate, light, and sedentary behavior) (15). The students who belonged to vigorous level were excluded in the first step, and the list of 204 inactive females and males were separated from the rest. To ensure the physical inactivity, the remained students underwent the Rockport Fitness walking test for estimating the VO_2max (16). Accordingly, those who belonged to the good or above categories were excluded (17). All procedures were consistent with ethical standards and written consents were obtained from the 198 inactive participants (66 females 33.33% and 132 males 66.66%), prior to data collection.

Data collection was done in two steps at Sharif University of Technology. Blood pressure was measured in the left arm, after resting for at least 5 minutes in the sitting position, using a mercury sphygmomanometer, and the average of twice measurements was used for all analysis. After an overnight fasting of 12 h,

blood samples were collected by lab experts via antecubital vein, and separated serums were stored at -20^{oC} to determine the fasting plasma glucose (Bio system, England), high-density lipoprotein cholesterol and triglycerides (Kit company test Pars, Iran) concentrations by photometric enzymatic assay later.

The participants underwent anthropometric measurements. Body weight, wearing light cloths (accuracy 0.1 kg), and standing height, without shoes (nearest 0.1 cm), were measured using electronic balance and stadiometer (Seca, Germany). Waist (between the lowest rib and iliac crest, at the end of the normal expiration with the standing position) and hip (around the widest portion of the buttocks) circumferences were measured using a non-stretchable tape. The WHR and WSR were calculated as the participant's WC divided by the hip circumference and high (all in centimeters), respectively. Body fat percentage was estimated using caliper (Harpenden CE 1020, England), by measuring skinfold thickness at three sites (triceps, suprailiac and thigh for female; chest, abdomen and thigh for male) on the right side of the body (18,19). All data were collected by trained researchers and research assistants.

The prevalence of MetS, according to the modified NCEP-ATP III guidelines 10, was identified among the young participants when two or more of the following criteria were met: elevated fasting plasma glucose (FPG ≥100 mg/ dl), reduced HDL cholesterol (HDL-C< 50 mg/dl for female and< 40 mg/dl for male), elevated serum triglyceride (TG ≥150 mg/dl), elevated systolic blood pressure (SBP≥ 130 mmHg) and/or diastolic blood pressure (DBP≥ 85 mmHg) (4,20). Considering to the age and race-ethnicity of the participants, the recommended WC cut-off points for Asian populations (female WC≥ 80 cm, and males WC ≥90 cm) were used (2,11).

BMI was calculated as weight (kg)/height (m^2). Underweight, normal, overweight and obesity were defined as a BMI< 18.5, < 25, < 30, > 30 kg/m^2, and BMI < 18.5, < 23, < 25, and> 25 kg/m^2 based on the SBC and ABC, respectively (9,11).

The ethics committee of Sharif University of Technology approved this study, IR.PNU.REC.1397.040

Statistical analyses

All analyses were run for female and male separately, using SPSS software version 24. Independent T-test was used to evaluate the variables difference between two similar categories belongs to SBC and ABC. Also, for each MetS components, one-way ANOVA with LSD as a post-hoc test was used to examine differences within SBC and ABC categories, separately. Results were reported as Mean (±SD) or n (%). Statistical significance accepted at *P*-value≤ 0.05 for all analyses.

Results

Because nobody had BMI ≥ 30, there was no data for obese category based on the SBC. Totally, 198 inactive students, 66 females (33.33%, with means of age 20.30 (± 1.75) years, BMI 20.94 (± 2.86) kg/m^2, VO_2max 20.76 (±3.61) ml/kg/min) and 132 males (66.66%, with means of age 20.44 (± 1.76) years, BMI 22.42 (± 3.17) kg/m^2, VO_2max 34.38 (± 3.78) ml/kg/min) were participated in this study. Descriptive statistics of the MetS components and anthropometric characteristics of both genders are presented in table 1. The most frequent abnormal values was low level of HDL-C followed by WSR in both genders, however, the incidence of abnormal WC and SBP were considerable in females and males, respectively. Elevated FPG and TG concentrations in both genders and that for TG concentrations in females exhibited the lowest incidence.

Table 2 shows the different allocation of females and males in the categories of SBC and ABC. In both genders, a number of participants who were allocated in the normal categories of SBC, were classified by ABC as overweight.

