



## HYPOTHYROIDISM

# Does a normal TSH mean that patients are on the right levothyroxine dose?

### BACKGROUND

Hypothyroidism (underactive thyroid) is very common, especially in women and is diagnosed most of the time by an increased TSH level. The main thyroid hormone produced by the thyroid is thyroxine ( $T_4$ ), with most of the active hormone,  $T_3$ , produced by conversion of  $T_4$  to  $T_3$  in peripheral tissues. Because of this, the standard treatment for hypothyroidism is synthetic  $T_4$  known as Levothyroxine. The treatment goal is to find the best Levothyroxine dose that brings the TSH level back to the normal range, which is thought to restore normal thyroid hormone levels in the body. However, a small proportion of patients have persistent hypothyroid symptoms on Levothyroxine treatment despite of normal TSH levels, and some of these patients feel better on other treatment options including a combination both  $T_4$  and  $T_3$ . The goal of this study was to evaluate the differences in the clinical presentation and laboratory tests between hypothyroid patients being treated with Levothyroxine and individuals without thyroid problems and normal TSH levels using data from the National Health and Nutrition Examination Survey (NHANES).

### THE FULL ARTICLE TITLE

Peterson SJ et al. Is a normal TSH synonymous with “euthyroidism” in levothyroxine monotherapy? *J Clin Endocrinol Metab.* October 4, 2016 [Epub ahead of print].

### SUMMARY OF THE STUDY

A total of 9981 NHANES participants had a normal TSH level (0.24–5.40 mIU/L) and met other inclusion criteria for this study. Among these individuals, 469 reported taking Levothyroxine and formed the L- $T_4$  group. The rest of 9512 individuals not taking L- $T_4$  formed the healthy control group. A total of 469 healthy controls were matched to the L- $T_4$  group by TSH level, age, gender, and ethnicity and formed the matched control group.

The L- $T_4$  group had 5-10% lower serum  $T_3$  levels and 10-15% higher serum  $T_4$  levels resulting in 15-20% lower  $T_3:T_4$  ratio as compared with the matched control

group, despite of having similar TSH levels. Serum  $T_3:T_4$  ratio did not correlate strongly with any of the 52 clinical parameters and laboratory tests studied.

The L- $T_4$  group had a 5% higher BMI and 5% less calorie intake adjusted by body weight than the matched control group, without any differences noted in type of food consumed. A higher proportion of the L- $T_4$  group reported participation in moderate recreational activities as compared with the matched control group, although physical activity in general was lower in the L- $T_4$  group. Additionally, in this group, more participants reported that their physical and mental health was not good as compared with the matched control group. Serum LDL, HDL, and total cholesterol were lower in the L- $T_4$  group, while blood pressure, heart rate, glucose, HbA1c and triglycerides were similar in both groups.

### WHAT ARE THE IMPLICATIONS OF THIS STUDY?

In this large population study, hypothyroid patients taking Levothyroxine who had a normal TSH level showed lower serum  $T_3$  and higher  $T_4$  levels, and consequently lower  $T_3:T_4$  ratios than matched healthy individuals without thyroid problems. In addition, there were differences noted between the Levothyroxine-treated and healthy matched subjects in BMI, cholesterol levels, medications used as well as reported caloric intake, physical activity, and the feeling of poor health. These findings suggest that a normal TSH level may not be sufficient as a single criterion used to find the right levothyroxine dose for each patient.

— Alina Gavrila, MD, MMSC

### ATA THYROID BROCHURE LINKS

Thyroid Function Tests: <http://www.thyroid.org/thyroid-function-tests/>

Hypothyroidism (Underactive): <http://www.thyroid.org/hypothyroidism/>

Thyroid Hormone Treatment: <http://www.thyroid.org/thyroid-hormone-treatment/>

**HYPOTHYROIDISM**, continued**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.

**Thyroxine (T<sub>4</sub>):** the major hormone produced by the thyroid gland. T<sub>4</sub> gets converted to the active hormone T<sub>3</sub> in various tissues in the body.

**Levothyroxine (T<sub>4</sub>):** synthetic T<sub>4</sub>, the standard treatment for hypothyroidism.

**Triiodothyronine (T<sub>3</sub>):** the active thyroid hormone, usually produced from thyroxine.

**Hypothyroidism:** a condition where the thyroid gland is underactive and doesn't produce enough thyroid hormone. Treatment requires taking thyroid hormone pills in order to return their thyroid hormone levels to normal.

**National Health and Nutrition Examination Survey (NHANES):** research program that assesses the health and nutritional status of Americans; the program evaluates a nationally representative sample of about 5000 persons each year through interview, physical examination and collection of lifestyle, clinical and laboratory data.

**Body Mass Index (BMI):** a person's weight in kilograms (kg) divided by his or her height in meters squared; used to define normal weight, overweight and obesity.

**Triglycerides, LDL, HDL, total cholesterol:** different types of fat measured in the blood.

**Glycated hemoglobin (HbA1c):** test for diabetes that measures the three-month average blood glucose concentration.

