ORIGINAL RESEARCH

Comparative study of serum TSH and BMI in hypothyroid and euthyroid women

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ABSTRACT

Background: Thyroid disorders are the most prevalent disorders in India, next to diabetes mellitus. Approximately, 42 million people in India are suffering from thyroid disorders. India has the world's biggest goiter belt in sub-Himalayan region. There is close relationship between body composition and thyroid hormone. In women, the risk of developing hypothyroidism increases with age, during pregnancy, the postpartum period and menopause. This research work has been approved by Institutional Ethical Committee, IIMS&R with consensus in the meeting dated 30th January 2019.

Aim: The present study is undertaken to find the level of TSH in euthyroid and hypothyroid women.

Material and Methods: Sample size was 60 females. Based on inclusion and exclusion criteria, blood samples were collected under aseptic conditions, Serum TSH (mIU/l) estimation was done using mini vidas fully automated analyser (fluorescent method) in central pathology of IIMS&R, Lucknow. Revised BMI guidelines for India by WHO was used to calculate BMI. P value <0.05 was considered significant.

Results: The result indicated that the mean value of BMI, serum TSH was higher in hypothyroid women than in euthyroid women. Mean value of BMI that is (27.97±4.25) was higher in hypothyroid women than euthyroid women (23.98±4.38).

Conclusion: Present study concluded that a hypothyroid woman has higher BMI as compare to euthyroid women and there is a positive correlation between serum TSH and BMI.

Key words: Hypothyroidism, TSH, BMI, Goiter.

INTRODUCTION

The relationship between thyroid function and body mass is not well understood. Changes in TSH levels, no matter how slight, might affect the BMI profile. Obesity is becoming recognised as a huge epidemic that is posing a threat to global health[1]. The pituitary gland secretes TSH, or thyroid stimulating hormone. Thyrotropin releasing hormone (TRH), which is produced by the hypothalamic paraventricular nucleus, regulates the release of thyroid stimulating hormone. Tetraiodothyronine (T4) and triiodothyronine (T3) are synthesised and released by the thyroid as a result of this thyroid stimulating hormone stimulating thyroid receptors (T3)[2]. Thyroid hormones have a crucial role in lipid and glucose metabolism, food intake, and fat oxidation. They also regulate basal metabolism and thermogenesis[3]. The body mass index is impacted by changes in thyroid hormones, particularly serum thyroid stimulating hormone. As thyroid hormones control thermogenesis and basal metabolism, increasing blood TSH levels, which result in hypothyroidism and are linked to a lower metabolic rate and decreased thermogenesis, raise the body mass index (BMI) and contribute to an increase in the incidence of obesity[4].

The body's metabolism is affected by the hormone hypothyroidism, and obesity is the result of being overweight or obese. Obesity increases the risk of cardiovascular disease and mortality[5].

There has been significant discussion over the relationship between BMI and dyslipidemia, and thyroid function within the normal range. According to the DanThyr Study, there is a connection between BMI and serum TSH, no relationship between BMIand serum free T3, and a negative link between BMI and serum free T4; these are the results[6].

MATERIALS AND METHODS

The case-control study was conducted at the Integral Institute of Medical Science and Research, Lucknow, from January 2019 to June 2019 in the Department of Physiology and Biochemistry, which included 60 subjects visiting various OPDs of the IIMS&R, Integral University, Lucknow, Uttar Pradesh (U.P.). Informed consent was obtained from each subject. The study was ethically approved by the Institutional Ethics Committee (IEC) of the institute (Ethical clearance No. IEC/IIMS&R/2019/25).

INCLUSION CRITERIA

- Female Subject visiting IIMS&R.
- Only hypothyroid and euthyroid women.

EXCLUSION CRITERIA

- Subject not giving consent.
- Female less than 20 years and more than 45 years of age.
- Pregnant female

DATA ANALYSIS

Statistical analysis was performed using the Statistical Package for Social Science Program (SPSS, 24.0 (IBM Corp., Armonk, NY)). The means and standard deviations were calculated for all the parameters. The independent sample t-test was used to compare the means of different variables in the two groups. In addition, the Pearson correlation coefficient (r) was used for correlation analysis. All statistical tests were two-sided, and $p<0.05$ was considered to indicate statistical significance.

RESULTS

Table 1: Comparison between hypothyroid and euthyroid women

	Hypothyroid (N=30) Mean ± S.D	Euthyroid(N=30) Mean±S.D	p-value
Age	37.4±7.35	33.6±7.76	0.0833
Height	149±6.34	149.53±8.49	0.7851
Weight	62.7±9.92	53.73±11.57	0.0021
TSH	8.39±6.72	2.446±0.94	0.0001
BMI	27.97±4.25	23.98±4.38	-2.6500

Table 2: Distribution as per age group in hypothyroid female.

Age	Frequency	Percentage
20-24	4	13%
25-29	1	3%
30-34	3	10%
35-39	9	30%
40-44	5	16%
45-49	8	26%

Table 3: Distribution as per BMI in hypothyroid women.

	BMI range	Frequency	Percentage
Underweight	<18.5 kg/m^2	1	3.33%
Normal	18.5-22.9 kg/m^2	2	6.67%
Overweight	23.0-24.9 kg/m^2	2	6.67%
Obese	≥25 kg/m^2	25	83.33%

Table 4: Distribution as per BMI in euthyroid women.

