

THE IMPORTANCE OF WEIGHT FOR HEIGHT FOR PREDICTION OF METABOLIC SYNDROME IN OBESE CHILDREN AND ADOLESCENTS: IMPACT OF GENDER AND PUBERTAL STATUS

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Aims

We aimed to investigate the role of anthropometric indices in prediction of metabolic syndrome (MetS) in pubertal obese children and to identify cutoff values of useful anthropometric indices for prediction of MetS. We also investigated the effects of gender on these indices.

Subjects and methods

A total of 291 obese children and adolescents (160 girls and 131 boys, age range: 6–16 years, mean age: 11.84±2.62 years) were included this study. Weight, height, waist circumference (WC) and hip circumference of all participants were measured. Body mass index (BMI) (body weight (kg) / height square), waist-hip ratio (WHR), waist-to-height ratio (WtHR), and weight for height were calculated. Sitting blood pressure was measured with a standard mercury sphygmomanometer.

Obesity was defined as BMI ≥ 95th percentile for age and gender based on published standards. Central obesity was defined as WC ≥ 90th percentile for age according to previously published data. The International Diabetes Federation (IDF) definition for diagnosis of metabolic syndrome was used. The IDF criteria for MetS in adolescents aged 10–16 years include abdominal or central obesity (90th percentile of waist circumference or adult cutoff if lower) plus at least two of the following features: fasting plasma triglyceride of ≥150 mg/dL, high-density lipoprotein cholesterol (HDL-C) of <40 mg/dL, systolic blood pressure of ≥130 mmHg and/or diastolic blood pressure of ≥85 mmHg, fasting plasma glucose of ≥100 mg/dL, or known type 2 diabetes mellitus. Student *t* test, χ^2 test, and logistic regression analysis were used for statistical analysis. ROC curves were used to determine optimal thresholds to detect metabolic syndrome.

Results

Figure 1 shows the prevalence of MetS for all obese children, pre-pubertal and pubertal obese children and obese girls and boys (22.3 %, 12,3%, 22.3%, 23.75, and 20.6%, respectively). The prevalence of MetS in pubertal obese children was significantly higher than in pre-pubertal ones ($p=0.004$).

* WC and weight for height in obese children with MetS were significantly higher than for obese children without MetS ($p=0.022$). BMI SDS, WHR, and WHtR did not differ significantly between the two groups ($p>0.05$).

*The anthropometric characteristics of pubertal and pre-pubertal obese children with and without MetS are shown in Table 1. Significantly higher weight for height was found in both pubertal and pre-pubertal obese children with MetS than those without MetS ($p=0.005$ and $p=0.01$, respectively). Pre-pubertal obese children with MetS had significantly higher WHtR than obese children without MetS ($p=0.008$).

* Height SDS, BMI SDS, WC, WHR and W/H were significantly higher in obese girls with MetS than obese girls without MetS ($p=0.007$, 0.04, 0.013, 0.021 and 0.001, respectively). In boys, no significant differences were found in age and anthropometric parameters between obese boys with and without MetS ($p>0.05$) (Table 2).

* In linear logistic regression with BMI SDS, W/H, WHR, and WHtR as candidate independent variables, we found that weight for height was a significant predictors of presence of MetS in all participants (OR:1.03, CI95%:1.014-1.04, $p<0.001$). In evaluating separately, we obtained similar results in pubertal (OR: 1.022, CI95%:1.005-1.04, $p=0.001$) and pre-pubertal (OR: 1.051, CI95%:1.011-1.094, $p=0.013$) obese and obese girls (OR: 1.043, CI95%:1.021-1.065, $p<0.001$) except obese boys ($p=0.332$).

* The cut-off points of W/H of 136.5% for all obese children, pubertal obese children and obese girls and 139.5% for pre-pubertal obese children were proposed to predict MetS.

Table 1. Anthropometric characteristics in obese children with and without MetS according to pubertal status

Anthropometric and biochemical characteristics	PUBERTAL n:97		p	PRE-PUBERTAL n:194		P
	Obese without MetS n:85	Obese with MetS n:12		Obese without MetS n:141	Obese with MetS n:53	
Age (years)	9.16±2.07	9.04±1.25	0.93	13.21±1.9	13.29±1.87	0.795
Height SDS	0.47±1.1	0.32±1.35	0.06	0.84±1.18	1.01±1.41	0.865
Weight SDS	3.11±1.2	3.51±1.8	0.432	3.2±1.51	4.2±2.27	0.36
BMI SDS	3.54±1.64	3.36±1.41	0.594	2.7±1.63	3.01±0.59	0.121
W/H (%)	143.51±17.98	151.98±17.33	0.005	139.61±14.98	151.33±16.71	0.01
WC (cm)	97.55±12.78	97.64±12.99	0.885	82.19±7.62	86.33±6.18	0.066
WHR	0.92±0.06	0.92±0.06	0.997	0.94±0.04	0.97±0.06	0.202
WHtR	0.61±0.06	0.62±0.07	0.557	0.59±0.04	0.62±0.04	0.008

SDS: Standard Deviation Scores BMI: Body mass index, WC: Waist circumference, WHR: Waist Hip Ratio, WHtR: Waist to Height Ratio, W/H: Weight for height, $p<0.05$ is significant

