

## Research Article

# A study of prevalence of thyroid dysfunction in patients with metabolic syndrome

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**Received:** 04 September 2015

**Revised:** 08 October 2015

**Accepted:** 09 October 2015

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### ABSTRACT

**Background:** The study was undertaken with an objective to study the thyroid functions in patients with metabolic syndrome diagnosed as per International Diabetes Federation (IDF) criteria and to know the spectrum of thyroid dysfunction.

**Methods:** A total of 300 patients with metabolic syndrome diagnosed as per IDF criteria were included in the study. A detailed history regarding symptoms of hypothyroidism and examination was done in all patients and all these patients underwent thyroid profile tests.

**Results:** A total of 300 patients with metabolic syndrome were included in this study. Thyroid dysfunction was present in 45% of the patients. Hypothyroidism was noted in 43 patients, subclinical hypothyroidism was noted in 114 patients, subclinical hyperthyroidism in 6 patients and hyperthyroidism in 1 patient. This study included 166 males and 134 females. 10% of the patients had symptoms related to hypothyroidism. 7% had goiter on examination. Thyroid dysfunction was seen in 68% females compared to that of 47% in males. Females had higher incidence compared to males. Elderly females (42%) and males in the age group of 40-50 years (41%) had higher incidence of subclinical hypothyroidism compared to others.

**Conclusions:** Prevalence of thyroid disorders in diabetics was 45%. Elderly population had more incidences. Sub-clinical hypothyroidism was more common among females.

**Keywords:** Metabolic syndrome, Subclinical hypothyroidism, IDF criteria

### INTRODUCTION

Metabolic syndrome is described as a cluster of abnormalities including abdominal obesity, insulin resistance, hypertension, hyperglycemia, increased triglycerides, and decreased high-density lipoprotein cholesterol (HDL-C).<sup>1</sup> Studies done before have shown that higher TSH (thyroid stimulating hormone) concentrations are associated with increased incidence for the occurrence of metabolic syndrome, especially in females. Thyroid dysfunction, hypothyroidism in

particular has been associated with atherosclerotic cardiovascular disease. Since metabolic syndrome and thyroid dysfunction are independent risk factors of atherosclerotic cardiovascular disease, presence of both increases the risk of cardiovascular morbidity in these patients. In 2001, Bakkar and Colleagues showed that the increased cardiovascular risk associated with subclinical hypothyroidism seems to extend itself into the normal range of thyroid dysfunction. They also showed that insulin resistant subjects are more susceptible to the increased levels of high LDL-C at increasing TSH levels

even within the normal range.<sup>2</sup> Bauer DC et al., showed that among older white women, high TSH levels were associated with deleterious changes in serum lipids and that women with multiple lipid abnormalities were twice as likely to have increased TSH level.<sup>3</sup>

### **Aim and objectives**

- 1) To study the thyroid functions in metabolic syndrome.
- 2) To know the spectrum of thyroid dysfunction in metabolic syndrome.

### **METHODS**

This study includes all patients who are diagnosed with metabolic syndrome as per IDF criteria from outpatient and in-patient department of Sri Ramachandra Medical College, Porur, Chennai during the period of September 2011 to May 2013. 300 patients were selected for the study.

Inclusion criteria in accordance with the International Diabetes Federation included waist circumference which was ethnicity specific (South Asian) measured midway between the uppermost border of the iliac crest and lower most border of the lower border of the costal margin for men with a circumference more than 90 cm and for women, more than 80 cm. Plus any two of the below mentioned criteria;

TGL (Triglycerides) - more than 150 mg/dl

HDL (High Density Cholesterol) - less than 40 mg/dl in men, 50 mg/dl in women

BP (Blood pressure) - Systolic more than 130 mm of Hg. Diastolic more than 85 mm of Hg

FBS (Fasting Blood Sugar) - more than 100 mg/dl

Exclusion criteria included patients with type 1 diabetes, GDM (Gestational Diabetes Mellitus), overt diabetes, patients who are on OCPs (Oral Contraceptive Pills), history of pancreatitis and those who were previously diagnosed of thyroid illness and on treatment.

A detailed history was taken from all patients included in the study regarding symptoms of thyroid dysfunction and examination was carried out as per the proforma.

Thyroid function tests were done by Chemiluminescent Immunoassay (CLIA) method.

### **Glucose and lipid analysis**

The analyses were carried on automated clinical chemistry analyzers. Serum glucose was measured by,

GOD-POD (Glucose oxidase-peroxidase) end point Trinder's method.

Total cholesterol was measured using the cholesterol oxidase test. Triglycerides were measured using the enzymatic method.

HDL and LDL cholesterol was measured using the direct homogenous method.

