



THYROID FUNCTION TESTS

Is there an association between obesity and changes in TSH and free T₃ levels?

BACKGROUND

Prior studies have reported that obese patients have slightly higher blood levels of TSH as compared to normal weight patients. In addition, and T₃ levels may be increased but T₄ levels unchanged. After weight loss, T₃ levels return to normal. These findings suggest that weight gain and obesity result in changes in the thyroid function, rather than the change in the thyroid function being the primary event resulting in obesity. It is not known whether the increase in TSH and T₃ levels are related or if they represent independent results of obesity. The aim of this study is to evaluate the relationship between TSH, free T₄ (FT₄) and free T₃ (FT₃) levels and weight measured by body-mass index (BMI) in a large database of pediatric and adolescent patients.

THE FULL ARTICLE TITLE

Karavani G et al. Increases in thyrotropin within the near-normal range are associated with increased triiodothyronine but not increased thyroxine in the pediatric age group. J Clin Endocrinol Metab. May 30, 2014 [Epub ahead of print]. DOI: <http://dx.doi.org/10.1210/jc.2014-1441>.

SUMMARY OF THE STUDY

This is a cross-sectional study of 21,023 blood samples drawn from pediatric and adolescent patients in community clinics in Jerusalem between February and November 2011. Only samples that tested all three parameters (TSH, FT₄, and FT₃) and had height and weight recorded within 6 months of the blood sampling available from electronic medical records were included in the analysis. Samples with TSH level above 7.5 mIU/L or from subjects with history of thyroid disease or on thyroid treatment or medications that can affect the thyroid function were excluded from analysis. Out of 3,276 samples that met the inclusion criteria, 1,317

samples were from patients 10 years old or younger and 1,959 samples were from patients 11 to 20 years old. The samples were divided in four BMI groups: underweight, normal weight, overweight and obese.

There was a positive correlation between the TSH and FT₃ levels in the entire group, when the samples were divided in 4 equal subgroups from the lowest to the highest TSH level, and when the samples were divided by gender or age (under 11 years vs. 11 to 20 years). No correlation was found between the TSH and FT₄ levels. Both TSH and FT₃ levels were slightly higher in the overweight and obese groups, as compared with the normal weight group. In the 1,903 samples from the normal-weight group, the FT₃ levels were higher in the subgroup with highest TSH than in the subgroup with the lowest TSH levels, while no difference was noted in the FT₄ or BMI levels.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

This study confirmed in a large database that for normal or slightly higher than normal TSH levels, the FT₃ but not FT₄ levels increase proportionally with the increase in TSH levels within the normal weight, overweight and obese groups. These findings support the hypothesis that TSH preferentially stimulates T₃ rather than T₄ production and/or secretion. Further studies are needed to examine the relationship between TSH, T₃ and T₄ levels as well as body weight and thyroid function.

—Alina Gavrila, MD, MMSC

ATA THYROID BROCHURE LINKS

Thyroid Function Tests: <http://www.thyroid.org/blood-test-for-thyroid>

Thyroid and Weight: <http://www.thyroid.org/weight-loss-and-thyroid>

ABBREVIATIONS & DEFINITIONS

TSH: Thyroid Stimulating Hormone — produced by the pituitary gland that regulates thyroid function; also

the best screening test to determine if the thyroid is functioning normally.

**THYROID FUNCTION TESTS, continued**

Thyroxine (T₄): the major hormone produced by the thyroid gland. T₄ gets converted to the active hormone T₃ in various tissues in the body.

Free thyroxine (FT₄): a minor proportion of T₄ that is not bound to proteins in the blood.

Triiodothyronine (T₃): the active thyroid hormone, usually produced from thyroxine.

Free triiodothyronine (FT₃): a minor proportion of T₃ that is not bound to proteins in the blood.

Body mass index (BMI): the weight in kilograms divided by the square of the height in meters.

Cross-sectional study: observational study that analyzes data from a study group collected at one time point.