RELATION BETWEEN THYROID AND BODY MASS INDEX.

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ABSTRACT

Aim :

The aim of the study is to calculate the BMI in hypothyroid and hyperthyroid patients.

Objective :

To calculate the BMI in hypothyroid and hyperthyroid patients and to correlate the values of BMI in hypothyroid and hyperthyroid patients.

Background :

Body Mass Index is a measure of body fat based on height and weight that applies to adult and children. A possible role of thyroid hormones in regulating adipose tissue metabolism in humans has been pro- posed with growing interest. Thyroid is off two types : hyperthyroid and hypothyroid. Hyperthyroidism is increase in thyroxin level and decrease in TSH . Clinical hyperthyroidism causes an increase in BMI . Hypothyroidism is decrease in thyroxin level and increase in TSH . Clinical hypothyroidism causes decrease in BMI. Thus, slight differences within the normal thyroid function may have important implications for regulation of body weight and the prevalence of obesity .

Reason : To know how thyroid level affects BMI in thyroid patients .

Keywords: BMI, hyperthyroid, hypothyroid,adipose tissue.

INTRODUCTION

As obesity is a widespread problem today, knowledge about the factors affecting or influencing it is important. Little is known about the changes in thyroid function in obese people. Influence on thyroid hormone synthesis has been proposed. Thyroid function has been often described as altered in obese children; however, it is not clear whether the altered thyroid function is the cause or the consequence of fat excess.

Long before the definition of the metabolic syndrome, alterations in thyroid function were reported in obese patients. Thyroid is a large ductless gland in the neck which secretes hormones regulating growth and development through rate of metabolism. Thyroid hormones play critical roles in differentiation, growth, and metabolism. Thyroid hormone is required for normal function of nearly all tissues, with major effects on oxygen consumption and metabolic. Obesity is a leading preventable cause of death worldwide, with increasing rates in adults and children. It is a condition in which excess body fat has accumulated to the extent that it may have a negative effect on health leading to a reduced life expectancy and increased health problems. Body mass index (BMI) is a very relevant parameter to decide if a person is obese. The BMI is defined as the body mass divided by the square of the body height. In some countries, people are considered obese when the BMI exceeds 30 kg/m2. A BMI of <18.5 is considered underweight while BMI≥30 is considered obese as established by WHO [1]. Some studies show that there is a relation between small size at birth and obesity, and this may contribute to the pathogens underlying the fetal origins hypothesis. In recent studies, people who were thin at birth and then showed rapid childhood growth had the greatest risk for diseases in adulthood. The etiology or cause of obesity is an imbalance between the energy ingested in food and the energy expended. The thyroid hormone binds on to the receptor that is ligand- regulatable transcription factors. Thyroid hormone synthesis and secretion is exquisitely regulated by a negative-feedback system that involves the hypothalamus, pituitary, and the thyroid gland. Thyroid- stimulating hormone (TSH) is the primary regulator of thyroid hormone. Thyroid hormone has many effects on the heart and vascular system. Many of the clinical manifestations of hyperthyroidism are due to the inability of thyroid hormone to alter cardiovascular hemodynamics. The thyroid hormone-induced increase in thermogenesis is explained, among other things, by an increased need for adenosine triphosphate (ATP) due to increased activity in most cells and reduced efficiency of ATP synthesis. Disorders of the thyroid gland are among the most common endocrine problems. Thyroid hormone status affects the functioning renal mass (measured as the kidney to body mass ratio), with hypothyroidism reducing this ratio and hyperthyroidism increasing it. During the process of development, apoptosis and cellular proliferation are balanced by this multi hormonal mechanism, the major actor of which is triiodothyronine (T3). Some studies show that triiodothyronine controls metabolic and energy homeostasis, and this influences body weight and TSH via receptors in fat tissues inducing differentiation of preadipocytes to adipocytes and expansion of adipose tissue. The thyroid hormone, thyroxine promotes protein synthesis and growth and also helps to regulate the body's metabolism. Thyroxine forms by combining the amino acid tyrosine with iodine. Some common thyroid disorders include Graves' disease, goitre, Hashimoto's disease, and thyroid nodules. Most of these occur due to problems in the thyroid gland. It is necessary to prevent the factors influencing these disorders as thyroid hormones regulate a lot of functions in our body. Thus, information about thyroid gland and its hormones is of at most importance.

