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Original Article

Comparative Study on Body Mass Index between Hypothyroidism Patients and Healthy Volunteers

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Abstract

Background: Hypothyroidism is known to interfere with the metabolism of all the cells in the body, particularly fat metabolism in adipose tissue. This, in turn, leads to obesity. Body mass index (BMI) is widely used to assess obesity and metabolic syndrome. Obesity leads to a higher incidence of cardiovascular morbidity and mortality.

Materials and Methods: Twenty-five hypothyroid subjects were enrolled (study group) from the Department of Endocrinology and Metabolism, Govt. Rajaji Hospital attached to the Madurai Medical College, Madurai. Twenty-five normal subjects who were age- and sex-matched with the study group were enrolled to form the control group. Serum levels of thyroid-stimulating hormone (TSH), total circulating T4, and total circulating T3 were measured by radioimmunoassay to confirm hypothyroidism. Height and weight were measured using a stadiometer and weighing scale, BMI was calculated using Quetelet's index formula.

Results and Conclusion: The results were tabulated and analyzed by applying unpaired *t*-test and SPSS software version 16.0. BMI values of the study group and control group were compared, but there was no statistical significance. BMI values when compared with serum TSH levels within the same group, the Pearson correlation coefficient also showed no statistical significance.

Key words: Body mass index, Hypothyroidism, Quetelet index, Serum thyroid-stimulating hormone level

INTRODUCTION

Hypothyroidism is known to interfere with the metabolism of all the cells in the body, particularly fat metabolism in adipose tissue. This, in turn, leads to obesity. Body mass index (BMI) is widely used to assess obesity and metabolic syndrome. Obesity leads to a higher incidence of cardiovascular morbidity and mortality.

Obesity and hypothyroidism are two common clinical conditions that have been linked together closely. The link has become more relevant in the context of an unprecedented rise in the prevalence of obesity worldwide.[1]

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Various researchers have studied the effect of the thyroid hormones on BMI, and it has been demonstrated that overt thyroid dysfunction affects body weight. Clinical hypothyroidism causes an increase in body weight, while hyperthyroidism reduces it.[2]

Thyroid hormones regulate basal metabolism and thermogenesis and play an important role in lipid and glucose metabolism, food intake, and fat oxidation.[3]

Hypothyroidism is associated with decreased thermogenesis and decreased metabolic rate and has also been shown to correlate with a higher BMI and a higher prevalence of obesity.[4] There is clinical evidence suggesting that even mild thyroid dysfunction in the form of subclinical hypothyroidism is linked to significant changes in body weight and represents a risk factor for overweight and obesity.[4]

Aims and Objectives

The aim of the study is to measure height and weight and to calculate the BMI using Quetelet index formula both in the study group and control group and to compare the

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same between the two groups. BMI values of each group are compared with serum thyroid-stimulating hormone (TSH) levels within the group.

MATERIALS AND METHODS

This study was done in the Institute of Physiology, Madurai Medical College, Madurai, in association with the Department of Endocrinology and Metabolism, Govt. Rajaji Hospital attached to the Madurai Medical College. The study group consisted of 25 subjects who were newly diagnosed hypothyroid subjects in the age group of 20–40 years, of which 20 cases were female and five cases were male. The control group consisted of 25 subjects who were age- and sex-matched normal and euthyroid individuals, free from any other diseases. Written consent was obtained from the subjects before procedures.

Inclusion Criteria

Normal healthy adults in the age group of 20–40 years willing to participate in our study had been included in the study.

Newly diagnosed hypothyroidism patients based on clinical diagnosis and laboratory confirmation in the age group of 20–40 years willing to participate in our study had been enrolled.

Exclusion Criteria

Subjects with any history of thyroid illness or those were on treatment taken for thyroid illness had been excluded from the study.

