

## Study of Body Mass Index in the Normal Individuals Compared with Hypothyroid Patients

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### Original Research Article

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**Abstract:** Thyroid diseases are among the commonest endocrine disorders. Hypothyroidism is an insidious condition in which the thyroid gland does not synthesize enough thyroid hormones to meet metabolic requirement of the body which is associated with subtle and nonspecific symptoms with significant morbidity. Hypothyroidism is the leading cause of several complications the commonest being overweight and obesity. The present study was undertaken to evaluate the BMI at the time of diagnosis in hypothyroid patients and compare with that of normal individuals. A comparative study was conducted, 100 cases of hypothyroidism at the time of diagnosis and 100 controls in the age group of 20-40 years, both Males and Females. BMI was calculated, data of T<sub>3</sub>, T<sub>4</sub> & TSH levels were collected & compared between normal and hypothyroid subjects. It was found that hypothyroid subjects had a higher body mass index than the normal individuals. Hence maintenance of thyroid hormones at normal level and regular monitoring of BMI in Hypothyroid patients will help in early detection and prevention of Obesity and its related complications in future.

**Keywords:** Body mass index, T<sub>4</sub>, T<sub>3</sub>, TSH.

### INTRODUCTION

Thyroid gland, one of the largest endocrine glands weighing 15-20 grams in adults, secretes Thyroxine (T<sub>4</sub>) and Triiodothyronine (T<sub>3</sub>). Both of these hormones profoundly increase basal Metabolic Rate of the body and play an important role in the control of cellular Metabolism [1, 2].

Thyroid diseases are among the commonest endocrine disorders. Worldwide about 42 million people have thyroid dysfunction of various categories. In India, thyroid disorders are most common among all endocrine disorders and hypothyroidism being more common than hyperthyroid state and carcinoma thyroid [3]. Hypothyroidism is an insidious condition in which the thyroid gland does not synthesize enough thyroid hormones to meet metabolic requirement of the body which is associated with subtle and nonspecific symptoms with significant morbidity [4]. Iodine deficiency is the most common cause of hypothyroidism worldwide. It can also be caused by other disorders of thyroid gland or less commonly the pituitary gland or hypothalamus [5]. Thyroid hormone induces changes in physical activity and in turn in the body mass [6]. BMI is a simple index of weight for height that is commonly used to quantify the amount of

tissue mass (Muscle, fat and bone) of an individual and categorize as underweight, normal weight, overweight or obese based on that value. BMI provides the most useful population level measure of overweight and obesity as it is same for both sexes and all ages. Low thyroid hormone levels cause body's function to decelerate leading to general symptoms like dry skin, fatigue, loss of energy, memory problems, higher cholesterol level and weight changes etc. Hypothyroidism can have serious health consequences at all the stages of the life cycle. Hypothyroidism is the leading cause of several complications the commonest being overweight and obesity. The present study was undertaken to evaluate the BMI at the time of diagnosis in hypothyroid patients and compare with that of normal individuals. Below table shows BMI and its classification.

BMI	CLASSIFICATION
< 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0-34.9	Obesity (Class I)
35.0-39.9	Obesity (Class II)
>40	Extreme Obesity (Class III)

Normal Thyroid Profile (According to Williams Text book of Endocrinology 11<sup>th</sup> Edition):

TSH value 0.4 – 4.2 mU/l

T<sub>3</sub> value 70 - 190 ng/dl

T<sub>4</sub> value 5 -11 micro grams/dl

## MATERIALS AND METHODS

Case control study was conducted in medical college.

### Study Group

100 cases of hypothyroidism at the time of diagnosis and 100 age matched controls.

### Inclusion Criteria

- Patients of hypothyroidism at the time of diagnosis in the age group of 20 to 40 years.
- 100 healthy volunteers are taken as controls.

### Exclusion Criteria

- Immunologically-compromised patients
- Patients with Diabetes Mellitus, Hypertension
- Chronic liver disease
- Chronic renal disease
- Patients taking any drugs altering serum TSH levels (somatostatin, opiates, dopamine, glucocorticoids, bromocriptin etc.)
- Pregnant and lactating female

All subjects were in the age group of 20 – 40 years. Height is measured with Harpenden stadiometer, & weight is measured with standard weighing machine. Participant should stand erect with chest straight and chin facing forward, bare foot & heels touching the wall. Participant should wear lightweight clothes. The information provided by the participant will be kept confidential and the Participation is voluntary.