Table 1. Descriptive statistics of metabolic syndrome components and anthropometric characteristics for females and males

Variables	Females (n=66)		Males (n=132)	
	Normal Number (%) M(±SD)	Abnormal Number (%) M(±SD)	Normal Number (%) M(±SD)	Abnormal Number (%) M(±SD)
SPB (mmHg)	60 (90.91) 107.36±8.87	6 (9.09) 137.33±6.02	92 (69.70) 112.96±7.30	40 (30.30) 132.95±4.81
DBP (mmHg)	52 (78/79) 71.72±6.06	14 (21.21) 91.29±1.50	118 (89.39) 68.50±7.89	14 (10.61) 91.29±1.86
FPG (mg/dl)	64 (96.97) 87.33±6.31	2 (3.03) 113.50±17.68	125 (94.70) 88.61±7.03	7 (5.30) 102.29±1.25
HDL-C (mg/dl)	36 (54.55) 60.94±10.78	30 (45.45) 43.27±4.52	75 (56.82) 46.28±5.03	57 (43.18) 34.77±4.59
TG (mg/dl)	64 (96.97) 72.86±21.28	2 (3.03) 185±41.01	110 (83.33) 94.40±27.63	22 (16.67) 193.32±66.24
WC (cm)	44 (66.67) 70.61±4.60	22 (33.33) 85.86±6.46	107 (81.06) 78.83±6.30	25 (18.94) 94.85±4.23
WHR (cm)	50(75.76) 0.78±0.04	16 (24.24) 0.89±0.04	114 (86.36) 0.84±0.04	18 (13.64) 0.93±0.03
WSR (cm)	47 (71.21) 0.44±0.03	19 (28.79) 0.53±0.03	88 (66.67) 0.44±0.03	44 (33.33) 0.53±0.03
BFP (%)	56 (84.85) 20.85±4.71	10 (15.15) 33.74±2.24	102 (78.79) 13.39±4.03	28 (21.21) 24.79±2.97

Data were presented as mean (±SD). Colored numbers represent the high prevalence. SBP; systolic blood pressure, DBP; diastolic blood pressure, FPG; fasting plasma glucose, HDL-C; high density lipoprotein cholesterol, TG; triglyceride, WC; waist circumference, BMI; body mass index, WHR; waist to hip ratio, WSR; waist to stature ratio, BFP; Body fat percentage (4,20)

Table 2. Different classification of the participants using SBC and ABC

Variables	Females (n=66)		Males (n=132)	
BMI categories	SBC Number (%) M±SD	ABC Number (%) M±SD	SBC Number (%) M±SD	ABC Number (%) M±SD
Underweight	13 (19.69) 17.54±0.88	13.(19.69) 17.54±0.88	17 (12.88) 17.86±0.42	17 (12.88) 17.86±0.42
Normal	44 (66.67) 20.88±1.64	38 (57.58) 20.45±1.30	85 (64.39) 21.85±2.06	52 (39.39) 20.48±1.34
Overweight	9 (13.64) 26.12±1.37	6 (9.09) 23.65±0.48	30 (22.70) 26.63±1.21	33 (25.00) 24.01±0.65
Obese	-	9 (13.64) 26.12±1.37	-	30 (22.73) 26.64±1.21

Data are reported as N (%) and M±SD. BMI categories; Underweight (SBC and ABC < 18.5), normal (SBC < 25, ABC < 23), overweight (SBC < 30, ABC < 25) and obesity (SBC > 30, ABC > 25) (9,11).

The same changes were observed for overweight and obese categories.

There was a difference in the prevalence rate of MetS between the normal and overweight categories of SBC and ABC (Table 3). Among the sample, 18 females (27.27%) and 36 males (27.27%) were diagnosed with MetS (≥ 2 risk factors). Using SBC, the highest prevalence of MetS among females and males belonged to the normal and overweight categories, respectively. Using ABC, the highest prevalence of MetS in females was observed in the both normal and obese categories, and for males belonged to the obese category. Moreover, underweight females and males had MetS. Approximately, the same distributions were observed in the normal participants, without MetS.

