Relationship between Hypothyroidism and Body Mass Index in Women: A Cross-Sectional Study

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ABSTRACT

Introduction: Hypothyroidism is mainly caused due to deficiency of hormones. It is categorised into congenital and acquired depending on the level of endocrinal dysfunction in primary and secondary or central and the severity of severe or clinical hypothyroidism and mild or subclinical.

Method: 50 Women with hypothyroidism and 50 normal healthy individuals were included in the present hospital-based case control study with proper inclusion and exclusion criteria. BMI and their relationship with Central Hypothyroidism were estimated using different methods with proper handling of samples.

Result and Observation: The mean value of T3, T4, TSH were more in control as compared to cases and this difference was significant. Correlation between TSH and BMI was positive and highly significant at $p < 0.01$ level of significance and negative correlation between T4 and TSH which was significant as $p < 0.05$.

Conclusion: Finding of present study indicates that there is positive correlation between TSH and BMI, which is highly significant at 0.001 level and negative correlation between T4 and TSH which is significant as $p < 0.05$. Thus, we conclude there is a strong positive relationship between BMI and hypothyroidism.

Key Words: Hypothyroidism, BMI, TSH, T4

INTRODUCTION

Hypothyroidism is mainly caused due to the deficiency of hormones. It is categorised into congenital and acquired depending on the level of endocrinal dysfunction in primary and secondary or central and the severity of severe or clinical hypothyroidism and mild or subclinical.¹ The problematic factor of primary hypothyroidism is thyroid gland disorder, which causes reduced synthesis and thyroid hormone secretion. Hypothyroidism is found in chronic autoimmune thyroiditis, which is autoimmune aetiology in 50% of cases. It is attributed to other factors or medications in the remaining 50%.² Central hypothyroidism is defined as hypothyroidism due to insufficient stimulation of an otherwise normal thyroid gland by the thyroid-stimulating hormone (TSH). It may happen at the hypothalamus or pituitary gland stage.³

The body mass index is currently used to define the characteristics of anthropometric height/weight in adults and to categorize them into classes. It is also widely utilized as a risk factor in the development or prevalence of several health problems and physical activities^{4,5}. A great medical concern has been given to the relation between thyroid function and body weight in euthyroid individuals. Different researchers studied the effect of thyroid hormones on the body mass index (BMI) and showed that overt thyroid dysfunction affects body weight. It's fascinating how clinical hypothyroidism induces weight gain, while hyperthyroidism decreases it⁶.

Dysfunction of the thyroid is related to changes in body weight and composition, body temperature and total energy expenditure for rest. Hypothyroidism is associated with reduced thermogenesis, decreased metabolic rate and has also

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been shown to correlate with an elevated body mass index (BMI) and increased obesity prevalence^{5,7}.

This aim of present study was planned to find out the relationship between Hypothyroidism and BMI in females.

AIMS AND OBJECTIVES

The current study was carried out in the Dept. of Biochemistry, Prakash Institute of Medical Sciences and Research Urun, Islampur in collaboration with Dept. of Physiology at Prakash Institute of Medical Sciences and Research Urun, Islampur, with following aims and objectives: -

Aim

- To find out the relationship between BMI and Hypothyroidism.

Objectives of study

- To find out the level of T3, T4, TSH in cases and control and calculate BMI.
- Find out correlation of T3, T4, TSH and BMI and correlate with hypothyroidism.

MATERIAL AND METHOD

Type of Study: Cross-sectional study

DURATION: 1 YEAR

Study area:

100 subjects were selected for study and grouped in following two categories.

Group I: 50 cases with hypothyroidism

Group II: 50 healthy cases

Type of Study: Hospital-based Cross Sectional

Patients selection criteria:

50 subjects were selected for study considering following inclusion and exclusion criteria. The proposed study was undertaken after approval by Institutional Ethical Committee.

Inclusion criteria:

Subjects included in present study were females between age group of 20 -45 2. Newly diagnosed cases of hypothyroidism

Exclusion criteria:

Subjects excluded were

- Not willing to participate
- Patients with incomplete thyroid subject taking medicines
- Pregnant women,
- History of chronic smoking and alcohol abuse

Blood sample collection

5 ml fasting blood sample was collected in dry plain vial from group I and group II after taking consent form. Blood samples were allowed to keep at room temperature for centrifugation at 3000 rpm for 30 min. The serum sample was collected for estimation of T3, T4 and TSH and BMI was calculated using following formula.

BMI= Weight in kg/ height in m²

The WHO Criteria for various subgroups of Body Mass Index was taken into consideration⁸

The parameter was assessed immediately using the following method:

Statistical analysis

Data were analysed by using SPSS (23.0 version).