### **RESULTS**

In this study, total of 300 patients with metabolic syndrome were included. Of these 300 patients, 166 were males and 134 were females.

The numbers of male patients were more (55.3%) in this study compared to females (44.7%). Out of the 166 male patients, 42 patients belong to age group 30-40, 70 patients belong to age group 41-50, 54 patients belong to age group 51-60.

Of 134 female patients, 27 patients belong to age group 30-40, 43 patients belong to age group 41-50, 64 patients belong to age group 51-60.

Of the 166 male patients, there were more patients in age group 41-50 years compared to others. 42.1% belonged to the age group 41-50 years compared to 51-60 years (32.5%) and 30-40 years (25.3%).

Of the 134 female patients, there were more patients in 51-60 age group compared to others. 47.7% belonged to the age group 51-60 years compared to 41-50 years (32.08%) and 30-40 years (20.1%).

Overall, 39% patients were in age group of 41-50 years and 38% in 51-60 years and the least number of patients in 31-40 years (23%).

The mean age of male patients in the study was 46.6.

The mean age of the female patients was 48.2 yrs. While comparing other variables, the mean TGL values in the male study group was found to be high (184) compared to the female group (164). The TSH values were similar in both groups.

Of total 300 patients with metabolic syndrome, 33 (male - 17 and female - 15) of them symptoms related to hypothyroidism. Of the 300 patients, 19 had goitre on examination. 17 had diffuse goiter and 2 patients had multinodular goitre.

More number of patients in the age group of 41-50 had abnormal TGL values, compared to the other age groups. While, HDL values were low in the 51-60 age group compared to others.

59% of patients within the age group of 31-40 years had high fasting sugars compared to that of the 30% in 41-50 years and 42% in 51-60 years. Abnormal PPBS values were found in the age group of 41-50 was 88%, where as it is 82% in 31-40 years age group and 71% in the 51-60 years.

Out of the 300 patients with metabolic syndrome, 47% had abnormal thyroid function tests. Subclinical hypothyroidism was the most common amongst, 37% and 14% of the study population had hypothyroidism, while subclinical hyperthyroidism was seen in only 4 patients (1.3%) and one patient had hyperthyroidism (0.3%).

As per age wise distribution it is seen that, subclinical hypothyroidism is the most prevalent thyroid dysfunction in all age groups. Hypothyroidism is seen in 17% of the 51 to 60 age group and it was 13% in both 31 to 40 and 41-50 age groups. Only one patient in the age group of 41-50 had hyperthyroidism. Subclinical hyperthyroidism is seen in 1.45 in 31-40 and 2.6 % in the 41 to 50 age group, none in the 51 to 60 years.

In female patients, the percentage of population with subclinical hypothyroidism is 35.8% and 16% of the study group had hypothyroidism and 47% of the patients had normal thyroid values.

The distribution of percentage is quite similar between the male and female patients in patients with normal thyroid values (male - 46% and female - 47%). Whereas subclinical hypothyroidism is slightly higher in males (39%) compared to the females. While hypothyroidism is seen only in 12% of male study population compared to that of the 16% in case of females. Subclinical Hyperthyroidism is seen in 3 male patients and in 1 female patient.

**Table 1: Prevalence and spectrum of thyroid dysfunction in present study.**

	Frequency	Percent
Subclinical hypothyroidism	113	37.7
Hypothyroidism	43	14.3
Euthyroidism	139	46.3
Subclinical hyperthyroidism	4	1.3
Hyperthyroidism	1	0.3

**Table 2: Prevalence of thyroid dysfunction in female patients in present study.**

Thyroid profile	Frequency	Percentage
Subclinical hypothyroidism	48	35.8
Hypothyroidism	22	16.4
Euthyroidism	63	47.0
Subclinical hyperthyroidism	1	0.7
<b>Total</b>	134	100.0

**Table 3: Prevalence of thyroid dysfunction in male patients in present study.**

	Frequency	Percentage
Subclinical hypothyroidism	65	39.2
Hypothyroidism	21	12.7
Euthyroidism	76	45.8
Subclinical hyperthyroidism	3	1.8
Hyperthyroidism	1	0.6
<b>Total</b>	166	100.0

**Table 4: Prevalence of metabolic syndrome among the spectrum of thyroid dysfunction in present study.**

		%
Euthyroid	21 of 48 euthyroid patients had metabolic syndrome	43%
Hypothyroid	5 of 24 hyperthyroid patients had metabolic syndrome	20%
Hyperthyroid	6 of 28 patients with hypothyroidism had metabolic syndrome	21%

On comparing, individual variables of metabolic syndrome with respect to thyroid values, shows that

- 1) Mean systolic blood pressure is high in patients with hypothyroidism (139.55), whereas it is almost the same in the subclinical hypothyroidism and euthyroid group.
- 2) Whereas, the mean diastolic blood pressure is high in both hypothyroid (90.75) and subclinical Hypothyroidism (88.37), compared to that of the euthyroid group who have a mean diastolic BP of 82 mm of Hg.
- 3) Triglycerides values are high in the hypothyroid group, mean value of 180 (SD - 49), whereas it is 168 in the euthyroid group and 171 in the subclinical hypothyroidism.