Table 4 presents the prevalence of MetS components based on the SBC and ABC. For each MetS components, an outstanding difference between categories of SBC or ABS was observed in WC. Indeed, based on the SBS, the significant differences between overweight and normal (*P*-value< 0.001), and also between normal and underweight (*P*-value= 0.015) categories were observed, and

Table 3. Distributions of participants with or without MetS in the categories of SBC and ABC

Variables	Females (n=66)				Males (n=132)			
	< 2 risk factors		≥ 2 risk factors		< 2 risk factors		≥ 2 risk factors	
BMI category	SBC Number (%)	ABC Number (%)	SBC Number (%)	ABC Number (%)	SBC Number (%)	ABC Number (%)	SBC Number (%)	ABC Number (%)
Underweight	12 (18.18)	12 (18.18)	1 (1.51)	1 (1.51)	14 (14.61)	14 (10.61)	3 (2.27)	3 (2.27)
Normal	34 (51.52)	31 (46.97)	10 (15.15)	7 (10.61)	71 (53.79)	45 (34.09)	14 (10.61)	7 (5.30)
Overweight	2 (3.03)	3 (4.55)	7 (10.61)	3 (4.55)	11 (8.33)	26 (19.70)	19 (14.39)	7 (5.30)
Obese	-	2 (3.03)	-	7 (10.61)	-	11 (8.33)	-	19 (14.39)
Total	48 (72.73)		18 (27.27)		96 (72.73)		36 (27.27)	

Data are reported as N (%). Colored numbers represent the highest prevalence of MetS within related categories of BMI for males and females.

Table 4. Comparison the prevalence of individual metabolic syndrome components between SBC and ABC

Variables		Females				Males			
		M±SD (n=66)		Prevalence of criterion Number (%)		M±SD (n=132)		Prevalence of criterion Number (%)	
BMI category		SBC	ABC	SBC	ABC	SBC	ABC	SBC	ABC
SBP	Underweight	106.92±11.12	106.92±11.12	0 (0)	0 (0)	119.41±11.09	119.41±11.08	6 (4.55)	6 (4.55)
	Normal	107.73±10.74	106.68±10.26	2 (3.03)	1 (1.52)	119.06±11.51	119.81±10.94	24 (18.18)	16 (12.12)
	Overweight	125.56±12.80✪●	114.33±12.29	4 (6.06)	1 (1.52)	118.67±12.31	117.88±11.66	10 (7.58)	8 (6.06)
	Obese	-	125.56±12.80*	-	4 (6.06)	-	118.67±12.31	-	10 (7.58)
	Total	110.00±12.58		6 (9.09)		119.00±11.36		40 (30.30)	
DBP	Underweight	73.85±8.43	73.85±8.43	2 (3.03)	2 (3.03)	69.41±8.30	69.41±8.30	1 (0.76)	1 (0.76)
	Normal	75.00±9.39	75.05±9.41	8 (12.12)	7 (10.61)	70.26±9.20	69.62±10.84	8 (6.06)	5 (3.79)
	Overweight	81.11±12.17	74.67±10.09	4 (6.06)	1 (1.52)	73.67±10.87	71.21±9.60	5 (3.79)	3 (2.27)
	Obese	-	81.11±12.17	-	4 (6.06)	-	73.67±10.87	-	5 (3.79)
	Total	75.60±9.40		14 (21.21)		70.90±10.27		14 (10.61)	
FPG	Underweight	89.31±5.74	89.31±5.74	1 (1.52)	1 (1.52)	91.94±6.67	91.94±6.67	2 (1.52)	2 (1.52)
	Normal	87.27±9.00	87.08±9.52	1 (1.52)	1 (1.52)	88.26±7.69	88.77±6.73	2 (1.52)	1 (0.76)
	Overweight	90.56±4.59	88.50±4.89	0 (0)	0 (0)	90.90±6.97	87.45±9.05	3 (2.27)	1 (0.76)
	Obese	-	90.56±4.59	-	0 (0)	-	90.90±6.97	-	3 (2.27)
	Total	88.12±7.99		2 (3.03)		89.33±7.50		7 (5.30)	
HDL-C	Underweight	53.85±12.29	53.85±12.29	4 (6.06)	4 (6.06)	41.88±8.64	41.88±8.64	7 (5.30)	7 (5.30)
	Normal	53.45±12.28	54.00±12.87	20 (30.30)	17 (25.76)	41.82±7.29	42.85±7.22	33 (25.00)	19 (14.39)
	Overweight	48.89±12.77	50.00±7.43	6 (9.09)	3 (4.55)	39.53±7.34	40.21±7.22	17 (12.88)	14 (10.61)
	Obese	-	48.89±12.77	-	6 (9.09)	-	39.53±7.34	-	17 (12.88)
	Total	52.91±12.26		30 (45.45)		41.31±7.49		57 (43.18)	
TG	Underweight	71.38±16.66	71.38±16.66	0 (0)	0 (0)	88.88±37.47	88.88±37.47	1 (0.76)	1 (0.76)
	Normal	72.43±24.30	71.79±25.64	1 (1.52)	1 (1.52)	105.84±38.14	103.23±35.44	12 (9.09)	7 (5.30)
	Overweight	102.00±48.68*	76.50±13.81	1 (1.52)	0 (0)	137.67±78.38*	109.94±42.29	9 (6.82)	5 (3.79)
	Obese	-	102.00±48.68	-	1 (1.52)	-	137.67±78.38*	-	9 (6.82)
	Total	76.26±28.98		2 (3.03)		110.89±52.04		22 (16.67)	
WC	Underweight	69.35±6.39	69.35±6.39	1 (1.52)	1 (1.52)	71.20±1.98	71.20±1.98	0 (0)	0 (0)
	Normal	75.07±6.99*	73.95±6.55*	13 (19.70)	9 (13.64)	80.24±6.18●	77.23±5.27●	4 (3.03)	1 (0.67)
	Overweight	87.94±9.45✪●	82.17±5.73*	8 (12.12)	4 (6.06)	92.51±5.92✪●	84.97±4.26●	21 (15.91)	3 (2.27)
	Obese	-	87.94±9.45	-	8 (12.12)	-	92.51±5.92●	-	21 (15.91)
	Total	75.70±8.94		22 (33.33)		81.86±8.67		25 (18.94)	

