

Thyroid function in obese Korean children & adolescents : KNHNE Survey 2013 to 2015

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INTRODUCTION

In recent years, there has been an increasing focus on thyroid function in pediatric obese patients, but no nationwide study evaluating the relationship between thyroid function and obesity has yet been conducted in Korea. We aimed to evaluate thyroid dysfunction in obese Korean children.

MATERIAL & METHODS

We analyzed the association between obesity and thyroid hormone levels among 975 Korean boys and girls aged 10–18 years, who participated in the Korean National Health and Nutrition Examination Survey VI (2013 to 2015). The target population of KNHANES comprises noninstitutionalized Korean citizens residing in Korea. The sampling plan follows a multistage-clustered probability design.

The normal values range between 0.35 and 5.50 mIU/L for TSH, and between 0.89 and 1.76 ng/mL for fT4. Obesity and overweight were defined according to the body mass index (BMI) \geq 85th percentile and \geq 95th percentile, respectively.¹⁰ Obesity degree was evaluated using the BMI z-scores, calculated with the LMS method.¹¹ We categorized the subjects with BMI \geq 85th percentile into the overweight and the remaining subjects into the nonobese group, and the cut-off value was based on the 2007 Korean National Growth Charts.

Table 2. Association between obesity index and thyroid function among the study subjects

		N [‡]	TSH > 5.5 uIU/mL [‡]	TSH \leq 5.5 uIU/mL [‡]	X ² (p) [‡]
BMI* [‡]	Non obese [‡]	757 [‡]	44 (5.5) [‡]	713 (94.5) [‡]	7.621(0.026) [‡]
	Overweight [‡]	218 [‡]	18 (9.5) [‡]	200 (90.5) [‡]	
WC† [‡]	Normal [‡]	861 [‡]	49(5.5) [‡]	812(94.5) [‡]	7.621(0.026) [‡]
	Obese [‡]	113 [‡]	12(10.6) [‡]	101(87.9) [‡]	

Table 4B. Association between abdominal obesity metabolic syndrome-related factors with free thyroxine

Variable	Simple			Multiple		
	β	SE	P-value	β	SE	P-value
WC	-0.042	0.018	0.023	-0.046	0.018	0.014
Systolic blood pressure	0.001	0.001	0.117	0.001	0.001	0.329
Diastolic blood pressure	0.002	0.001	0.172	0.001	0.001	0.375
Fasting glucose	0.002	0.001	0.077	0.001	0.001	0.105
HbA _{1c}	0.015	0.033	0.660	-	-	-
HDL cholesterol	0.000	0.001	0.771	-	-	-
Triglyceride	0.000	0.000	0.052	0.000	0.000	0.039

Adjusted for age, sex.

Table 3A. Association between obesity and metabolic syndrome-related factors with thyroid stimulating hormone

Variables	Simple			Multiple		
	β	SE	P-value	β	SE	P-value
Overweight	0.104	0.058	0.075	0.081	0.059	0.174
Systolic blood pressure	0.005	0.003	0.068	0.003	0.003	0.246
Diastolic blood pressure	0.004	0.004	0.279	-	-	-
Fasting glucose	0.002	0.002	0.362	-	-	-
HbA _{1c}	0.034	0.065	0.603	-	-	-
HDL cholesterol	0.003	0.002	0.181	0.006	0.003	0.013
Triglyceride	0.001	0.000	0.001	0.002	0.000	0.000

Adjusted for age, sex.

Table 3B. Association between abdominal obesity and metabolic syndrome-related factors with thyroid stimulating hormone

Variable	Simple			Multiple		
	β	SE	P-value	β	SE	P-value
WC	0.201	0.074	0.007	0.177	0.077	0.023
Systolic blood pressure	0.005	0.003	0.068	0.003	0.003	0.306
Diastolic blood pressure	0.004	0.004	0.279	-	-	-
Fasting glucose	0.002	0.002	0.362	-	-	-
HbA _{1c}	0.034	0.065	0.603	-	-	-
HDL cholesterol	0.003	0.002	0.181	0.007	0.003	0.011
Triglyceride	0.001	0.000	0.001	0.002	0.000	0.001

Adjusted for age, sex.

Table 4A. Association between obesity metabolic syndrome-related factors with free thyroxine

Variable	Simple			Multiple		
	β	SE	P-value	β	SE	P-value
Overweight	-0.050	0.015	0.001	-0.057	0.016	0.000
Systolic blood pressure	0.001	0.001	0.117	0.001	0.001	0.156
Diastolic blood pressure	0.002	0.001	0.172	0.001	0.001	0.448
Fasting glucose	0.002	0.001	0.077	0.001	0.001	0.098
HbA _{1c}	0.015	0.033	0.660	-	-	-
HDL cholesterol	0.000	0.001	0.771	-	-	-
Triglyceride	0.000	0.000	0.052	0.000	0.000	0.067

Adjusted for age, sex.