Figure 1. Prevalence of MetS in obese children and adolescents

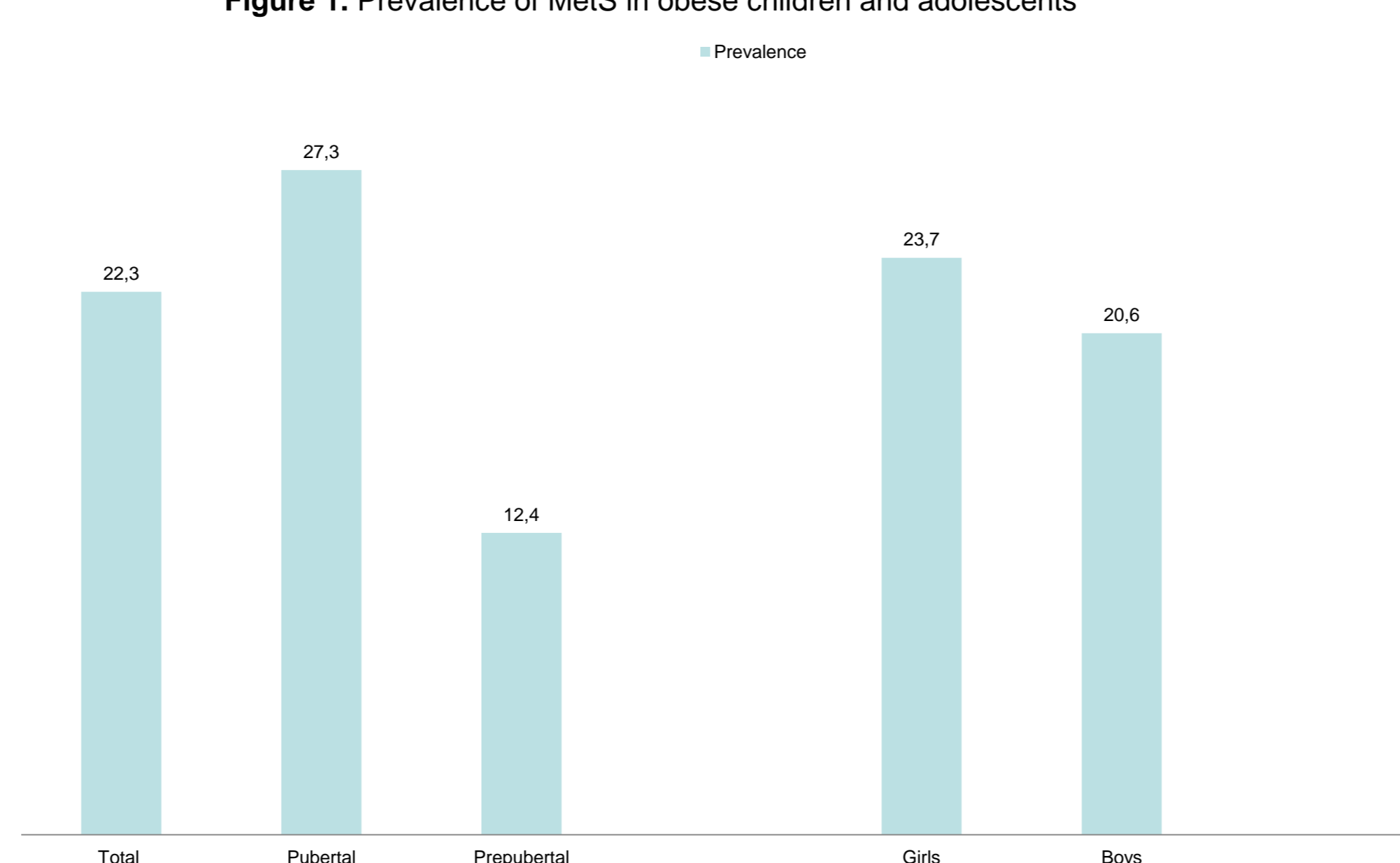


Table 2. Anthropometric characteristics in obese children with and without MetS according to gender

Anthropometric characteristics	GIRLS n:160		p	BOYS n:131		P
	Obese without MetS n:122	Obese with MetS n:38		Obese without MetS n:141	Obese with MetS n:53	
Age (years)	11.3±2.93	12.71±2.33	0.04	11.85±2.51	11.9±2.54	0.672
Height SDS	0.83±1.1	0.21±1.27	0.007	0.45±1.09	0.78±1.47	0.283
Weight SDS	3.25±1.22	3.6±2.02	0.94	3.11±1.44	3.72±1.76	0.172
BMI SDS	3.11±1.38	3.37±1.51	0.04	2.7±1.63	3.01±0.59	0.121
W/H (%)	140.13±16.34	154.92±18.98	0.001	144.28±17.53	147.55±17.88	0.392
WC (cm)	88.89±12.39	95.09±13.63	0.013	94.69±13.8	93.88±11.63	0.435
WHR	0.91±0.06	0.90±0.06	0.905	0.95±0.05	0.95±0.06	0.740
WHtR	0.59±0.05	0.62±0.07	0.021	0.62±0.06	0.62±0.07	0.906

SDS: Standard Deviation Scores BMI: Body mass index, WC: Waist circumference, WHR: Waist Hip Ratio, WHtR: Waist to Height Ratio, W/H: Weight for height, $p<0.05$ is significant

Conclusion

Metabolic syndrome is more common in pubertal obese children than pre-pubertal obese children. Anthropometric indices should be assessed in obese children and adolescents. Waist-to-height ratio may be a signal to predict of MetS, particularly in pre-pubertal children and obese girls. We conclude that weight for height may be a better marker for prediction of MetS in obese children and adolescents, except obese boys. The cut-off points of W/H of 136.5% for all obese children, pubertal obese children, and obese girls, and 139.5% for pre-pubertal obese children were proposed to predict MetS.