



Relationship between obesity and thyriod hormone level in human body

Muhammad Muzammal, Safeer Ahmad*, Muhammad Zeeshan Ali, Muhammad Ikram, ToqeerAhmad, Sohail Ahmad, Rizwan, Saima Mashal, Amna Karim, Fatima, Sana Saleem Jan

Gomal Center of Biochemistry and Biotechnology, Gomal University, Dera Ismail Khan, Kpk, Pakistan

Key words: Thyroid hormone, Elisa, Thyroxine, Triiodothyronine, Overweight, Obese.

<http://dx.doi.org/10.12692/ijb/14.1.70-74>

Article published on January 11, 20199

Abstract

Thyroid gland is the largest and purest endocrine gland in the body about 20gm in weight. It secretes two types of hormones Thyroxine (T₄) and Triiodothyronine (T₃). These two hormones are involved in the basic metabolic process in the body. Due to malnutrients our youth is facing many problems related to health. This study was done on the normal and obese individuals to find out the level of thyroid hormone in their body that either obesity has any effect on the thyroid hormone level in the body. Using standard method the BMI of all the individuals was calculated. Also the level of Thyriod hormone was calculated using Elisa technique. In our finding highest level of TSH in male participants was found to be 2.672 μ IU/ml and his BMI was 32.196, while he had low level of T₃ and T₄ hormone i.e. 0.971ng/ml and 5.683 μ g/dl respectively. In Female participants highest level of TSH was found to be 2.875 μ IU/ml. Her BMI was 32.87 and her T₃ and T₄ hormone level was 1.019ng/ml and 5.621 μ g/dl respectively, Which was significantly lesser then the rest of the female participants with normal BMI. Our study strongly relates to the hypothesis that obese individuals has high level of TSH while low level of T₃ and T₄ hormone as compared to the normal individuals. So our study suggest that for normal level and functioning of hormones in the body, focus on your diet and avoid malnutreints, so your body weigth remains normal as such your hormonal level.

* **Corresponding Author:** Safeer Ahmad ✉ Safeer9365@Gmail.com

Introduction

Thyroid gland, which is present in the body as one of the major and important gland. Size of gland, depends upon age, sex (greater in female and lesser in male) and physiological condition (Pregnancy, lactation). This gland is rich in blood supply and originates from the floor of the pharynx. It secretes two types of hormones i.e. Thyroxine (T₄) and Triiodothyronine (T₃). Collectively known as thyroid hormones. Secretion of these hormones is controlled by another hormone known as thyroid stimulating hormones which are secreted by the hypothalamus of the brain (Morris *et al.*, 2015).

Thyroxine (T₄) and Triiodothyronine (T₃) are secreted by follicular cells and can be stored in the thyroid gland for 2-3 months. They have a high effect on metabolic rate of the body (Hajer *et al.*, 2008). Concentration of Thyroxine is much greater than the Triiodothyronine i.e. 93 % and 7% respectively. T₃ and T₄ are mainly composed of iodine. A deficiency of iodine leads to reduced production of T₄ and T₃ enlarges the thyroid tissue and will cause the abnormality known as goiter. Thyroid hormone presents in the blood mainly in the form of thyroxine (T₄), and has a higher half-life than T₃.

Thyroxine is a prohormone and a reservoir for the most active and main thyroid hormone T₃ (Kansagra *et al.*, 2010) as required T₄ is converted in the tissues by the enzyme iodothyronine deiodinase. Deficiency of deiodinase can mimic hypothyroidism due to iodine deficiency (Wassettal., 2013) T₃ is more active than T₄, (Hennemann *et al.*, 2001) though it is present in less quantity than T₄.

Obesity is characterized by abnormal or excessive fat accumulation that is the result of a chronic imbalance between energy intake and energy expenditure (Brent, 2012). Obesity, which is now the major cause of many diseases, especially heart problem (Hajer *et al.*, 2008). Now a day's obesity rate is increasing in our youth. So main aim of this study to determine the level of thyroid hormones in the students having different body weight and prove the fact those thyroid

hormones is really involved in the metabolism of the body and obesity is also increasing in the youth due to hormonal imbalance.

Due to improper diet our young generation getting more and more fats in their body which puts the bad effect on their personality as well as their hormone level. Which can cause major abnormality in the later part of their life, so this study aware the about their health issue related to obesity.

The aim of this study was to compare the level of thyroid hormone in young people's having different body weight and show that high level of body fat can affect the presence of hormonal level in the body.

Materials and methods

This study was done on 20 students (10 male and 10 female) of Gomal University in the month of March 2017. The participant age ranges from 20 to 25.

Body Mass Index

Their body mass index was calculated using the formula.

$$\text{BMI} = \text{Weight} / \text{height in meters}^2$$

Body mass index (BMI) below 18.9 is considered as underweight, from 18.9 to 24.9 is normal, 25 to 29.9 BMI is overweight and over 30 BMI is said to be obese.