BMI was calculated as body weight (Kilograms) divided by height squared (Meters). Data of T<sub>3</sub>, T<sub>4</sub> & TSH levels were collected & compared between normal and hypothyroid subjects. Mean values of T<sub>3</sub>, T<sub>4</sub>, TSH, BMI was calculated. These values were compared between normal subjects and hypothyroid patients. P value was calculated .P < 0.001 was considered significant.

## RESULTS

Out of 100 hypothyroid subjects 89 were females and 11 were males..Out of 100 normal individuals 70 were females and 30 were males. According to WHO classification the BMI value between 18.5 and 24.9 is considered as normal weight. BMI value between 25 and 29.9 is considered as overweight. BMI value of 30 and above is considered as obesity.

It shows BMI in normal and hypothyroid male and female subjects.BMI is more in hypothyroid subjects as compared to normal subjects

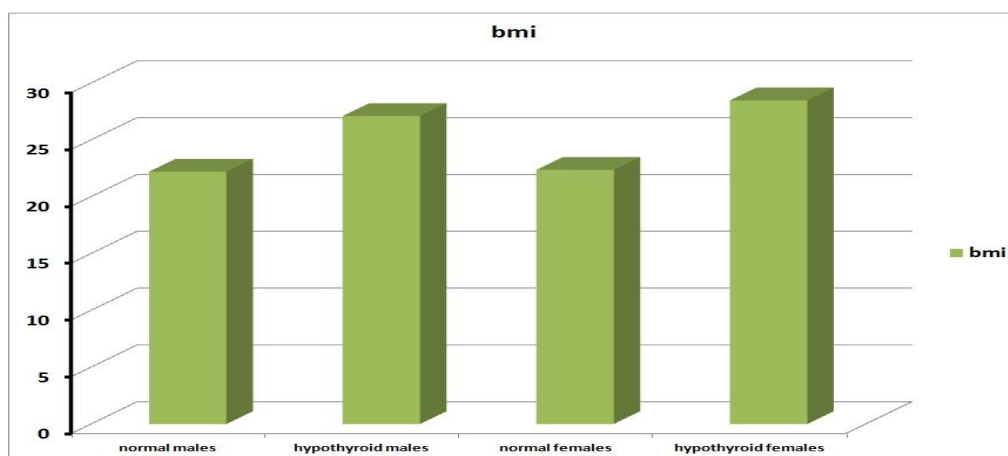


Fig-1: Depicting BMI in study population

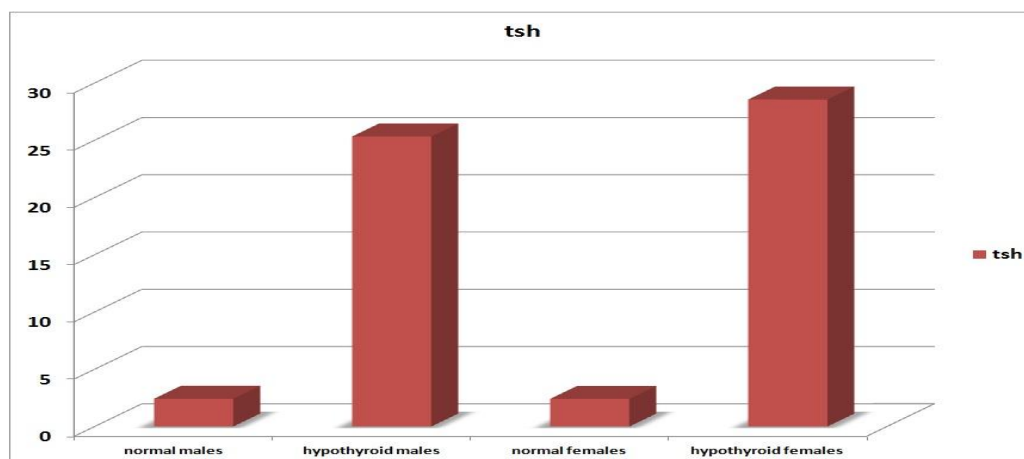


Fig-2: Figure depicting TSH in study population

Table-1: Showing BMI &amp; Thyroid profiles of study population

Parameter	Normal males (Mean value)	Hypothyroid males	P value	Normal females (Mean value)	Hypothyroid females	P value
BMI(kg/mt <sup>2</sup> )	22.2063032	27.10361061	0.0008	22.36539541	28.48236955	0.0006
TSH(mU/l)	2.4259375	25.33076923	0.0003	2.414285714	28.56	0.0004
T <sub>4</sub> (mcg/dl)	8.0625	5.661538462	0.02	8.354285714	6.196666667	0.0002
T <sub>3</sub> (ng/dl)	129.1875	112.8461538	0.015	128.5	106.0751111	0.012

It shows TSH is more in hypothyroid subjects as compared to normal subjects (Fig-2).