The thyroid is the principal endocrine gland that regulates body functions, growth and metabolism. Amongst all the endocrine disorders, thyroid diseases are the most common glandular disorder [2]. Good metabolism leads to good BMI. BMI is a measure of body fat based on height and weight that applies to adult and children. Thyroid is off two types : Hyperthyroid and Hypothyroid. Hyperthyroidism is increase in thyroxin level and

decrease in TSH. Clinical hyperthyroidism causes an decrease in BMI. Hypothyroidism is decrease in thyroxin level and increase in TSH . Clinical hypothyroidism causes increase in BMI. Thus, slight differences within the normal thyroid function may have important implications for regulation of body weight and the prevalence of obesity .

Body composition and thyroid hormones appear to be closely related since the latter is known to be involved in the regulation of basal metabolism and thermogenesis, playing an important role in lipid and glucose metabolism, food intake and fat oxidation [3,4]. An important cause of obesity is said to be hormonal imbalance as in hypothyroidism (under active thyroid gland). Since obesity is related to hormonal imbalance, in this study, the levels of thyroid hormones in thyroid patients have been studied to find out the relation between BMI and thyroid. The present study aims at the detection of correlation between the thyroid and the fluctuations of BMI and its parameters (weight and height).

MATERIALS AND METHODS

This cross-sectional study was conducted at Saveetha medical college. All age groups were included in the study. A total of 100 patients were considered in the study. Both male and female patients suffering from Hyperthyroidism and Hypothyroidism were included. The results were calculated based on the BMI of the patients.

a. Height: Height of an individual was measured , without having shoes [5].

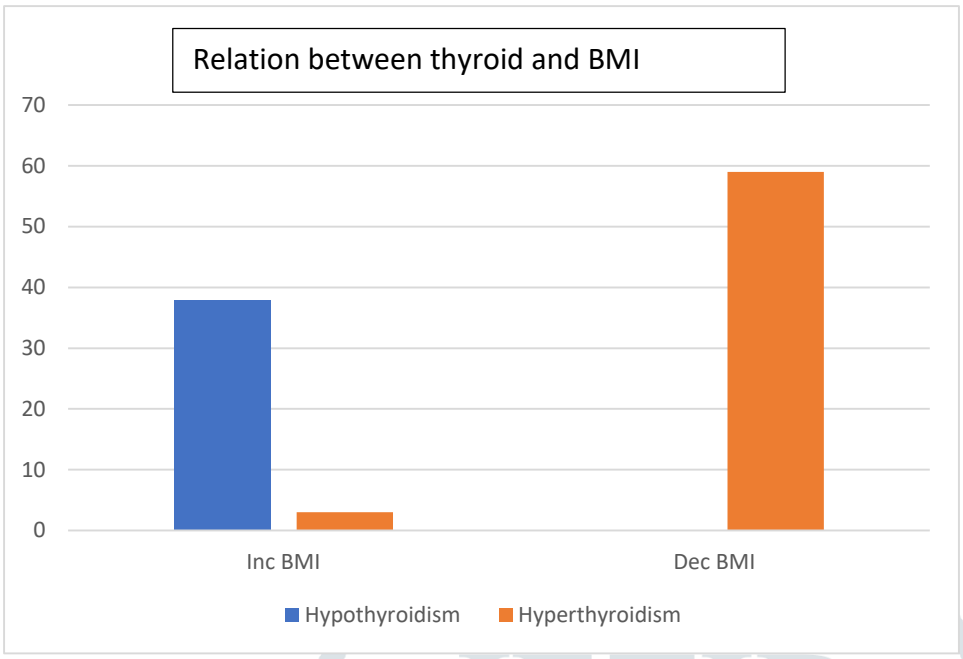
b. Weight: Weight of the participant was measured by digital weight machine [6].

