Association of Thyroid-Stimulating Hormone and Free Thyroxine Concentrations with Cardiometabolic Risk Factors in Euthyroid Obese Children and Adolescents with Metabolic Syndrome

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BACKGROUND

Obesity in childhood and adolescence represents a major public health problem of our century and the leading cause of premature cardiovascular disease (CVD). A moderate elevation of thyroid-stimulating hormone (TSH) concentrations is frequently observed in obese children.

AIM

The aim of our study was to evaluate the association of TSH and free thyroxine (FT4) concentrations with the clustering of cardiometabolic risk factors in obese euthyroid children and adolescents with Metabolic Syndrome (MS) compared with their counterparts without MS.

METHODS

One thousand four hundred (n=1400) obese children and adolescents attending our 'Out-patient Clinic for the Prevention and Management of Overweight and Obesity in Childhood and Adolescents' were evaluated and screened in order to determine those fulfilling the International Diabetes Federation (IDF) criteria for MS. The study was approved by the local Committee on the Ethics of Human Research. Written informed consent was obtained in all cases by a parent/guardian. All participants underwent clinical examination and standard anthropometric measurements were obtained by a single trained observer. A fasting blood sample for baseline biochemical and endocrinologic investigations was obtained at 08:00h, and was followed by an oral glucose tolerance test.

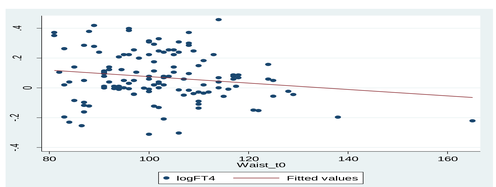
RESULTS

Seventy eight (n=78) children and adolescents [mean age ± SD: 13.1 ± 1.9 years; 46 males (59.0%) and 32 females (41.0%); 13 prepubertal (16.7%) and 65 pubertal (83.3%), BMI 35.6 ± 4.6, SBP (mm Hg) 126.8 ± 12.2, DBP (mm Hg) 75.2 ± 1.1] were identified as having MS compared with fifty four (n= 54) obese children and adolescents without MS [mean age ± SD: 12.0 ± 2.1 years; 33 males (61.1%) and 21 females (38.9%); 16 prepubertal (29.6%) and 38 pubertal (70.4%), BMI 32.3 ± 3.8, SBP (mm Hg)115.6 ± 9.8, DBP (mm Hg) 68.1 ± 1.2]. In the MS group, the variables FT4 and waist circumference appeared to have a statistically significant negative correlation (r=-0.246, p-value=0.031) after adjustment for possible confounders. Similar negative correlation was found between FT4 and BMI (r=-0.225, p-value=0.048), whereas in the non MS group, a there was a negative correlation between FT4 and insulin (r=-0.393, p-value=0.004). Simultaneously, comparable correlations adapted to age, sex and BMI were performed in both populations between TSH, FT4 and cardiometabolic risk factors, and repeatedly FT4 had a negative correlation with insulin (r=-0.176, p-value=0.048). No significant correlation was found between TSH and other cardiometabolic risk factors. These results were comparable for the two patient groups with or without MS, indicating that the prevalence of MS didn't affect these variables to a great extend.