Table-1 shows that BMI is more in hypothyroid males and females as compared to normal subjects, and this is statistically significant ( $p < 0.001$ ). Hypothyroid patients were found to be overweight.

## DISCUSSION

The function of Thyroid gland is due to the secretion of Thyroxine and Triiodothyronine the two hormones which are secreted by functional unit of thyroid gland that is thyroid follicle. The Thyroid gland maintains the level of metabolism in the tissues that is optimal for normal functioning. Thyroid Hormones stimulate oxygen consumption of most of the body cells, helps in regulation of lipid and carbohydrate metabolism and are necessary for normal growth and maturation [7]. Thyroid hormone mobilizes lipids rapidly from the fat tissue which reduces the fat stores of the body and it increases free fatty acid concentration in plasma and accelerates the oxidation of free fatty acid by the cells. Thyroid hormone increases the number of LDL receptors on liver cells leading to rapid removal of LDL from plasma by the liver. Reduced thyroid hormones greatly increase the plasma concentration of cholesterol, phospholipids, triglycerides and excessive deposition of fat in the liver [8]. Recently, several clinical studies evaluated the issue of hormonal changes associated with obesity. Thyroid hormone is indeed an important determinant of energy expenditure and contributes to appetite regulation. On the other hand, secretory products from

the adipose tissue act on the CNS to inform on the quantity of energy stores, and this may have an impact on the activity of the hypothalamus–pituitary–thyroid axis [9]. Hypothyroidism causes a weight increase together with a decrease in basal metabolic rate and thermogenesis. Moreover, it has also been reported that there is an inverse correlation between free thyroxine (fT<sub>4</sub>) values and body mass index (BMI), even when fT<sub>4</sub> values remain in the normal range [10] BMI has been negatively associated with serum free T<sub>4</sub> (fT<sub>4</sub>), and fat accumulation has been associated with lower fT<sub>4</sub> and higher TSH levels among slightly overweight euthyroid individuals, thereby resulting in a positive correlation between TSH and the progressive increase in weight with time. The alterations in body weight associated with hypothyroidism may reflect both the accumulation of body fat, due to decreased REE and reduced physical activity, and the increased water content of the body, consequent to a reduced capacity of excreting free water. Hypothyroid subjects also have increased amounts of glycosaminoglycans that are responsible for the greater water-binding capacity, a condition that results in the typical ‘myxedema’ of hypothyroidism [11, 12]. Restoration of euthyroidism is followed by an increase in REE and even small variations in serum TSH, induced by L-T<sub>4</sub> substitution, are associated with opposite changes in REE. However, in spite of adequate substitution with L-T<sub>4</sub>, hypothyroid patients may experience only a modest and/or transient loss of weight during hormone treatment. Excretion of excess body water, rather than reduction in fat mass, accounts for this change of body weight [13, 14]. In this study an attempt has been made to compare the BMI between

hypothyroid subjects and normal individuals to emphasize the relation between BMI and TSH. A significant correlation was found between BMI and TSH.

## CONCLUSION

Hypothyroidism is the most common thyroid disorder associated with low level of thyroid hormones. Hypothyroidism is the leading cause of several complications such as Dyslipidemia, Obesity and Cardiovascular diseases. Central obesity is related to many endocrine disorders including thyroid dysfunction. BMI is commonly used to quantify the amount of tissue mass which includes Muscles, Fat and Bone of an individual. BMI provides the most useful population level measure of overweight and obesity as it is same for both sexes and all ages. This Study suggests that Hypothyroidism influences body weight and BMI of the patients significantly. Most of the Hypothyroid subjects in the present study fall under the category of overweight. However, this parallel increase in BMI due to weight gain along with increase in TSH may further lead to complications of overt hypothyroidism if left untreated. Obesity itself could produce various metabolic disorders in coming future. Hence maintenance of thyroid hormones at normal level and regular monitoring of BMI in Hypothyroid patients will help in early detection and prevention of Obesity and its related complications in future. Awareness of weight reduction and regular physical exercise are to be advised to patients with hypothyroidism.

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