Table 1. Characteristics of the study subjects who 10-18 years old children and underwent thyroid function tests as part of the Korea National Health and Nutrition Examination Survey IV (2013-2015)

Characteristic [‡]	Status of obesity* [‡]		
	Total [‡]	Non obese [‡]	Overweight [‡]
N (%) [‡]	975 [‡]	757 (77.7) [‡]	218 (22.4) [‡]
Demographics[‡]			
Age (yr) [‡]	14.3 \pm 0.1 [‡]	14.2 \pm 0.1 [‡]	14.3 \pm 0.2 [‡]
Gender (Female) [‡]	459(46.8%) [‡]	355(46.3%) [‡]	104(48.2%) [‡]
Anthropometric indexes[‡]			
WC (cm) [‡]	71.2 \pm 0.4 [‡]	67.7 \pm 0.3 [‡]	83.5 \pm 0.7 [‡]
BMI (kg/m ²) [‡]	21.4 \pm 0.1 [‡]	19.8 \pm 0.1 [‡]	26.7 \pm 0.3 [‡]
BMI z-scores [‡]	-0.1 \pm 0.1 [‡]	-0.2 \pm 0.0 [‡]	1.7 \pm 0.0 [‡]
Blood pressure[‡]			
Systolic (mmHg) [‡]	108.9 \pm 0.4 [‡]	107.4 \pm 0.4 [‡]	113.8 \pm 0.7 [‡]
Diastolic (mmHg) [‡]	66.2 \pm 0.3 [‡]	65.9 \pm 0.4 [‡]	67.2 \pm 0.6 [‡]
Biochemical indexes[‡]			
Fasting glucose (mg/dl) [‡]	91.8 \pm 0.4 [‡]	91.6 \pm 0.4 [‡]	92.4 \pm 0.5 [‡]
HbA _{1c} (%) [‡]	5.5 \pm 0.0 [‡]	5.4 \pm 0.0 [‡]	5.5 \pm 0.0 [‡]
Total serum cholesterol (mg/dl) [‡]	158.6 \pm 1.0 [‡]	157.2 \pm 1.1 [‡]	163.5 \pm 2.1 [‡]
HDL cholesterol (mg/dl) [‡]	51.9 \pm 0.4 [‡]	53.0 \pm 0.4 [‡]	48.3 \pm 0.8 [‡]
Triglyceride (mg/dl) [‡]	82.8 \pm 1.9 [‡]	78.4 \pm 1.7 [‡]	98.0 \pm 5.1 [‡]
FT4 (ng/dl) [‡]	2.8 \pm 0.1 [‡]	2.7 \pm 0.1 [‡]	3.1 \pm 0.2 [‡]
Abdominal obesity† [‡]	113(12.3%) [‡]	6(0.8%) [‡]	107(49.1%) [‡]
High TSH (> 5.5 uIU/mL) [‡]	62(6.4%) [‡]	44(5.8%) [‡]	18(8.3%) [‡]

Table 4B. Association between abdominal obesity metabolic syndrome-related factors with free thyroxine

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WC	-0.042	0.018	0.023	-0.046	0.018	0.014
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HDL cholesterol	0.000	0.001	0.771	-	-	-
Triglyceride	0.000	0.000	0.052	0.000	0.000	0.039

Adjusted for age, sex.

RESULT

Average serum thyrotropin (TSH) and serum free thyroxine (fT4) levels in the non-obese group were 2.7 \pm 0.1 μ IU/mL and 1.3 \pm 0.0 ng/dL, and in the obese group were 3.1 \pm 0.2 μ IU/mL and 1.2 \pm 0.0 ng/dL. Serum TSH level was significantly higher in the abdominal obesity group than that in the normal weight group ($P = 0.023$). Free T4 levels were significantly lower in both the obese and abdominal obesity groups than that in the normal group ($P < 0.001$, $P = 0.014$). Serum TSH levels were associated positively with abdominal obesity and levels of high-density lipoprotein cholesterol and triglyceride (TG). Serum fT4 levels were negatively correlated to abdominal obesity ($P = 0.014$).

CONCLUSIONS

Korean children with abdominal obesity showed increased TSH and decreased fT4 levels compared to normal children.

