The Prediction Of Cut-off Points in Metabolic Syndrome During Childhood

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The metabolic syndrome (MetS) is associated with increased risk for atherosclerotic cardiovascular disease and type 2 diabetes. There is no consensus on the definition of MetS and its risk components in childhood. This study aimed to identify the components of MetS in childhood and to determine the cut-off points and to evaluate the presence of MetS according to pubertal stages.

Methods:

This prospective study included 306 children aged 7 to 17 years (154 girls, 152 boys). The studied variables were age, gender, fasting serum glucose and insulin, serum lipids, thyroid function tests and blood pressure(BP). Anthropometric measurements were taken. BMI and HOMA score were calculated. Children were divided into three groups according to Marshall & Tanner's sexual maturation staging: prepubertal (Stage I), mid-pubertal (Stages II-IV) and post-pubertal (Stage V).

The present study was evaluated based on Ferranti criteria (WaC >75th percentiles, TG ≥100 mg/dl, HDL <50 mg/dl/<45 mg/dl in boys for 15 to 18 years, FGlu ≥110 mg/dl, SBP >90th percentile) which was adapted from Adult Treatment Panel III (ATP III) criteria defined and used commonly in epidemiological studies in adults for MetS (8,9). The chosen criteria were compared with the Ferranti criteria.

Statistical Analysis:

Receiver operating characteristic (ROC) curve analysis was carried out to calculate 95% confidence intervals for the area under the curve (AUC) to identify the best cut-off points of parameters.The highest value for Youden's index was accepted as the best cut-off value.

Table 1: The distribution of individual cut points of metabolic parameters according to ROC Analysis

	Cutoff	Sensitivity (%)	Specificity (%)	AUC	p
WaC	76.5	89	73	0.876	**<0.001***
TChol					0.308
HDL	50.5	57	68	0.657	**<0.001***
TG	89.5	50	71	0.649	**<0.001***
LDL					0.322
SBP	111	57	67	0.649	**<0.001***
DBP					0.345
MAP	79.8	68	51	0.587	**0.008***
FGlu	90.5	64	49	0.573	**0.027***
Insulin	10.65	66	67	0.707	**<0.001***
HOMA-IR	2.0	77	57	0.701	**<0.001***
BMI	22.4	91	79	0.935	**<0.001***

*ROC Curve, * p<0.05 ; AUC: Area Under Curve*

Table 2: The distribution of cut points of metabolic parameters by ROC Analysis according to sexual maturation stages.

	Cut-off	SN (%)	SP (%)	AUC		pMean ± SD (Median)	individual percentiles 25	50	75	85	95	97
TANNER 1 (Pre-pubertal)												
WaC	71.5	96	77	0.926	**<0.001***	75.5 ± 11.8 (77)	66	77	85	87	94	98
HDL	50.5	63	65	0.625	**0.021***	50.5 ± 11.3 (49)	42	49	58	64	71	77
TG	--	--	--	0.605	0.053	88 ± 47 (78)	54	78	112	125	193	201
SBP	109.5	67	65	0.699	**<0.001***	107 ± 11 (110)	100	110	115	120	124	125
Insulin	8.85	69	73	0.725	**0.002***	11.1 ± 5.8 (10.06)	7.1	10.1	13.6	15.6	21.9	28.7
HOMA-IR	1.83	74	73	0.732	**0.001***	2.52 ± 1.32 (2.31)	1.57	2.31	3.07	3.64	5.07	5.91
TANNER 2-4 (Mid-pubertal)												
WaC	83	89	80	0.903	**<0.001***	78.8 ± 13.7 (79,5)	67	79.5	90	95	101	103
HDL	53	44	83	0.648	**0.047***	50.7 ± 11.4 (50)	42	50	58	62	75	81
TG	60.5	96	38	0.679	**0.016***	91.6 ± 52 (76)	58	76	100	143	208	226
SBP	114.5	73	55	0.659	**0.021***	114 ± 13 (115)	106	115	121	127	135	140
Insulin	14	70	82	0.780	**0.001***	12.2 ± 5.7 (11.3)	7.8	11.3	15.2	17.4	22.5	26.4
HOMA-IR	3.21	70	79	0.756	**0.002***	2.87 ± 1.43 (2.72)	1.7	2.7	3.7	3.9	5.7	7.0
TANNER 5 (Post-pubertal)												
WaC	85.8	95	84	0.946	**<0.001***	83.3 ± 16.4 (85.5)	68	85.5	95	105	110	110.4
HDL	43.5	85	51	0.725	**0.001***	48.7 ± 11 (48)	43	48	55	59	68	75
TG	81.5	78	38	0.727	**<0.001***	93 ± 37 (88)	60.5	88	116	134	176	179
SBP	111	73	68	0.742	**<0.001***	112 ± 11 (110)	103	110	120	122	133	134
Insulin	18.5	46	97	0.768	**<0.001***	15.2 ±10 (12.2)	8.4	12.2	19.6	24.4	39.8	44.5
HOMA-IR	3.11	65	78	0.764	**<0.001***	3.45 ± 2.4 (2.86)	1.86	2.86	4.42	5.38	8.85	10.92

*ROC Curve, * p<0.05, AUC: Area Under Curve ; WaC: waist circumference; SP: Sensitivity; SP: Specificity*

Results:

The selected parameters according to cut-off points were waist circumference (WaC)>75th percentiles, HDL ≤50 mg/dl, TG ≥90 mg/dl, HOMA-IR ≥2.0, and Systolic BP >95th percentile. The statistical consistency in a determination of MetS was higher in the current study than with the Ferranti criteria (Kappa coefficient: 0.428 vs 0.276).

Conclusion:

The components of MetS in children were determined as elevated WaC, TG, SBP, HOMA-IR and low HDL levels. The prevalence of MetS was higher in boys, in the post-pubertal stage and in children with obesity. Elevated WaC could predict insulin resistance as the most common metabolic abnormality in children with obesity. Elevated HOMA-IR warns us about future risks of obesity and MetS as the most common metabolic abnormality.

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