* Significant difference from lower category at *P*-value < 0.05, ● Significant difference from lower category at *P*-value < 0.001 using one-way ANOVA. ✪ Significant differences with the same category in ABC at *P*-value < 0.001 using Independent t-Test. Data are reported as M±SD and N (%). Colored numbers represent the high prevalence of each MetS criterion and the most incidence among corresponding BMI categories. The MetS criteria defined by NCEP-ATP III: SBP; systolic blood pressure ≥ 130 mmHg, DBP; diastolic blood pressure ≥ 85 mmHg, FPG; fasting plasma glucose ≥100 mg/dl, HDL-C; high density lipoprotein cholesterol <50 mg/dl for females and <40 mg/dl for males, TG; triglyceride ≥150 mg/dl, WC; waist circumference ≥80 for females and ≥90 for males (2,4,11,20).

based on the ABC, there were significant differences between overweight and normal (*P*-value= 0.009), and also between normal and underweight (*P*-value= 0.042) categories for females' WC, whereas, there was a significant difference between overweight categories of ABC and SBC (*P*-value< 0.001). Almost, there were the same differences for

males' WC, in addition to that, a significant difference between obese and overweight categories of ABS was observed. (all *P*-value < 0.001). The highest prevalence among MetS components in females was low levels of HDL-C (45.45%), followed by WC (33.33%), and DBP (21.21%) respectively, and in males was low levels of HDL-C (43.18%), followed by SBP (30.30%), and WC (18.94%), whereas, the incidence of elevated FPG was very low in both genders (Females: 3.03%, males: 5.30%). As seen in the table 4, there was almost no difference between BMI classifications or between their categories, especially in FPG and HDL-C.

Discussion

Because nobody had BMI ≥ 30, there was no data for obese category based on the SBC. The present study compared the prevalence of MetS using two BMI classifications based on the SBC (Standard BMI Cut-off points) and ABC (Asian BMI Cut-off points). Although, the MetS risk factors and anthropometric characteristics had prevalence in both genders (table 1), they all were in the normal range (table 4). Among all inactive participants (66 females 33.33% and 132 males 66.66%), MetS was identified in 18 (27.27%) females and 36 (27.27%) males (table 2). These prevalence rates are higher than similar studies which have conducted on college students (12,13). The results showed a difference in the prevalence rate of Mets between SBC and ABC. Indeed, the prevalence rate in the normal category of SBC was divided into two categories of normal and overweight in ABC with no significant differences between those categories. For example, using SBC, of 18 females at risk, 10 were in the normal category, whereas, they were allocated in normal (n= 7) and overweight (n= 3) categories by ABC (table 3). A same distribution was observed in males too, even for those who were diagnosed without MetS. Unfortunately, not only the students with normal BMI, but also those belonged to the underweight category had MetS, especially males. In this regard, based on the ABC, out of 18 females at risk, 7 (10.61%) and 1 (1.51%) belonged to normal and underweight categories, respectively. Compared to females and even other studies (13,14), the more prevalence of MetS (≥ 2 risk factors) was observed in normal (n= 7, 5.30%) and underweight (n= 3, 2.27%) males. These findings indicate that ABC is more accurate than SBC for classification the young people with MetS.