c. BMI: BMI of a person is defined as the weight of the person in kilogram divided by the square of the height in meter. Normal BMI was said to be between 18.5-24.99 kg/m2. People ≥25kg/m2 referred overweight [7].

d. Thyroid function test: TSH, FT4 and T3 were estimated.

Normal range of thyroid tests was TSH - 0.39-6.16 (µIU/ml), free T4 - 0.8-2.0 (ng/dl) and T3 - 0.52-1.85 (ng/ml). Patients with TSH levels >6.2 (µIU/ml) with normal FT4 and T3 values[8].

RESULT



Graph 1: Relation between thyroid and BMI

Among 62 hyperthyroid patients 59 had decrease in BMI and 3 had increase in BMI. Among 38 hypothyroid patients , all the hypothyroid patients had increase in BMI (graph 1).

DISCUSSION

A sample of 100 patients were taken in the study. Out of 100 patients 62 patients had hyperthyroidism and 38 had hypothyroidism. Among 62 hyperthyroidism patients ,59 had decrease in BMI i,e decrease in weight and 3 had increase in BMI whereas 38 hypothyroidism patients had increase in BMI i,e increase in body weight. Fatourechi V et al also states that Clinical hypothyroidism causes an increase in body weight, while hyperthyroidism reduces it [8]. Body consumption and thyroid hormones appears to be closely related since the latter is known to be involved in the regulation of basal metabolism and thermogenesis , playing a role in lipid and glucose metabolism , food intake and fat oxidation. The relationship between BMI and variations in thyroid function could be explained by the process of thermogenesis.Thyroid hormones increase thermogenesis through an increase in cellular activity to produce ATP[10].

The correlation between TSH and BMI could be mediated by leptin produced by adipose tissue. Leptin physiologically regulates energy homeostasis by making the central nervous system aware of its adipose tissue reserves. It modulates the neuroendocrine and behaviour responses to overfeeding, thereby controlling the amount of food consumed and energy expenditure. Leptin is also an important regulator of the hypothalamic-pituitary-thyroid axis by regulation of TRH gene expression in the paraventricular nucleus, and TSH in turn will stimulate leptin secretion by human adipose tissue[11]. Leptin also affects thyroid deiodinase activities with activation of T_4 to T_3 conversion[12,13]. All the foregoing data support the concept of an inverse relationship between thyroid hormone and leptin. Factors secreted or stimulated by adipose tissue, with a detrimental effect directly on the thyroid, might be the cause of the result of our study.

An elevated serum concentration of TSH, suggesting subclinical hypothyroidism, was frequently reported in human obesity. Several investigations, mostly represented by cross-sectional population studies, demonstrated a correlation between serum levels of TSH and BMI. These data suggested that thyroid function (even within the normal range) could be one of several factors contributing to determining body weight in the general population . A recently published study by Marzullo et al *[14]* supported this concept by suggesting that obesity is a risk factor for thyroid autoimmunity, thus establishing a link between the main cause of acquired thyroid failure and obesity

In order to Increase energy consumption, thyroid hormones have been administered for the treatment of obesity with little success. The increase of the dosage for the achievement of the maximal desired effects led to side effects, and thus it was abandoned[15]. Some studies show that triiodothyronine control metabolic and energy homeostasis and this influences body weight and TSH vis receptors in fat tissues including differentiation of preadipocytes to adipocytes and expansion of adipose tissue[16].

