Association of Thyroid function with Cardiometabolic Risk Factors in Euthyroid Korean Children and Adolescents Aged 10-18 years: The Korean National Health and Nutrition Examination Survey 2015

Jung Sub Lim[1], Young Suk Shim[2], Eun Young Kim[3]

[1]Department of Pediatrics, Korea Cancer Center Hospital, Seoul, Republic of Korea
[2]Department of Pediatrics, Hallym University School of Medicine, Seoul, Korea
[3]Department of Pediatrics, Chosun Uinversity School of Medicine, Gwangju, Korea

OBJECTIVES

Thyroid hormone and its regulating hormone (thyroid stimulating hormone, TSH) are not only required to regulate metabolic processes essential for normal growth and development but also to control metabolism. It was reported that there is a significant increase in insulin and glucose levels in patients with hypothyroidism. Recent reports also demonstrated that thyroid function may be related cardiometabolic disease and its components among individuals with hypothyroidism and euthyroid. The present study aimed to evaluate the association of free thyroxine (FT4) and TSH with insulin resistance indices in euthyroid Korean children and adolescents using nationally representative data.

METHODS

A total of 259 subjects from data from the Korean National Health and Nutrition Examination Survey 2015. Blood samples were collected after at least 8 h of fasting. TSH, fT4 and anti-TPO were determined by electrochemiluminescence immunoassay (E-602; Roche, Mannheim, Germany). Serum insulin level was measured by immunoradiometric assay (1470 WIZARD gamma-counter; PerkinElmer, Turku, Finland). Insulin resistance was estimated by the homeostatic model assessment of insulin resistance (HOMA-IR). The HOMA-IR was calculated according to the following formula: fasting insulin (μIU/mL) × fasting glucose (mmol/L)/22.5.

RESULTS

Table 1. Clinical characteristics of the study population.

	Males (n=137)	Females (n=122)	*P*
Age (years)	14.37 ± 2.53	14.16 ± 2.55	0.493
Height SDS	0.72 ± 1.06	0.44 ± 1.11	0.037
Weight SDS	0.52 ± 1.09	0.38 ± 1.21	0.325
WC SDS	0.10 ± 1.10	0.09 ± 1.09	0.961
BMI SDS	0.25 ± 1.12	0.24 ± 1.13	0.963
SBP (mmHg)	111.39 ± 9.20	106.40 ± 7.89	< 0.001
DBP (mmHg)	65.82 ± 7.97	66.93 ± 7.52	0.254
Glucose (mg/dL)	93.53 ± 8.39	91.16 ± 6.81	0.013
HbA1c (%)	5.32 ± 0.26	5.31 ± 0.28	0.794
Insulin (μU/mL)	13.37 ± 10.04	14.30 ± 10.72	0.474
HOMA−IR	3.20 ± 3.18	3.30 ± 2.74	0.789
TC (mg/dL)	158.47 ± 26.79	164.13 ± 23.99	0.076
HDL (mg/dL)	50.71 ± 10.42	52.06 ± 9.19	0.279
TG (mg/dL)	83.19 ± 57.24	87.86 ± 41.97	0.451
LDL (mg/dL)	91.14 ± 23.95	94.70 ± 22.67	0.228
TSH (μU/mL)	2.23 ± 0.81	2.08 ± 0.87	0.151
FT4 (ng/mL)	1.34 ± 0.17	1.27 ± 0.18	0.002
Anti-TPO antibody (U/mL)	10.45 ± 27.44	11.34 ± 29.22	0.801
Smoker (%)	26 (19.0%)	88 (6.6%)	0.006
Alcohol dunker (%)	7 (5.1%)	5 (4.1%)	0.928
Physical activity (%)	78 (56.9%)	68 (55.7%)	0.946

Table 2. Adjusted correlation of thyroid stimulating hormone (TSH) and free thyroxine (FT4) with clinical parameters in euthyroid Korean children and adolescents aged 10-18 years after controlling for gender, age, and body mass index (BMI) standard deviation score (SDS).

	TSH		FT4	
	r	*P*	r	*P*
SBP (mmHg)	0.004	0.951	−0.038	0.554
DBP (mmHg)	−0.033	0.605	0.035	0.582
Glucose (mg/dL)	0.166	0.009	−0.037	0.558
Insulin (μU/mL)	0.147	0.021	−0.169	0.008
HOMA−IR	0.168	0.008	−0.163	0.010
TC (mg/dL)	0.009	0.886	−0.070	0.273
HDL (mg/dL)	0.023	0.720	0.007	0.915
TG (mg/dL)	0.152	0.017	−0.100	0.117
LDL (mg/dL)	−0.066	0.300	−0.036	0.570
TSH (μU/mL)	–	–	−0.058	0.364
FT4 (ng/mL)	0.058	0.364	–	–
Anti-TPO antibody (U/mL)	0.045	0.482	0.072	0.262

Table 3. Adjusted odds ratios (95% CI) of metabolic syndrome (MetS) and its components according to non-HDL-C levels stratified by gender in Korean children and adolescents aged 10-18 years.

	Serum fasting glucose (mg/dL)			Serum fasting Insulin (μU/mL)			HOMA-IR		
	β	SE	*P*	β	SE	*P*	β	SE	*P*
Age	−0.119	0.901	0.022	−0.148	0.205	0.023	−0.152	0.050	0.021
BMI SDS	0.125	0.407	0.067	0.405	0.398	<0.001	0.404	0.097	<0.001
HDL-C (mg/dL)	−0.160	0.119	0.355	0.288	0.116	0.045	0.252	0.028	0.080
TG (mg/dL)	−0.057	0.013	0.562	0.399	0.013	<0.001	0.374	0.003	<0.001
LDL-C (mg/dL)	−0.288	0.100	0.417	0.845	0.098	0.004	0.756	0.024	0.010
TSH (μU/mL)	0.143	0.506	0.023	0.071	0.496	0.166	0.090	0.121	0.082
FT4 (ng/mL)	−0.041	2.467	0.516	−0.110	2.415	0.036	−0.106	0.590	0.043

CONCLUSIONS

Our results suggest that in a Korean population, a non-HDL-C level of 120 mg/dL for males and 150 mg/dL for females is the threshold between borderline high and high risk for MetS.