Interestingly, the same differences between two BMI classifications were observed for each individual MetS components. The prevalence rate of each component in the normal category of SBC was divided into two categories of normal and overweight in ABS with no significant differences between those categories. Although, all MetS components were in the normal range in both genders, the prevalence was observed for each component. As presented in table 4, the highest prevalence for MetS component was low levels of HDL-C in females (45.45%; n= 30) and males (43.18%; n= 57), followed by abdominal obesity (33.33%; n= 22) and hypertension (21.21%; n= 14) in females, and hypertension (30.30%; n= 40) and abdominal obesity (18.94%; n= 25) in males, respectively, whereas, the lowest incidence in both genders (females, 3.03%; n= 2 and males, 5.30%; n= 7) was hyperglycemia (table 4). The prevalence of MetS increases with age 21, and the presence of one MetS component at the younger age increases the risk for developing MetS and consequently CVD risk later in life (22).

A few considerable findings exist in the present study. First, even the participants who belonged to the underweight BMI categories were diagnosed with MetS (≥ 2 risk factors), especially by ABC which seems to be more appropriate for Asian population. It has been mentioned that prevalence of at least 2 risk factors in people less than 50 years old is a cause for concern, because they will have a prolonged exposure to other risk factors associated with MetS (23). In this regard,

existence of 2 or more risk factors in our students may cause great concern, and should be considered as a warning sign for public health. Second, the most prevalent MetS components were low levels of HDL-C, hypertension, and abdominal obesity which all are affected by both nutritional status and physical activity levels (24). This finding was expectable due to physical inactivity of the participants. Third, the lowest incidence of FPG is inconsistent with the raising of prevalence of type 2 diabetes in adolescents (25). It has been proved that lack of or deficiency of secretion of insulin by the pancreas or inability of a body to use it effectively leads to diabetes (26). On the other hand, it has been stated that insulin resistance is an underlying risk factor and was defined as the primary cause of the syndrome (4). Apart from gestational diabetes, there are two other types of diabetes. Type 1 diabetes mellitus which occurs most frequently in children and adolescents, whereas type 2 diabetes is most commonly seen in older adults (25). As the results of the present study showed, the young people like college students, are less susceptible to type 2 diabetes, and if they have type 1 diabetes (Less common types of diabetes), they will be a candidate to have MetS. Noteworthy point in this regard may be related to the selection of MetS definition to diagnose young people. For example, in the present study, instead of NCEP-ATP III criteria, if the WHO definition in which hyperglycemia has been defined as a major underlying risk factor was chosen, [20] only two females (3.03%) and seven males (5.30%), of course with additional two risk factors, probably would be diagnosed with MetS, while there are actually more undiagnosed susceptible students. Early screening the young people, like college students, for MetS risk factors is suggested to prevent or reducing its development (12) to help improve the public health. These findings indicate the need for a redefinition of MetS criteria for accurate identification the young people at risk.

Conclusions

In conclusion, the findings of the present study revealed that SBC and ABC differently allocate the participants with or without MetS to their categories and ABC is more accurate. Moreover, as an alert, the findings showed that even underweight participants have MetS (≥ 2 risk factors). Also, the most prevalence of MetS components was low HDL-C followed by hypertension and WC in both genders. On the other hand, the elevated FPG levels showed the lowest prevalence among all MetS criteria, so that only two females and seven males were diagnosed as patients with diabetes. In this regard, selection a more precise MetS criteria is an important step for accurate identification the young people such as our inactive participants. So, to improve public health via preventing or reducing the development of MetS, diabetes, CVD risk, and consequently increasing the morbidity and mortality, definition a proper MetS criteria to diagnose young people with MetS, seems to be a critical step.

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Conflict of Interest

There is no conflict of interest to be declared.

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