Assessment Of Thyroid Function In Euthyroid Obese Medical Students.

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Abstract : Background: It is well known that Thyroid Hormones play a key role in regulating energy homeostasis. The association between thyroid hormones and energy expenditure is well established. There is inverse relationship between obesity and energy expenditure. There is a limited data on thyroid function in euthyroid obese young individuals. Objectives: The present study was designed to evaluate the relationship between thyroid function and obesity in euthyroid young individuals. Materials & Methods: Obesity was defined as per Body Mass Index. (BMI)Undergraduate medical students were grouped as normal, overweight and obese as per their Body Mass Index Thyroid function was assessed by measuring fT3, fT4 and TSH levels by using automated chemiluminescence immunoassay system. Results: We found that the levels of TSH showed significant increase in overweight and obese subjects ($p< 0.001$) however there was no statistical difference in the levels of fT3and fT4 in overweight and obese students as compared to normal($p> 0.05$). Interpretation & Conclusion: Our results suggest that thyroid function though within the normal range could be one of several factors acting in concert to determine body weight in a population. Even slightly elevated serum TSH levels are associated with an increase in BMI. [Padwal M et al NJIRM 2013; 4(3) : 8-12]

KEY Words: Thyroid Stimulating hormone (TSH), free Triidothyronine (fT3), Free thyroxine (fT4), Body Mass Index (BMI)

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Introduction: Obesity is defined as a medical condition in which excess adipose tissue mass is accumulated to such an extent that it may have an adverse effect on health leading to reduction in life expectancy and / or increase in health problems[1]. Over the last few years there is an unprecedented rise in obesity worldwide & it has become a global epidemic. The proportion of people in the general population who are overweight and obese has doubled over the past two decades in developed and developing countries including India[2].Many factors have been implicated in etiology of obesity like nutritional behaviour, level of physical activity, genetic makeup and environmental influences.

Thyroid hormones (T_3 & T_4) are key regulators of metabolism and energy homeostasis. They stimulate O_2 consumption of most of the body cells and influence metabolism of lipids and carbohydrates by way of substrate cycling, ion cycling, and mitochondrial oxidative phosphorylation[3]. Direct association between the levels of thyroid stimulating hormone (TSH) & body mass index (BMI) is reported in many studies.[4] Association between levels of thyroid hormones and body weight has been well documented in individuals with thyroid disorders. Overt hypothyroidism is known to be related to weight gain while overt hyperthyroidism leads to weight loss[5]. At the same time, various clinical trials have found that in patients with hypothyroidism, there was no effect on BMI after thyroxine supplementation[6]. This has raised the question that whether TSH varies (within physiological range) with body weight.

Recently few studies conducted in obese individuals have shown increased T_3 & TSH levels [7,8]. In our study, we have explored the relationship between thyroid status and BMI in euthyroid medical students.

Material and Methods: Present study was a non randomised cross sectional study conducted in department of biochemistry of our college between April 2012 to September 2012; after obtaining approval from institutional ethical committee.

One hundred and Twenty (120) students, of both genders studying in I, II & III M.B.B.S. course between the age group of 17 – 24 years were recruited as subjects. Written informed consent was obtained from all of them. Detailed history was taken & through clinical examination was

done in all the subjects. Subjects suffering from thyroid disorders, acute or chronic diseases, DM, hypertension or on any medication were excluded from the study.

Standing height was measured to the nearest of 0.1 cm and weight was recorded to the nearest of 0.1 kg with the subjects barefooted and in light clothing using standardized instruments.

Body mass index was calculated using the formula[9]:

BMI = Weight in Kg ÷ of (Height in meter)^2
Based on their BMI subjects were divided in three groups as follows:

Group	BMI Kg/m^2	No. of subjects
A:Non obese	18.5 – 24.99	60
B: Overweight	25 – 29.99	30
C:Obese	> 30	30

The three groups were age and sex matched. In the central clinical laboratory of Bharati Hospital, 1 ml of fasting blood sample was collected by venous puncture with all aseptic precautions in a plain vacutainer. It was allowed to clot for 30 minutes. The serum was separated by centrifugation at 2500 rpm for 5 minutes at room temperature. Serum was free from hemolysis and turbidity. It was subjected for estimation of:
1. free Triiodothyronine (fT_3)
2. free Thyroxine (fT_4) and
3. Thyroid Stimulating hormone (TSH).
to assess of thyroid function

All the hormones were estimated by automated chemiluminescence immunoassay system (CLIA) Alpha Prime LS, France by using commercially available kits of Acculite Monobind Inc (USA).

Principle of estimation of fT_3 and fT_4 was competitive immunoassay while principle of estimation of TSH was non-competitive immunoassay. Quality control was done by Bio-Rad immunoassay controls. Sensitivity of all the assays was 98% with lowest detection limits.