Blood Samples

To calculate the thyroid hormone in the body or the participants, they were fasted for 12 hours, then the blood from the vein using a disposable syringe.

Then the blood was allowed to clot in a tube at room temperature, then blood was centrifuged at 3000 rpm for 12 mins to remove serum. Then blood was kept at 20°C to be analyzed later on.

Measuring Blood Hormonal level

Serum Thyroxine (Muzzaffari *et al.*, 1998) and Triiodothyronine (Braverman *et al.*, 1996) and TSH (Spencer, 1995) were calculated by Elisa kit

According to manufacturer instruction..

Results and discussion

This study was done on individuals with different body weight to determine including both male and

female. Male and Female participants were placed in separate tables. In table1 we have male participant with their height, weight, BMI, level of TSH, T3 and T4 hormone respectively while in table 2 we have a data of female participants.

Table 1. Different parameters of BMI,TSH,T3 and T4 in male participants.

S.No	Weight in kg	Height In meters	BMI	TSH Level (μ IU/ml)	T3 Level (ng/ml)	T4 Level (μ g/dl)
1	70	1.778	22.144	1.548	1.188	7.8411
2	68	1.752	22.157	1.549	1.186	7.809
3	58	1.625	21.969	1.543	1.190	8.078
4	65	1.803	19.70	1.410	1.198	8.565
5	63	1.752	20.527	1.471	1.191	8.287
6	60	1.676	21.367	1.549	1.197	8.333
7	<u>85</u>	<u>1.625</u>	<u>32.196</u>	<u>2.672</u>	<u>0.971</u>	<u>5.683</u>
8	<u>78</u>	<u>1.701</u>	<u>26.933</u>	<u>2.212</u>	<u>1.033</u>	<u>7.122</u>
9	<u>80</u>	<u>1.676</u>	<u>28.490</u>	<u>2.511</u>	<u>1.010</u>	<u>6.455</u>
10	<u>90</u>	<u>1.778</u>	<u>28.418</u>	<u>2.501</u>	<u>1.014</u>	<u>6.760</u>

(Overweight and obese readings are bold and underlined).

In male participants highest level of thyroid stimulating hormone was 2.672μ IU/ml found in individual with BMI 32.196 and his T3 and T4 level was 0.971 ng/ml and 5.683μ g/dl respectively. While level of thyroid stimulating hormone, T3 and T4 hormone was found to be normal in individuals with normal body weight and BMI. Among all the male participants, lowest level of thyroid stimulating hormone was 1.410μ IU/ml in a participant and his T3 and T4 level was 1.198 ng/ml and 8.565μ g/dl respectively and his BMI was 19.70 as in Table 1.

In female participants highest level of thyroid stimulating hormone i.e. 2.875μ IU/ml was found in individual with BMI 32.87 and her T3 and T4 level was 1.019 ng/ml and 5.621μ g/dl respectively. While level of thyroid stimulating hormone, T3 and T4 hormone was found to be normal in individuals with normal body weight and BMI. Among all the female participants, lowest level of thyroid stimulating hormone was 1.399μ IU/ml in a participant and his T3 and T4 was 1.21 ng/ml and 8.655 μ g/dl respectively and her BMI was 19.810 as in Table 2.

Table 2. Different parameters of BMI,TSH,T3 and T4 in female participants.

S.No	Weight in kg	Height In meters	BMI	TSH Level (μ IU/ml)	T3 Level (ng/ml)	T4 Level (μ g/dl)
1	46	1.524	19.810	1.399	1.21	8.655
2	54	1.651	19.810	1.403	1.199	8.568
3	<u>70</u>	<u>1.574</u>	<u>28.259</u>	<u>2.505</u>	<u>1.035</u>	<u>6.244</u>
4	70	1.727	23.474	1.866	1.098	7.69
5	54	1.642	20.439	1.469	1.93	8.445
<u>6</u>	<u>95</u>	<u>1.70</u>	<u>32.87</u>	<u>2.875</u>	<u>1.019</u>	<u>5.621</u>
7	53	1.651	19.48	1.471	1.203	8.76
8	66	1.651	24.26	1.932	1.067	6.885
9	67	1.727	22.46	1.70	1.193	7.88
10	55	1.574	22.26	1.66	1.199	7.93

(Overweight and obese readings are bold and underlined).

In results the concentration of Hormones was slightly higher in female as compared to male participants. Also the concentration of TSH, T₃ and T₄ stimulation hormones was normal in normal body weight participants, but as the body weight increases the concentration of TSH increases but the concentration of T₃ and T₄ decreases. The thyroid gland secretes both thyroxine (T₄) and triiodothyronine (T₃), which exerts a negative feedback on TSH releasing hormone and TSH secretion (Brent, 2012). For normal function of the body, the normal concentration of thyroid hormones is required, but as the obesity of body increase it disturb the thyroid level in the body. Concentration of T₃ was lesser than the T₄ in the blood of all the participants because T₄ produced in the body in higher concentrations as compared to T₃.