**DISCUSSION**

Metabolic syndrome is a conglomeration of risk factors for the development of cardiovascular disease. Many studies done in the past has shown higher incidences of association of thyroid dysfunction (subclinical hypothyroidism) with metabolic syndrome.<sup>4,5</sup> Thus the detection of thyroid abnormalities and its treatment in patients with metabolic syndrome may help in reducing the risk of CVD they already have.

Prevalence and spectrum of thyroid dysfunction in metabolic syndrome (Table 1) - We have found that out of the 300 patients, 161 had abnormal thyroid values. Around 54% of the study population had thyroid dysfunction, of which most of them had subclinical hypothyroidism (113 of 300 patients - 37.7%) followed by 43 patients with hypothyroidism (14% of the study

group) and 4 patients with subclinical hyperthyroidism and 1 patient with hyperthyroidism.

Gyawali et al., studied the prevalence of thyroid dysfunction in patients with metabolic syndrome. Total 128 patients were included for the study. The overall prevalence of the thyroid dysfunction was 31.25% (40). Of the 128 subjects, 28.90% (37) had subclinical hypothyroidism, 1.55% (2) had overt hyperthyroidism, 0.80% (1) had subclinical hyperthyroidism and 68.75% (88) were euthyroid. Overt hypothyroidism was not present in any of the subject. Avanthika C Waring et al.,<sup>6</sup> studied the thyroid function in incidence and prevalence of metabolic syndrome in older adults, which showed that the higher TSH levels more than 10 mIU/ml were more commonly associated with prevalent metabolic syndrome. Muhammed et al.,<sup>7</sup> in his study done in a euthyroid population from Pakistan, included 100 patients with metabolic syndrome and 30 patients in the control group compared the TSH values between both the group and showed that there was a significant difference in TSH values between both groups. Jayakumar et al.,<sup>8</sup> included 120 patients with metabolic syndrome, of which 60% of patients had thyroid abnormalities. 52 patients (44% of study group) had subclinical hypothyroidism and 18 had hypothyroidism (15%), 2 patients with subclinical hyperthyroidism and 48 had normal values.

Sat Byul Park et al.,<sup>9</sup> a study done in Korean population considered 594 patients with metabolic syndrome. 41% of patients had thyroid dysfunction. Of 594 patients, 158 had subclinical hypothyroidism, 49 patients had subclinical hyperthyroidism and hypothyroidism in 38 patients. The percentage of patients with subclinical hyperthyroidism is more in this study (8.2 %) compared to our study (1.3%). Whereas, subclinical hypothyroidism was seen in 26% patients in the Korean study and 37% patients in Indian patients with metabolic syndrome.

Chih Yuan Wang et al.,<sup>10</sup> in his study done at Taiwan university hospital, had included 9055 subjects for evaluation and all subjects were split into three groups - subclinical hypothyroidism (412 patients), euthyroidism (8404 patients) and subclinical hyperthyroidism (239 patients). The results of this study showed that there is no statistical correlation between metabolic syndrome and subclinical hypothyroidism. Tehrani et al.,<sup>11</sup> in his population bases study enrolled 914 women with hypothyroidism, of this 19.2% had subclinical hypothyroidism; our study had 35% of female patients with hypothyroidism. Gaurav et al.,<sup>12</sup> in a study done in south Indian women included 76 patients with metabolic syndrome, of which 53% had subclinical hypothyroidism and 25 % were euthyroid. Park HT et al.,<sup>13</sup> in his study done in postmenopausal euthyroid women, who included 2205 women, identified a close relationship between TSH values and metabolic syndrome. Higher the value of TSH more is the prevalence of metabolic syndrome. Shresta et al.,<sup>14</sup> studied the association of metabolic syndrome association with thyroid abnormalities in 48 females from

Nepal. 32% of the study population had metabolic syndrome. Of which, the prevalence of metabolic syndrome was more common in the euthyroid group compared to the hyperthyroid and hypothyroid group. This study stated that the thyroid dysfunction might be protective for the development of metabolic syndrome, which contradicts from our study.

