THYROID HORMONES

Both age and sex affects the relationship between blood levels of T₄ and TSH

BACKGROUND
The main thyroid hormone that is produced by the thyroid gland is thyroxine (T₄). The production of T₄ is regulated by thyroid stimulating hormone (TSH) which is secreted by the pituitary gland. T₄ is measured in the blood as free T₄ (FT₄). In general, there is a direct relationship between blood levels of FT₄ and TSH. However, there is little information as to whether age or sex has any influence on this FT₄:TSH relationship. This is important, since management of the treatment of hypothyroidism or hyperthyroidism relies on getting both FT₄ and TSH in the normal range. The aim of this study was to examine the effect of age and sex on the relationship between blood measurements of FT₄ and TSH.

THE FULL ARTICLE TITLE
Hadlow NC et al. The relationship between TSH and free T₄ in a large population is complex, non-linear and differs by age and gender. J Clin Endocrinol Metab. May 13, 2013 [Epub ahead of print].

SUMMARY OF THE STUDY
The authors of this study examined the general relationship between TSH and FT₄, as well as differences according to age and sex, using blood samples from 152,261 individuals that had been collected in a single laboratory in Australia over 12 years. The study excluded blood specimens from individuals who were in hospital, pregnant, younger than 1 year of age, since these factors can alter both FT₄ and TSH levels. Approximately 21% of the blood specimens in the study were from individuals who were taking thyroid hormone. The authors performed complex statistical analyses and graphed the results, determining that the relationship between TSH and FT₄ levels was complex. For FT₄ measurements that were within the normal range, men tended to have slightly higher TSH values than women and TSH values tended to be higher with older age. However, in hypothyroid patients with low FT₄ levels below normal range, TSH values tended not to be as high in older individuals as compared to younger individuals. In general, when FT₄ levels were normal, the relationship between TSH measurements and FT₄ was not significantly different between individuals treated with thyroid hormone, as compared to those not treated with thyroid hormone.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?
This study shows that the relationship between TSH and FT₄ blood measurements is more complex than originally thought. In patients with normal thyroid function, men appear to have higher TSH levels than women. The degree of TSH elevation in hypothyroidism is less in the older patient than in the younger one. Thus, this study suggests that both age and sex need to be taken in consideration when interpreting blood levels of FT₄ and TSH.

— Anna Sawka, MD

ATA THYROID BROCHURE LINKS
Hypothyroidism: [http://www.thyroid.org/what-is-hypothyroidism]
Hyperthyroidism: [http://www.thyroid.org/what-is-hyperthyroidism]
Thyroid Hormone Treatment: [http://www.thyroid.org/thyroid-hormone-treatment]

ABBREVIATIONS & DEFINITIONS
Hypothyroidism: a condition where the thyroid gland is underactive and doesn't produce enough thyroid hormone. Treatment requires taking thyroid hormone pills.

Hyperthyroidism: a condition where the thyroid gland is overactive and produces too much thyroid hormone. Hyperthyroidism may be treated with antithyroid meds (Methimazole, Propylthiouracil), radioactive iodine or surgery.

continued on next page
Thyroid hormone therapy: patients with hypothyroidism are most often treated with Levothyroxine in order to return their thyroid hormone levels to normal. Replacement therapy means the goal is a TSH in the normal range and is the usual therapy. Suppressive therapy means that the goal is a TSH below the normal range and is used in thyroid cancer patients to prevent growth of any remaining cancer cells.

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

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.