



## THYROID AND WEIGHT

### Fat accumulation within the thyroid may affect the thyroid function

#### BACKGROUND

Recent data has clearly shown a role for fat cells in regulating a variety of functions of other cells. The normal thyroid gland contains a small amount of fat cells but their role in regulating thyroid function is unclear. It is known that obesity causes fat accumulation in different organs, such as the liver, which impairs their function. Prior studies have reported thyroid problems in obese patients, however it is not known whether this is due to fat deposition in the thyroid gland. Studies have used obese mouse models to study fat accumulation in the thyroid. The goal of this study is to evaluate whether there is fat accumulation in the thyroid gland in obese humans and mouse models and whether the changes in the thyroid fat content associated with obesity have an effect on the thyroid function.

#### THE FULL ARTICLE TITLE

Lee MH et al. Thyroid dysfunction associated with follicular cell steatosis in obese male mice and humans. *Endocrinology* 2015;156:1181-93. Epub January 2, 2015.

#### SUMMARY OF THE STUDY

The study included 35 Korean patients who underwent total thyroidectomy for thyroid cancer; 9 patients had normal weight and 26 patients were obese. The normal thyroid lobe without thyroid cancer was examined for presence of fat deposits between the thyroid follicles and inside the thyroid cells. The study also evaluated the amount and localization of fat in the thyroid gland and the thyroid function of obese mice on a high fat diet compared to lean mice fed a normal diet as well as genetically obese mice with a more severe form of fat accumulation.

The frequency and amount of fat in the thyroid gland was higher in obese patients compared to non-obese patients. Most obese patients showed fat accumulation both inside and outside the thyroid cells. Most non-obese patients did not have a significant amount of fat in their thyroid, only a few patients showing fat accumulation outside the thyroid follicles with or without fat accumulation inside the thyroid cells; fat accumulation only inside the thyroid cells was not noted in non-obese patients. Blood TSH and T<sub>4</sub> levels were not different between obese and non-obese

patients. However, when evaluating the entire group, the blood TSH levels were higher in patients with fat accumulation compared to patients without fat accumulation in their thyroid, suggesting that fat accumulation may impair the thyroid function.

Obese mice fed a high fat diet showed a higher amount of fat outside the thyroid follicles compared to normal mice fed a regular diet, and the amount of fat correlated positively with the blood TSH level. Obese but not normal mice also showed fat accumulation inside the thyroid cells. Obese mice had higher triglyceride and cholesterol levels in their thyroid. Obese mice had higher blood TSH levels and lower blood T<sub>3</sub> and T<sub>4</sub> levels and showed decreased thyroid hormone production compared to normal mice. Similar findings were noted in genetically obese mice. These findings suggest that mice with diet induced and genetically induced obesity have primary thyroid dysfunction.

#### WHAT ARE THE IMPLICATIONS OF THIS STUDY?

Obesity results in fat accumulation in the thyroid gland in humans and a mouse model. This may affect the thyroid hormone production and result in hypothyroidism, as suggested by studies in obese mice. Further studies in humans are needed to confirm these findings and evaluate whether weight loss can reverse the thyroid malfunction. Weight loss may be a better treatment option for obese patients with hypothyroidism compared to thyroid hormone replacement treatment.

— Alina Gavriila, MD, MMSC

#### ATA THYROID BROCHURE LINKS

Thyroid Surgery: <http://thyroid.org/patients/patient-brochures/surgery.html>

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

Hypothyroidism: <http://www.thyroid.org/what-is-hypothyroidism>

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



## THYROID AND WEIGHT, continued

### ABBREVIATIONS & DEFINITIONS

**Total thyroidectomy:** surgery to remove the entire thyroid gland.

**Thyroid follicle:** small spherical vesicles located in the thyroid gland that are lined with thyroid cells and contain a fluid called colloid; thyroid hormones are produced by the thyroid cells and stored as a precursor named thyroglobulin inside the colloid.

**Genetically obese mice:** mice with certain changes in their genes (mutations) that predispose them to become obese.

**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 ( $T_4$ ):** the major hormone produced by the thyroid gland.  $T_4$  gets converted to the active hormone  $T_3$  in various tissues in the body.

**Triiodothyronine ( $T_3$ ):** the active thyroid hormone, usually produced from thyroxine.

**Triglycerides:** a major form of body fat.

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