Chih Cheng Lai<sup>15</sup> et al. studied the prevalence of subclinical hypothyroidism and its association with metabolic syndrome in elderly Taiwan people. This study showed that 32% subjects with subclinical hypothyroidism had metabolic syndrome and 28% of patients with subclinical hyperthyroidism.

Pattern of lipid profile derangement in metabolic syndrome patients (Table 5) - Out of 300 patients included in this study, 228 patients had abnormal triglyceride levels (76% of study group) and 215 patients had low HDL values (71%).

Punia et al.,<sup>16</sup> investigated the prevalence of metabolic variable in metabolic syndrome and associated thyroid dysfunction. Of the 360 patients included in the study 62% had high TGL values, and 83 % had a low HDL.

Jayakumar et al.,<sup>8</sup> in his study of thyroid status in metabolic syndrome included 120 patients. Of which 72 patients had low HDL (60% of study group) and 67 had high triglycerides - 56 % of the study group.

Ruhla et al.,<sup>4</sup> in her study done in a German population of 1333 with TSH values in the range of 0.3 to 4.5 mu/L who were not on treatment. The study results showed that patients with high normal TSH had a significant higher TGL levels compared to the patients with lower TSH values and higher BMI and that these patients were at 1.7 fold increased risk of developing metabolic syndrome.

**Table 5: Comparison of pattern of lipid profile derangement in metabolic syndrome patients in present study with two similar studies.**

Studies	Percentage of population with abnormal HDL	Percentage of population with abnormal TGL
Current study	71%	76%
Punia et al.	83%	62%
Jayakumar et al.	60%	56%

Prevalence of abnormal fasting sugars and hypertension (Table 6) - 41% of the total study population (125 out of 300 patients) had abnormal FBS values. While 73% of the patients had elevated BP (220 patients in 300).

Jayakumar et al.,<sup>8</sup> had 39% of the patients with elevated fasting glucose values whereas 57.5% patients had high blood pressure. Though the percentages of abnormal sugars are almost the same in both studies (41% and 39%), the numbers of patients with high blood pressure

are more in our study (73%) compared to the other study (57.5%).

Gaurav et al.,<sup>12</sup> in his study in south Indian women with metabolic syndrome showed that 75% of them had high FBS and 63% had high blood pressure. Whereas in the present study considering only the female patients, 42% had abnormal FBS while, 90% had high blood pressure.

**Table 6: Comparing prevalence of abnormal fasting sugars and hypertension in present study with a similar study.**

Study	Percentage of population with abnormal FBS	Percentage of population with high BP
Current study	41%	73%
Jayakumar et al. <sup>8</sup>	39%	57.5%

The drawbacks of the present study are that it included a small group of population and it cannot be applied on a global scale, as the study group included was mainly people in and around Chennai. Insulin resistance was not monitored in the present study.

## CONCLUSION

1. According prevalence of thyroid dysfunction is seen in 54% of the patients with metabolic syndrome studied.
2. Subclinical hypothyroidism was more common than other thyroid dysfunction contributing 38% of the total study population, and 70% of the thyroid dysfunction.
3. Patients in the age group of 30-40 years had higher incidence of subclinical hypothyroidism (41%) compared to 41-50 years (36%) and 51-60 years (36%).
4. Whereas, 17% of age group 50-60 years had hypothyroidism compared to 13% in 30-40 years and 12% in 40-50 years.
5. The incidence of thyroid dysfunction is almost the same in both men (54%) and women (53%).
6. 76% of the patients with hypothyroidism had symptoms related to hypothyroid.
7. One must have a strong suspicion of subclinical hypothyroidism in patients with metabolic syndrome, as the incidence is high in them.

## Summary

- 1) 300 cases of metabolic syndrome (166 males and 134 females) were taken up for the present study.

- 2) Detailed history regarding symptoms of thyroid dysfunction and examination was carried out in all the patients and fasting thyroid profile was done in all patients to look for the prevalence of thyroid dysfunction.
- 3) Of 300 patients, 33 of them had symptoms related to hypothyroidism.
- 4) 54% of the study group had thyroid dysfunction.
- 5) The most common thyroid dysfunction was subclinical hypothyroidism contributing to 70% of thyroid dysfunction.
- 6) 76% of the patients with hypothyroidism had symptoms related to hypothyroid.
- 7) Incidence of Subclinical hypothyroidism was more in the age group of 30-40, whereas hypothyroidism was seen in older age group, 50-60 years.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

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**Cite this article as:** Senthil N, Sneha T, Santhosh P, Sujatha S. A study of prevalence of thyroid dysfunction in patients with metabolic syndrome. *Int J Res Med Sci* 2015;3:3171-6.