	BMI range	Frequency	Percentage
Underweight	<18.5 kg/m^2	5	16.67%
Normal	18.5-22.9 kg/m^2	7	23.33%
Overweight	23.0-24.9 kg/m^2	7	23.33%
Obese	≥25 kg/m^2	11	36.67%

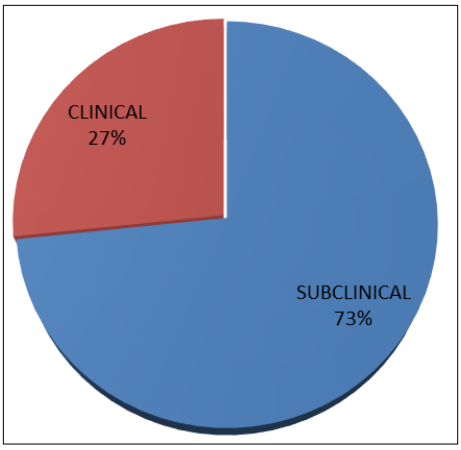

Fig 1: Distribution on the basis of clinical and subclinical hypothyroidism in women

Table 5: Thyroid Stimulating Hormone was positively correlated with BMI in hypothyroid women whereas; it is negatively correlated with BMI in euthyroid women.

Parameters	r value	p value
TSH-BMI (Hypothyroid)	0.0998	0.599783
TSH-BMI (Normal)	-0.0288	0.879091

DISCUSSION

Thyroxine and triiodothyronine are two thyroid hormones that control lipid synthesis, mobilisation, and metabolism. As a result, there is a direct connection between thyroid hormones and obesity, and small changes in serum thyroid hormone levels can result in localised fat deposition and increased body mass[7].

TSH and thyroid hormone levels fluctuate as thyroid function is gradually lost until clinical hypothyroidism manifests. This could be a cover for a biological mechanism that explains subsequent variations in body weight. Thermogenesis may be able to explain the causal link between changes in thyroid function and BMI. Thermogenesis is increased by thyroid hormones via increased cellular activity to create ATP[8]. The precise mechanism is still unknown. Thyroid hormone administration has been tried unsuccessfully to treat obesity by increasing energy consumption. Side effects resulted from increasing the

dosage in order to attain the maximum desired outcomes, so it was stopped[9].

The thyroid hormones are essential to maintaining healthy bodily functions and serve a variety of vital activities in our bodies. They were necessary for maintaining proper myocardial infarction, pulmonary ventilation, energy homeostasis, vascular tone, and water and electrolyte balance, which also contribute to the CNS's ability to operate normally.

The present study was designed to assess the association between BMI and thyroid function in hypothyroid and euthyroid women. It has also been discovered that thyroid hormones in the euthyroid range play a role in metabolic disorders. In a study with 16975 participants, Xu*et al*. discovered that thyroid function may affect body weight and contribute to the emergence of obesity[10]. The regulation of resting energy expenditure by thyroid hormone affects body weight, albeit the precise process is still unclear[11]. Although not all resting energy expenditure depends on thyroid hormone levels, even small variations in thyroid hormone levels have a big impact on it. For instance, while the serum TSH concentration rises by 0.5 to 1 mIU/L, still within the normal range, resting energy expenditure drops by 75 to 150 kcal/d. Long-term maintenance of this modification may cause significant weight gain[12].

In this study, the mean values of BMI (27.97±4.25) and serum TSH (8.39±6.72) were found to be higher in hypothyroid women as compared to euthyroid women. And with the increase in TSH, the mean value of BMI also increases in hypothyroid patients. Similar results have been reported by Solanki *et al*.13, who found that with the increase in BMI, the mean value of serum TSH also increases.

Studies conducted by Nillni*et al*. (2003) have mentioned that an increase in TSH levels in obese individuals is due to increased production of pro-TRH in the presence of leptin[14]. Burman*et al*. (1980) reported that TSH levels increase due to decreased T3 receptors in the hypothalamus, which causes impaired feedback.

In the present study, a positive correlation between serum TSH and BMI was found in hypothyroid women and a very poor negative correlation in euthyroid women. Suganty*et al*. (2011) reported that there was a significant positive correlation between serum TSH and BMI in euthyroid females. J.J. Deiz*et al*. also noticed a significant correlation between TSH and BMI in euthyroid subjects. They conclude that TSH levels significantly increased with weight[17].

Subclinical hypothyroidism (SCH) can be defined as a biochemical condition with normal free thyroxine concentration while serum TSH levels are high[18]. In the present study, out of 30 hypothyroid women, 73.33% were reported under the category of subclinical hypothyroid while 26.67%in were clinically hypothyroid. while the study conducted by Barun K. Chakarbarty*et al*.found 14.4% were subclinical and 3.2% were clinical[19].

Mean age for the study group was 37.4±7.35 years in hypothyroid were as in euthyroid it was 33.6±7.76 years. There was no significant difference in the mean age of hypothyroid and euthyroid subjects. Singlagesu *et al*. (2016)observed that the mean age for the study was 42.2±15.30 years and for the control group was 36.07±14.24 and he also observed no significant difference in the mean age of the two groups[20].

The present study suggests an early stage and routine health checkup for thyroid dysfunction in healthy women. Early-stage detection will be helpful to minimise the burden of thyroid disorders in the population.

CONCLUSION

From the above study, it is concluded that the women suffering from hypothyroidism have a higher mean value of BMI as compared to euthyroid women. From the study, it is also concluded that the correlation between serum TSH and BMI in hypothyroid women was found to be positive, whereas in euthyroid women the correlation is negative. Since our sample size was minimal, an elaborate study is needed to validate our findings.

CONFLICT OF INTEREST

The authors report no financial or any other conflicts of interest in this work

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