OBSERVATIONS AND RESULTS

Table 1: Age wise distribution of Cases and Controls

Age in Years	Cases		Controls		Total	
	Numbers	%	Numbers	%	Numbers	%
<20	18	18.0%	16	16.0%	34	34.0%
20-25	24	24.0%	22	22.0%	46	46.0%
>25	8	8.0%	12	12.0%	20	20.0%
Total	50	50.0%	50	50.0%	100	100.0%

Analysis of the above table shows:

- The age wise distribution of cases and controls.
- Age in years is divided into three groups with cases and control matched in number.

Table 2: Comparison of T3, T4, TSH, BMI, LH and FSH in Cases and Control

Parameters	Cases		Controls		P Value
	Mean	SD	Mean	SD	
T3	2.13	0.37	2.38	0.19	<0.01*
T4	5.51	1.43	6.82	1.59	<0.01*
TSH	5.40	1.22	3.41	0.91	<0.01*
BMI	26.53	3.02	23.06	1.16	<0.01*

* 'P' =0.001 significantly high

Analysis of the above table shows:

- Comparison of T3, T4, TSH in group I and group II.
- Average value of T3 is more in group II as compared to group I and this difference is **significant**.
- The mean value of T4 is more in group II as compared to group I and this difference is **significant**.

- The mean value of TSH is more in group I than in group II, which is **significant**.
- The mean value of BMI is more in group I as compared with group II and this difference is **significant**

Table 3: Correlation between T₃, T₄, TSH and BMI in Cases

Parameters	Mean	SD	Karl Pearson's Correlation Coefficient (r)	P Value
T ₃	2.13	0.37	-0.159	.446
BMI	26.53	3.02		
T ₄	5.51	1.43	-0.173	0.41
BMI	26.53	3.02		
TSH	5.40	1.22	0.521	<0.001*
BMI	26.53	3.02		
T ₃	2.13	0.37	-0.374	0.066
TSH	5.40	1.22		
T ₄	5.51	1.43	-0.466	0.019**
TSH	5.40	1.22		
T ₃	2.13	0.37	0.274	0.185(NS)
T ₄	5.51	1.43		

* 'P' = 0.001 significantly high

** Correlation is Significant at 0.05 Level of Significance

Analysis of above table 3 shows:

- The correlation of T₃ with BMI, T₄ with BMI, TSH with BMI, T₃ with TSH, T₄ with TSH and T₃ with T₄.
- We found a negative correlation between T₃ and BMI which is not significant.
- We found a negative correlation between T₄ and BMI, which is not significant.
- We found a positive correlation between TSH and BMI, which is **highly significant** at 0.01 Level.
- We found a negative correlation between T₃ and TSH, which is not significant.
- We found a negative correlation between T₄ and TSH, which is **significant** as p<0.05.
- A positive correlation was found in between T₃ and T₄, which is not significant.

DISCUSSION

The present study was carried out in the Dept. of Biochemistry in collaboration with Dept. of Physiology and Dept. of General Medicine, at tertiary care hospital. Study is for 50 cases with hypothyroidism and 50 normal cases between 20-45 years of age newly diagnosed with subclinical hypothyroidism.

Average BMI in current study was 26.53±3.02. It coincides with study by Garg et al⁹. Correlation analysis in subclinical

cal Hypothyroid female in present study observed positive, highly significant (p<0.001) correlation. While, statistically significant positive correlation between BMI and thyroid function in women was observed in study conducted by Garg et al⁹. and Milonis et al¹⁰. Also in a study by Garg et al⁹ cases of subclinical Hypothyroid females indicated a positive correlation between BMI and TSH (r= 0.58) was found to be statistically significant (p=0.005*). Zhang et al¹¹.observed, risk of obesity was quite elevated in SCH adult among Chinese Population. Gaurav Gupta et al¹²observed that there was positive correlation between TSH and BMI in SCH women. Velivala et al¹³. Supported present study that the prevalence of subclinical hypothyroidism is high in females and greater than before in comparison to BMI. Solanki et al¹⁴observed that the level of TSH is fairly higher in obese patients and increase with increase in BMI. Thus, relationships between thyroid hormones and metabolic risk markers were recognized, suggesting that thyroid function may be one factor that influences body weight and the comorbidities of obesity as it was experiential in cohort study conducted by Xu R et al¹⁵.

Study conducted by S Kumar et al¹⁶. in pregnant women, BMI correlates positively with TSH in the first and second trimesters while it correlates negatively with FT₄ in the second and third trimesters but has not shown significant association with FT₃ in any of the trimesters in pregnant women with euthyroid. Above literature strongly supports the objective of present study. This may provide new insight, further study on correlation of BMI with hypothyroidism. Thyroid hormone is detrimental to the thyroid hormone system effects on the mental and physical activities^{16,17}.

CONCLUSION

The finding of present study indicates that there is positive correlation between TSH and BMI which is highly significant at p<0.01 level and negative correlation between T₄ and TSH which is significant as p<0.05. There is a negative correlation between T₃ and BMI and is insignificant. The correlation between T₃ and TSH is negative and insignificant. Thus, we conclude there is strong positive relationship between BMI and hypothyroidism.

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