BIOCHEMIICAL & ENDOCRINOLOGICAL PARAMETERS	Children with MS	Children without MS	
	N (%)	N (%)	p-value
	78 (59.1%)	**54 (40.9%)**	
Sex [N (%)] Boy	46 (59.0%)	33 (61.1%)	0.806
Girl	32 (41.0%)	21 (38.9%)	
Puberty [N (%)]Prepubescent	13 (16.7%)	16 (29.6%)	0.077
Pubescent	65 (83.3%)	38 (70.4%)	
Age (years) [N(Mean ± Std)]	78 (13.1 ± 1.9)	54 (12.0 ± 2.1)	**0.001**
BW (kg) [N(Mean ± Std)]	78 (94.6 ± 18.9)	54 (79.6 ± 16.2)	**< 0.001**
BMI (kg/cm^2) [N(Mean ± Std)]	78 (31.4 ± 25.4)	54 (32.1 ± 10.8)	**< 0.001**
DBP (mm Hg) [N(Mean ± Std)]	78 (75.2 ± 1.1)	50 (68.1 ± 1.2)	**< 0.001**
SBP (mm Hg) [N(Mean ± Std)]	78 (126.2 ± 12.1)	50 (115.2 ± 31.9)	**< 0.001**
Glucose (mg/dL) [N(Mean ± Std)]	76 (84.5 ± 2.2)	54 (88.4 ± 1.1)	0.140
HbA1c (%) [N(Mean ± Std)]	72 (5.3 ± 0.4)	46 (5.3 ± 0.4)	0.814
Cholesterol [N(Mean ± Std)]	78 (157.8 ± 30.9)	53 (158.2 ± 27.7)	0.940
Insulin [N(Mean ± Std)]	77 (29.4 ± 1.6)	52 (20.2 ± 1.4)	**< 0.001**
HDL [N(Mean ± Std)]	78 (39.1 ± 1.2)	53 (45.5 ± 1.2)	**< 0.001**
TG [N(Mean ± Std)]	78 (121.3 ± 74.1)	53 (88.4 ± 53.9)	**< 0.001**
LDL [N(Mean ± Std)]	78 (91.1 ± 27.5)	53 (93.0 ± 27.5)	0.685
TSH [N(Mean ± Std)]	78 (2.9 ± 1.9)	54 (3.0 ± 1.9)	0.604
FT4 [N(Mean ± Std)]	78 (1.1 ± 0.9)	54 (1.1 ± 0.9)	0.224
Anti-TPO [N(Mean ± Std)]	77 (14.4 ± 7.5)	54 (12.4 ± 9.0)	0.283
Anti-TG [N(Mean ± Std)]	77 (22.1 ± 20.5)	54 (20.0 ± 18.6)	0.490
ApoA1 [N(Mean ± Std)]	77 (123.9 ± 17.4)	52 (136.9 ± 16.7)	**< 0.001**
ApoB [N(Mean ± Std)]	77 (87.2 ± 68.4)	52 (82.1 ± 62.3)	0.268
Lp(a) [N(Mean ± Std)]	76 (8.5 ± 2.7)	50 (9.0 ± 2.8)	0.656

CHILDREN WITH MS

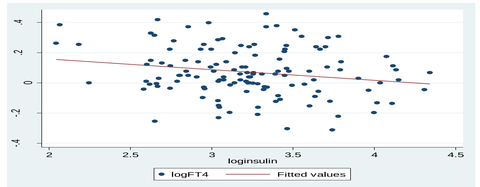
	TSH (μU/ml)		FT4 (ng/ml)	
	r	p-value	r	p-value
Age (years)	-0.072	0.533	-0.152	0.183
BMI (kg/cm^2)	-0.175	0.126	-0.225	**0.048**
DBP (mm Hg)	-0.109	0.343	-0.050	0.666
SBP (mm Hg)	0.128	0.263	-0.063	0.582
Glucose (mg/dL)	-0.218	0.059	0.103	0.376
HbA1c (%)	-0.275	**0.020**	-0.090	0.451
Insulin	-0.088	0.448	-0.042	0.716
Cholesterol	-0.007	0.952	0.056	0.629
HDL	0.115	0.315	0.064	0.578
TG	0.049	0.671	-0.072	0.531
LDL	-0.069	0.547	0.090	0.432
TSH	-	-	0.037	0.747
FT4	0.037	0.747	-	-
Anti-TPO	0.151	0.191	0.020	0.865



Correlation between FT4 and waist in MS populaton

CHILDREN WITHOUT MS

	TSH (μU/ml)		FT4 (ng/ml)	
	r	p-value	r	p-value
Age (years)	-0.161	0.246	-0.088	0.526
BMI (kg/cm^2)	-0.145	0.297	-0.058	0.675
DBP (mm Hg)	0.115	0.428	0.019	0.898
SBP (mm Hg)	0.003	0.983	0.131	0.364
Glucose (mg/dL)	-0.092	0.506	0.152	0.273
HbA1c (%)	-0.208	0.165	0.311	**0.035**
Insulin	-0.143	0.310	-0.393	**0.004**
Cholesterol	0.086	0.539	-0.081	0.564
HDL	0.078	0.578	0.210	0.132
TG	0.120	0.392	-0.111	0.430
LDL	0.088	0.532	-0.095	0.498
TSH	-	-	-0.034	0.808
FT4	-0.034	0.808	-	-
Anti-TPO	0.348	**0.010**	-0.196	0.155



Correlation between FT4 and insulin in non MS population

CONCLUSIONS

Our findings demonstrate that lower FT4, even within the reference ranges, may be related to increased cardiometabolic risk factors in obese children and adolescents with or without MS.