The results showed that more the body fats lesser the concentration of metabolic hormones like T₃ and T₄. Normal concentration of these two hormones are necessary for normal function of the body but if the body the fat increase in the body the T₃ and T₄ decreased so the normal metabolic processes are affected.

Results showed that the Thyroid stimulating hormones that is controlled by T₃ and T₄ in the body was basically higher in concentration in obese or over eight person, because there were not much hormones in the body to control or put a negative feedback for release of Thyroid stimulating hormone from the brain. It has been reported that Thyroid hormones play a very important role in controlling the body's metabolism that is the rate at which the body uses energy (Stipanuk, 2000).

So the concentration of Thyroid stimulating hormones cannot be controlled in obese persons as compared to normal. In obesity, there is an imbalance in adipokines production, a fact which, together with the inability to store fat in the adipocytes, results in a process of adipose tissue dysfunction (Van, 2009). Obesity increases the risk of the development of conditions such as hypertension, Type 2 diabetes mellitus, osteoarthritis, coronary artery disease,

stroke, and respiratory complications, as well as cancers of the breast, prostate, and colon (Park, 2003).

This study showed that in normal persons the if the body gain excess fats than its hormonal level do beyond the normal and body fails to respond in normal situations. While if someone wants that their bodies perform normally, one should control on body fats with proper diet and proper exercise. In this way its thyroid level remains constant in the body. A personally tailored food plan should be coupled with a personally tailored physical activity plan (Kozak *et al.*, 2000).

Conclusion

This study was done to evaluate the level of thyroid hormone in obese and normal individuals. Main finding of this study is that the concentration of thyroid hormones in the body is directly related to the body weight or body fat. As the body fat increases the concentration of thyroid hormones also disturbed and it puts the negative effects on the body. From this study it is also concluded that not only our diet, but also hormones is responsible for excess body fats. This study is about the youth and help full to know the hormonal level in youth rather than child and old ones.

References

- Braverman LE, Utigen RD, Eds. Werner Ingbar's.** 1996. "The Thyroid – A Fundamental and Clinical Text" 7th Ed. Philadelphia. Lippincott – Raven.
- Brent GA.** 2012. Mechanisms of thyroid hormone action. *J Clin Invest* **122**, 3035–43.
- Hajer GR, Van Haeften TW, Visseren FL.** 2008. Adipose tissue dysfunction in obesity, diabetes, and vascular diseases *Eur Heart J*, **29**, 2959-71.
- Hennemann G, Docter R, Friesema EC, de Jong M, Krenning EP, Visser TJ.** 2001. "Plasma membrane transport of thyroid hormones and its role

in thyroid hormone metabolism and bioavailability". *Endocrine Reviews* **22**(4), 451–476.

Kansagra Shayri M, McCudden Christopher R, Willis, Monte S. 2010. "The Challenges and Complexities of Thyroid Hormone Replacement". *Laboratory Medicine* **41**(6), 338–348.

Kozak D, Springer-Riddle J. 2000. Foolproof Weight Loss. Rodale.

Lobo JC, Torres JP, Fouque D, Mafra D. 2010. Zinc deficiency in chronic kidney disease: is there a relationship with adipose tissue and atherosclerosis? *Biol Trace Elem Res.* **135**, 16–21.

Morris MJ, Beilharz JE, Maniam J, Reichelt AC, Westbrook RF. 2015. Why is obesity such a problem in the 21st century? The intersection of palatable food, cues and reward pathways, stress, and cognition. *Neurosci. Biobehav* **58**, 36–45.

Muzzaffari EL, Gharib H. 1998. Thyroxine suppressive therapy in patients with nodular thyroid disease". *Ann Inter Med.* **128**, 386–394.

Park, Yong-Woo, Shankuan Zhu, Latha Palaniappan, Stanley Heshka, Mercedes R. Carnethon, Steven B. Heymsfield. 2003. "The Metabolic Syndrome: Prevalence and Associated Risk Factor Findings in the US Population from the Third National Health and Nutrition Examination Survey, 1988–1994." *Archives of Internal Medicine* **163**, 427–36.

Spencer CA. 1995 Interlaboratory / Intermethod differences in Functional Sensitivity of Immunometric Assays of Thyrotropin (TSH) and Impact on Reliability of Measurement of Subnormal Concentration of TSH. *Clinical Chemistry* **41**, 367.

Stipanuk MH. 2000. Biochemical and Physiological Aspects of human nutrition. Saunders, Philadelphia. 763-775.

Van Kruijsdijk RC, Van der Wall E, Visseren FL. 2009. Obesity and cancer: the role of dysfunctional adipose tissue *Cancer Epidemiol Biomarkers Prev* **18**, 2569-78

Wass John AH, Stewart Paul M. 2011. Oxford Textbook of Endocrinology and Diabetes (2nd ed.). Oxford: Oxford University Press, p 565.