The results were expressed as mean ± SD and analysed by applying Z test using Microsoft excel 2007.

Results: We found that there was no statistical difference in values of fT_3 among the three groups as shown in table 1a and table 1b.

Table 1a: Comparison of fT_3 levels in group A and B

Group	freeT_3 (fT_3) pg/ml, mean ± SD	z-value	p-value
A: Non obese	2.54 ± 0.82	1.21	0.22
B: Overweight	2.34 ± 0.40		

Table 1b: Comparison of fT3 levels in group A and C

Group	freeT_3 (fT_3) pg/ml mean ± SD	z-value	p-value
A: Non obese	2.54 ± 0.82	1.00	0.31
B: Overweight	2.33 ± 0.47		

We also found that there was no statistical difference in values of fT_4 among the three groups as shown in table 2a and table 2b.

Table 2a: Comparision of fT_4 levels in group A and B

Group	freeT_4 (fT_4) ng/dl mean ± SD	z-value	p-value
A: Non obese	1.29 ± 0.22		
B: Overweight	1.21 ± 0.09	1.65	0.10

Table 2b: Comparison of fT_4 levels in group A and C

Group	freeT_4 (fT_4) ng/dl mean ± SD	z-value	p-value
A: Non obese	1.29 ± 0.22		
B: Overweight	1.19 ± 0.19	1.57	0.11

However, there was statistically significant difference in levels of TSH among the three groups as shown in table 3a and table 3b.

Table 3a: Comparison of TSH levels in groupA and B

Group	TSH (µIU/ml) mean ± SD	z-value	p-value
A: Non obese	1.12 ± 0.53		
B: Overweight	1.71 ± 0.48	4.4	< 0.001

Table 3b: Comparison of TSH levels in groupA and C

Group	TSH (µIU/ml) mean ± SD	z-value	p-value
A: Non obese	1.12 ± 0.53	7.7	< 0.001
B: Overweight	2.56 ± 0.78		

Discussion: The present study was designed to assess the relationship between thyroid function and Body Mass Index (BMI) in euthyroid obese medical students. We found that the levels of TSH showed significant increase in overweight and obese subjects however there was no statistical difference in values of $fT_3$and fT_4.

Similar findings were obtained by the endocrine society of USA in 2005 in a study conducted to investigate the association between thyroid function and obesity in normal population[10]. Their result showed a positive association between BMI and TSH. However they concluded that there was a large variation in BMI that could be explained by age, lifestyle, dietary habits and physical activity. Thus to determine the effects of these factors further studies are needed.

Studies done by Iacobellis et al [11] , Sari et al [12]reported no change in thyroid hormone levels at all ranges of BMI. Whereas studies done by Knudsen et al[13] and Rotondi et al[14] reported elevated T_3 and TSH levels in obese patients.
Findings similar to our study are reported by other researchers.[15,16,17]

It has been speculated that the association between bodyweight and TSH is caused by signals from adipose tissue. It has been suggested that the inflammatory cytokines released by visceral fat may inhibit hypothalamo- pituitary -thyroid axis.[18]

Leptin produced by adipocytes has important influences on central regulation of thyroid function through its influence on neurons in hypothalamus and thyrotropic axis. This seems to be important for down regulation of thyroid function not only in the states of energy deficits but also in normal physiological condition showing a positive association between serum leptin and TSH.[19] Furthermore, there is a synchronicity between the secretion of leptin and TSH.

Studies on subjects undergoing weight reduction has been found to be associated with decrease in T_3 and TSH levels. There was a decrease in T_3 receptors in obesity and a decreased negative feedback between TSH and peripheral thyroid hormones leading to increase in TSH and T_3, T_4 in obesity. This suggests that only a slight perturbation in metabolism detected by an increase in serum TSH still within the normal range is associated with increase in BMI.
However some researchers have reported either no association between TSH and BMI or decrease in TSH levels with increase in BMI.[20,21]

The interrelationship between obesity and thyroid physiology have been studied both in the etiology of obesity and as a reason for using thyroid hormones in weight loss regimens. There is conflicting data in the literature regarding the relationship between obesity and thyroid hormones.

Conclusion: The association between TSH and BMI has become a complex issue in the light of endocrine activity of adipocytes. In our study we have found significant increase in thyroid stimulating hormone level with increase in BMI however there was no significant change in fT3 and fT4 levels. Larger studies are needed to elucidate the relationship of thyroid hormones and BMI.

Strength of the study: The participants included in the study were euthyroid young adults between the age groups of 17-24 years who were healthy therefore there were less confounding variables.

Limitation of the study: Lifestyle factors, physical activity and nutritional choices were not taken in consideration. Inclusion of these factors would have helped in better
correlation.

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