CONCLUSION

It is important to note that the increased prevalence of obesity worldwide may further confound the definition of the normal TSH range in population. More research is necessary to determine whether mild thyroid hormone deficiency and the consequent mild TSH increase, *i.e.* to the upper limit of the reference range, are involved in the development of obesity. Moreover, studies are required to establish the potential role of high leptin levels produced by adipose tissue in increasing susceptibility to thyroid autoimmunity, which in turn entails a high risk of developing subclinical or overt hypothyroidism. Thyroid disorders are accompanied by differences in BMI due to the changes in the metabolic rate. The possible implications of the slight differences in thyroid function (without reaching overt thyroid dysfunction) for the risk of gaining weight and developing overweight or obesity and losing weight have high actuality with the present worldwide epidemic of obesity and complications associated with obesity.Further multi-centric and large studies are required for a general assumption of the correlation between obesity and variations of normal thyroid function with more focused approach on the mechanistic aspects[17].

REFERENCE

1. BMI Classification. Global Database on Body Mass Index. Geneva: World Health Organization; 2006. ???. [Last retrieved on 2012 Jul 27].
2. Subramanium P,Jagannathan N. Oral Manifestations of Hypothyroidism. International Journal of Pharmaceutical and Clinical Research 2014; 6(4): 281-283
3. Silva JE. Thermogenic mechanism and their hormonal regulation. Physiol Rev 2006;86:435-464.
4. Rosenbaum M, Hirsch J, Murphy E, Leibel RL. Effects of changes in body weight on carbohydrate metabolism, catecholamine excretion, and thyroid function Comment in Am J Clin Nutr. 2001 Mar;73(3):655-8.
5. Tolonen H. Recommendation for Indicators, International Collaboration, Protocol and Manual of Operations for Chronic Disease Risk Factor Surveys. European Health Risk Monitoring. 2002.

6. World Health Organization: Obesity and overweight .2015
7. R A, Milionis C. Correlation between body mass index and thyroid function in euthyroid individuals in Greece. ISRN Biomark 2013;2013:651494.
8. Burtis CA, Ashwood ER, Bruns DE. Teitz Fundamentals of Clinical Chemistry. 6th ed. St. Louis: Saunders Elsevier; 2008. p. 422-4.
9. Fatourechi V. Subclinical hypothyroidism: An update for primary care physicians. Mayo Clin Proc 2009;84(1):65-71.
10. L. Sestoft, Metabolic aspects of the calorigenic effect of thyroid hormone in mammals ClinicalEndocrinology. 1980;vol.13 no.5,pp. 489–506.
11. Aniruddh Menon, Prof. M.S. Thenmozhi Correlation Between Thyroid Function and Obesity Research J. Pharm. and Tech 2016; 9(10):1568-1570.
12. Reinehr T Obesity and thyroid function.*Mol Cell Endocrinol 2010;* 316:165–171.
13. Zimmermann-Belsi ,Brabant, Holst JJ, Feldt-Rasmusse U 2003 Circulating leptin and thyroid dysfunction.*Eur J Endocrinol* 149:257–27.
14. Marzullo P,Minocci A,Tagliaferri MA,Guzzaloni G,Di Blasio A, De Medici C,Aimaretti G,Liuzzi A Investigations of thyroid hormones and antibodies in obesity: leptin levels are associated with thyroid autoimmunity independent of bioanthropometric, hormonal and weight-related determinants.*J Clin Endocrinol Metab 2010;*95:3965–3972.
15. M. Krotkiewski, Thyroid hormones in the pathogenesis and treatment of obesity, European Journal of Pharmacology,2002;vol. 440, no. 2-3, pp. 85-98.
16. Fathima and Preetha ,Evaluation of thyroid function test in obese patients.Asian J Pharm Clin Res, Vol 9, Suppl. 3, 2016, 353-355.
17. Gaurav gupta , Preeti sharma , Pradeep kumar , m itagappa , Rachna sharma , a correlation between thyroid stimulating hormone and body mass index in women with subclinical hypothyroidism, asian j pharm clin res, 2015;vol 8, issue 4, 206-208