

Insulin-like Growth Factor-1 and Binding Protein-3 in Children with Metabolic Syndrome

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* No conflicts of interest to we solve

Purpose

To examine the association of insulin-like growth factor-1 (IGF-1) and insulin-like growth factor binding protein-3 (IGFBP-3) with metabolic parameters of childhood obesity and assess its relationship with the prevalence of metabolic syndrome (MetS)

Methods

A cross-sectional study of total 307 children and adolescents referred for growth assessment was performed. Subjects were divided into three groups based on body mass index (BMI) percentile for age and gender, and anthropometric profiles and biochemical data were collected examining their association with IGF-1 and IGFBP-3.

Characteristics	Normoweight (n=207)	Overweight (n=36)	Obesity (n=64)	p
Male/female (number)	91/116	20/16	24/40	
Age (years)				
Height SDS	8.88±2.07	9.62±2.64	9.40±2.76	0.094
BMI SDS	-0.82±1.00	-0.41±1.25	0.51±1.08	<0.001*
IGF-1 SDS	-0.37±0.73	1.07±0.52	2.26±0.78	<0.001*
IGFBP-3 SDS	-0.31±1.11	-0.66±1.36	-0.34±0.93	0.206
IGF-1/IGFBP-3	-0.92±1.16	-1.11±1.06	-0.65±1.07	0.116
FBS (mg/dL)	0.08±0.03	0.08±0.03	0.08±0.03	0.862
ALT (U/L)	94.85±7.71	95.14±7.65	93.09±5.93	0.219
TG (mg/dL)	16.07±6.53	24.06±31.53	34.20±38.43	<0.001*
UA (mg/dL)	96.28±72.56	104.31±72.32	88.97±44.55	0.541
HDL-C (mg/dL)	4.16±0.93	4.88±1.58	5.38±1.16	<0.001*
LDL-C (mg/dL)	58.41±11.32	55.22±13.82	49.78±9.63	<0.001*
	90.48±24.30	99.04±33.02	105.89±25.92	<0.001*
	Non-MetS (n=296)	MetS (n=11)		P
BMI SDS	0.24±1.21	3.05±1.00		<0.001*
IGF-1 SDS	-0.32±1.10	-1.51±0.93		<0.001*
IGFBP-3 SDS	-0.90±1.13	-0.81±1.33		0.798
IGF-1/IGFBP-3	0.08±0.03	0.80±0.03		0.848
FBS (mg/dL)	94.46±7.34	95.91±8.83		0.524
ALT (U/L)	18.83±18.22	73.09±49.03		0.004*
TG (mg/dL)	94.67±67.98	123.36±51.40		0.167
UA (mg/dL)	4.40±1.09	6.99±0.73		<0.001*
HDL-C (mg/dL)	56.89±11.46	38.73±6.19		<0.001*

Table 1. General characteristics and obesity parameters of subjects

Abbreviations: 25(OHD), calcidiol; A1c, glycated hemoglobin; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; FBS, fasting blood glucose; HDL-C, high density lipoprotein-cholesterol; IGF-1, insulin-like growth factor-1; IGF-BP3, insulin-like growth factor binding protein-3; LDL-C, low density lipoprotein-cholesterol; SDS, standard deviation score; TC, total cholesterol; TG, triglyceride; UA, uric acid

*p < 0.05

		Univariate			Multivariate		
		β	SE	p	β	SE	p
IGF-1 SDS	AST (U/L)	-0.18	0.01	0.011*			
	ALT (U/L)	-0.01	<0.01	<0.001*	-0.01	<0.01	<0.001*
	UA (mg/dL)	-0.18	0.05	0.001*	-0.13	0.05	<0.001*
	TC (mg/dL)	-0.01	<0.01	0.012*	-0.01	<0.01	0.013*
	LDL-C (mg/dL)	-0.01	<0.01	0.029*			
	25(OH)D (ng/mL)	-0.02	0.01	0.020*	-0.02	0.01	0.035*
IGFBP-3 SDS	BMI-SDS	0.09	0.05	0.048*			
	25(OH)D (ng/mL)	-0.02	0.01	0.001*	-0.02	0.01	0.003*
IGF-1/IGFBP-3	AST (U/L)	<0.01	<0.01	<0.001*	<0.01	<0.01	<0.001*
	UA (mg/dL)	<0.01	<0.01	0.011*	<0.01	<0.01	0.009*
	TC (mg/dL)	<0.01	<0.01	<0.001*	<0.01	<0.01	<0.001*
	LDL-C (mg/dL)	<0.01	<0.01	0.002*			
	HOMA-IR	<0.01	<0.01	0.001*	<0.01	<0.01	0.011*

Table 2. Factors independently associated with IGFs

	Univariate		Multivariate	
	OR (95 % CI)	p	OR (95 % CI)	p
IGF-1 SDS	0.62 (0.34-1.15)	0.128*	0.24 (0.09-0.63)	0.004*
IGFBP-3 SDS	2.21 (1.17-4.19)	0.015*	5.28 (1.96-14.21)	0.001*
IGF-1/IGFBP-3	1.09 (<0.01-10.00)	0.938		

Table 3. Logistic regression model for the presence of metabolic syndrome

Result

Alanine aminotransferase ($\beta=-0.01$, $p<0.01$), uric acid ($\beta=-0.13$, $p<0.01$) and total cholesterol ($\beta=-0.01$, $p=0.01$) were inversely associated with IGF-1 while not related to IGFBP-3 or IGF-1 to IGFBP-3 ratio. The prevalence of MetS was 11.2 % (63.64 % in males; 36.36 % in females) among children who were older than 10 years. IGF-1 was lower in children with MetS compared to ones without MetS (-1.51 ± 0.93 vs. -0.32 ± 1.10 , $p<0.01$) whereas showed no difference among three groups subdivided by BMI. Low IGF-1 (OR: 0.24, 95 % CI: 0.09-0.63, $p<0.01$) and high IGFBP-3 (OR: 5.28, 95 % CI: 1.96-14.21, $p<0.01$) were found to be risk factors of MetS. In children with MetS, no significant associations existed between IGF-1, IGFBP-3, or IGF-1 to IGFBP-3 ratio and any single component of MetS.

Conclusion

IGF-1 and IGFBP-3 may be another key factors related to metabolic parameter of obesity and the presence of metabolic syndrome of youth. Elucidating the role of insulin-like growth factors might help to understand its metabolic action in obesity related condition.

