Study on the Association between the Serum Thyroid Stimulating Hormone Levels and the Body Mass Index

B Rajini[1], R Haragopal[2]

ABSTRACT

Introduction: The prevalence of the obesity is increasing day by day globally. One of the most important factors causing obesity is thyroid dysfunction. The present study was aimed to assess the association between the serum Thyroid stimulating hormone (TSH) levels and the body mass index (BMI).

Material and methods: 80 subjects were recruited in the study in which 40 were male and 40 were female. The age, gender, body weight and height were noted and the body mass index (BMI) was calculated. The serum thyroid stimulating hormone (TSH) levels were measured using ECLA method. The serum TSH levels were compared with age and the body mass Index (BMI).

Results: The subjects were divided into 4 groups based on the body mass index. In the present study 6.25% of subjects were under weight, 12.5% subjects were normal weight, 17.5% were overweight, and 62.5% were obese. The mean TSH of underweight, normal weight, over weight and the obese groups were 13.36 ± 5.52 µIU/ml, 15.16 ± 5.77 µIU/ml, 26.30 ± 21.4 µIU/ml, and 61.66 ± 27.50 µIU/ml respectively. There was a strong positive correlation between the serum TSH levels and the body mass index and negative correlation between the age and the serum TSH levels.

Conclusion: Based on the results of the present study, a highly significant association was found between the serum TSH levels and the body mass index. The mean TSH levels were higher in the obese subjects and there was no association between the serum TSH levels with the age and gender.

Keywords: Obesity, Thyroid Stimulating Hormone, Body Mass Index, Thyroid Dysfunction, Hypothyroidism.

INTRODUCTION

The prevalence of obesity in India is lower when compared to the western countries. The Indians body composition and the centrally distributed body fat makes them to prone for significant morbidity not only in adults but also in children.[1] The thyroid stimulating hormone (TSH) is secreted from the pituitary gland. The secretion of thyroid stimulating hormone is controlled by thyrotropin releasing hormone (TRH) which is produced by the paraventricular nucleus of hypothalamus. This thyroid stimulating hormone stimulates the receptors on the thyroid to synthesise and release the tetraiodothyronine (T4) and triiodothyronine (T3). In case of the primary hypothyroidism, the increased production of thyrotrophin releasing hormone from the paraventricular nucleus of hypothalamus leads to increased production of TSH.[2] Thyroid hormones regulate basal metabolism, thermogenesis, carbohydrate metabolism, lipid metabolism, food intake and fat oxidation.[3] Alterations in the thyroid hormones, especially serum thyroid stimulating hormone affects the body mass index.[4,5] As the thyroid hormones regulates the thermogenesis and basal metabolism the elevated serum TSH levels causing hypothyroidism which is associated with decreased thermogenesis and decreased metabolic rate in turn leads to a higher body mass index (BMI) and increased prevalence of obesity.[6]

The diagnosis of thyroid dysfunction in subclinical stage is very much essential as the subclinical hyperthyroidism where the serum TSH levels are low and the free thyroxine levels are within the normal range is one of the major risk factor foe atrial fibrillation.[7,8] On the other side the subcinical hypothyroidism where the serum TSH levels are elevated and the free thyroxine levels are within normal range causes dyslipidemia which is one of the major risk factor for coronary heart disease leads to mortality.[4,9,10] The present study was aimed to assess the association between the between the serum thyroid stimulating hormone (TSH) levels and the body mass index (BMI).

MATERIAL AND METHODS

The present study was conducted on 40 male and 40 female individuals within the age group of 40 to 60 years. It was a cross-sectional study. All the individuals were recruited in the study by obtaining the informed consent after explaining about the study and the procedures. The individuals with the past history of thyroid disorders were excluded from the study. The age, height, and weight of the individuals were noted and the body mass index (BMI) was calculated in all the individuals. The serum TSH levels were measured using ECLIA method. Institutional ethical clearance was taken to carry out the research.

The individuals were divided into 4 groups based on the BMI values. Underweight BMI <18 kg/m^2 were considered as underweight, BMI between 18 and 22.9 kg/m^2 were considered as normal, BMI between 23 and 24.9 kg/m^2 were as overweight, and BMI ≥25 kg/m^2 as obese.[11]

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STATISTICAL ANALYSIS

The percentage of distribution of subjects according to the BMI was calculated. The mean and standard deviations of BMI and serum TSH levels in each group was calculated. Pearson correlation coefficient was performed to assess the association between the serum TSH and the BMI, between the serum TSH and the age.

RESULTS

In the present study, 6.25% of subjects were underweight, 12.5% of subjects were normally weight, 17.5% were overweight, and 62.5% were obese (Figure 1). The gender wise distribution was depicted in table 1.