Any patient with chronic liver disease, chronic renal disease, pregnancy, or taking any drug altering serum TSH levels (octreotide, somatostatin, opiates, dopamine, glucocorticoids, growth hormone, L-dopa, bromocriptine, pimozide, phentolamine, thioridazine, methysergide, cyproheptadine, iodine, dopamine antagonists, and amiodarone) have been excluded from the study.[5]

Estimation of T3, T4, and TSH

Laboratory evaluation: Serum levels of TSH, total circulating T4, and total circulating T3 were measured by radioimmunoassay. Radioimmunoassay technique is a type of antibody-based competitive immunoassay.

Measurement of height: Using stadiometer height was measured in all individuals in meters.

Measurement of weight: Using standard spring type weighing scale, weight was measured in all subjects in kilograms.

Calculation of BMI: BMI was done using Quetelet index formula,

Body mass index = Weight (kg)/Height (m^2)

OBSERVATION AND RESULTS

The results of unpaired *t*-test for BMI comparison are as follows.

95% confidence interval of the difference in mean = from –1.5215 to 1.8695

Intermediate values used in calculations:

$t = 0.2063$

df = 48

Standard error of difference = 0.843

P-value = 0.8374.

Statistical Comparison within Group

When the BMI values are compared with serum TSH levels within group, the following data were obtained as shown in Table 1.

i. In the study group
   Mean of BMI of hypothyroid subjects = 21.798
   Mean of serum TSH level of hypothyroid subjects = 74.6
   Pearson correlation coefficient t(R) = –0.0217
   Coefficient of determination (R^2) = 0.0005
   P-value = 0.9179
The result is not significant at $P < 0.05$.

ii. In the control group
   Mean of BMI of normal subjects = 21.624
   Mean of Serum TSH level of normal subjects = 2.344
   Pearson correlation coefficient(R) = 0.358
   Coefficient of determination (R^2) = 0.1282
P-value = 0.0788
The result was not statistically significant at $P < 0.05$.

Table 1: Comparison of BMI between the study group and control group

Statistical parameter	Group one (study group)	Group two (control group)
Mean	21.7984	21.6244
SD	4.0210	1.2679
SEM	0.8042	0.2536
N	25	25

SD: Standard deviation, SEM: Standard error of mean, *n*: Numbers

DISCUSSION

Thyroid hormones, including thyroxine and triiodothyronine, regulate the synthesis, mobilization, and breakdown of lipids. Therefore, thyroid hormones are closely related to obesity, and slight changes in serum thyroid hormone level can cause local fat accumulation and increased body mass.[6]

In a study done by Verma *et al*.,[7] it was found that in obesity patients, overt hypothyroidism was present in 33% of patients and subclinical hypothyroidism in 11% of patients. In our study, first, we have compared BMI scores of the study group with that of the control group. However, we have not found any statistically significant relationship ($P > 0.05$). The reason may be the recent onset of hypothyroidism in the study group population.

In a study done by Kare *et al*., in terms of the relationship between BMI and thyroid hormones, no significant relationship was found in Indian normal as well as obese adults groups.[8]

In a study by Solanki *et al*., they found a significant relationship between serum TSH and BMI and mean TSH increased as BMI increased.[9]

On comparison of serum TSH levels with BMI values within groups, no statistical significance was observed. This fact can be explained by the presence of BMI values >25 only in few numbers of persons in the study group population. Moreover, this might be linked with the prevalence of obesity and metabolic syndrome itself at the community level.

In a study done by Nyrnes *et al*.,[10] a positive and significant association between serum TSH within the normal range and BMI, both in a cross-sectional and a longitudinal study, was found. However, this does not necessarily imply a causal relationship between thyroid function and BMI within the normal serum TSH range.

CONCLUSION

Hypothyroidism and obesity go hand in hand. In our study, we found no statistical significance when we compared the BMI values of healthy individuals with hypothyroidism patients. On comparing, BMI values with serum TSH levels with each group also showed no statistical significance. Since our sample size was minimal, an elaborate study is needed to validate our findings.

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