The mean serum TSH of an underweight group was 13.36 ± 5.52 µIU/ml, the normal weight group was 15.16 ± 5.77 µIU/ml, the overweight group was 26.30 ± 21.4 µIU/ml, and the obese group was 61.66 ± 27.50 µIU/ml. The mean TSH values of all the 4 groups were compared in figure 2. Out of 80 subjects, only 5 subjects were having the serum TSH levels within the normal range and remaining 75 subjects were having elevated serum TSH levels.

The association between the TSH levels and the BMI were tested using Pierson correlation coefficient test and found a strong positive correlation between TSH levels and the BMI that means higher TSH levels were leading to higher BMI. The R value was 0.7741 and the coefficient of determination R2 was 0.5992. The P value was <0.00001 which suggests a statistically significant association between the TSH levels and the BMI.

The association between the age and the TSH levels of the subjects were also tested using Pierson correlation coefficient test and found a negative correlation. The age was not a factor in elevating or decreasing the TSH levels as the R-value was -0.0754 with P value 0.50 which suggests statistically no significant association between the age and the TSH levels.

Group	Male (n=40)	Female (n=40)
Underweight	1 (2.5%)	4 (10%)
Normal weight	4 (10%)	6 (15%)
Overweight	6 (15%)	8 (20%)
Obese	29 (72.5%)	21 (52.5%)

Table-1: Showing the distribution of subjects according to their BMI.

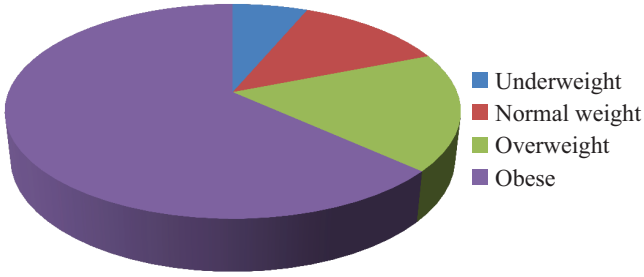

Figure-1: Pie chart showing the distribution of subjects according to their BMI

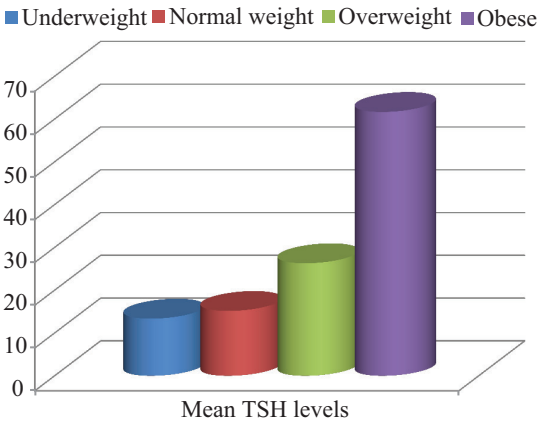

Figure-2: Bar diagram showing the variation in means of TSH levels of all the 4 groups.

DISCUSSION

Overweight and obesity causes more deaths than the underweight or normal weight groups globally. In developing countries higher rates of mortality and morbidity was observed in obese individuals when compared to non obese individuals.[12] Obesity is an emerging health problem in the urban areas of India accounting 30 to 65% in adult population.[13] The prevalence of obesity is gradually increasing not only in urban but also in rural areas of India which was reported by the previous studies on the prevalence of obesity and overweight.[14] Elevated serum TSH levels in hypothyroidism is a main cause of overweight and obesity. The association between the serum TSH levels and body mass index in adults is of a great medical concern. Thus, the present study was aimed to find out the association between the serum thyroid stimulating hormone levels and body mass index.[15]

In the present study the serum TSH levels were strongly correlated with the body mass index. The serum TSH levels were much higher in overweight and obese subjects when compared to normal subjects in the adults. These results were correlating with other studies.[16,17] Amrita Solanki et al., had studied on the relationship of serum TSH with BMI in healthy adults and found that, the subjects with higher BMI had elevated levels of serum TSH levels. They reported the mean TSH levels in underweight group as 1.6036 mIU/L, normal weight group as 2.1727 mIU/L, overweight group as 2.2870 mIU/L and obese group as 2.6416 mIU/L which were much lesser than the present study.[17] The present study results were in argument with Namburi RP et al., who found the subclinical hypothyroidism in children and adolescents where 13.33% were overweight, 15.7% were obese and 0% in normal group. They reported that serum TSH was not significantly correlated with BMI in children and adolescents.[18]

The diagnosis of subclinical hypothyroidism in obese subjects should not be diagnosed only based on the elevated serum TSH levels. The circulating thyroid antibodies are also should be considered as there is a chance of autoimmune thyroid failure.[19]

CONCLUSION

The present study results reported highly significant

association between the serum TSH levels and the body mass index. The elevated levels of TSH were found in the obese and overweight subjects with no relation to the age and gender. Further studies should be carried on the relation between the body mass index and the thyroid antibodies.

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