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# A Study of Thyroid Dysfunction in Metabolic Syndrome

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**Abstract:** ***Introduction**: Metabolic syndrome is described as a cluster of abnormalities including abdominal obesity, insulin resistance, hypertension, hyperglycaemia, increased triglycerides, and decreased high-density lipoprotein cholesterol (HDL-C).Thyroid dysfunction is a risk factor for atherosclerotic cardiovascular disease mediated by the effects of thyroid hormones on lipid and glucose metabolism and blood pressure, hence on the components of metabolic syndrome. **Objective**: Present study was conducted to study thyroid dysfunctions in patients with metabolic syndrome attending SNMC and HSK hospital. **Results**: A total of 40 Patients with metabolic syndrome fulfilling IDF criteria were selected.Thyroid dysfunction was observed to occurin17.5% of metabolic syndrome patients. Prevalence of Subclinical hypothyroidism (12.5%) and Overt Hypothyroidism (5.0%) is observed in metabolic syndrome patients which is higher than that of general population. **Conclusions**: One sixth of metabolic syndrome patients had Subclinical Hypothyroidism. Prevalence of thyroid dysfunction is much more common in Females than males. Hence there is a need to exclude the presence of Thyroid dysfunction while managing metabolic syndrome patients.***

**Keywords**: metabolic syndrome, thyroid dysfunction, subclinical hypothyroidism, overt hypothyroidism

## 1. Introduction

Metabolic syndrome refers to a cluster of aberrations of metabolic origin[1,2],characterized by atherogenecity, hypertension, hyperglycemia, prothrombotic andproinflammatory conditions. Metabolic syndrome also leads to atherosclerotic vascular disease with a higher riskof morbidity and mortality due to cardiovascular disease[3,4] and Type 2 Diabetes[5]. It is noteworthy that the greater the number of the components of the metabolic syndrome, the greater is the cardiovascular disease risk[4,6,7] . No single factor has been indicated to be causative of the metabolic syndrome, eventhough insulin resistance has been suggested to be involved in its pathogenesis[8].

Thyroid dysfunction has been identified as a cause of secondary hyperlipidemia for a long time, and routine screening is recommended for thyroid dysfunction in hyperlipidemic patients[9,10].Therefore, the aim of this study is to investigate theprevalence of thyroid dysfunction with the metabolic syndrome in the population of Bagalkot .Previous studies support the concept that insulinconcurrently functions with TSH as a growth factor and stimulates thyroid cellproliferation[8]. These effects are partially mediated via insulin-like growth factor1(IGF1) dependent mechanisms.Therefore, it is hypothesized that functional changes in the thyroid gland might havean association with MS .

Previous studies among populations of various countries[11-16] have reportedinconsistent thyroid functional changes with increased TSH levels in the subjectsseeming to be a consistent finding in Metabolic Syndrome. Studies in South Indianpopulation also had reported higher prevalence of hypothyroidism in femalemetabolic syndrome patients[17,18] .Against this background with limited data available on this subject, we aim to studyserum TSH with FT3 and FT4 as reliable and sensitive screening test for Thyroid Dysfunction in Snmc and Hsk hospital, fulfilling the diagnostic criteria for MetabolicSyndrome & association of TSH and FT4 with components of MS.

## 2. Objectives

To study thyroid dysfunctions in patients with metabolic syndrome attending SNMC and HSK hospital.

## 3. Methodology

Study was carried out form 01-12-2016 to 31-12-2017 on patients who were diagnosed as metabolic syndrome and fulfil inclusion and exclusion criteria in HSK Hospital and Research Centre, Bagalkot. Inclusion criteria for the study groupare patients who fulfilled the criteria for metabolic syndrome by International diabetic federation (IDF) and patients with metabolic syndrome not on any medications – newly detected metabolic syndrome patients. Exclusion criteria for the study group arepatients with known hypothyroidism or sub-clinical hypothyroidism or hyperthyroidism andpatients taking medications for diabetes mellitus, hypertension, thyroid disorders, dyslipidemia and individuals with age less than 18 years. AsperIDF 2005for a person to be defined as having the metabolic syndrome they must have: Central obesity – waist circumference ≥ 94 cm for European men and ≥ 80 cm for European women. For South Asians – Waist circumference ≥ 90 for men and ≥ 80 for women plus, any two of the following four factors:1.Raised TG level ≥ 150 mgs/dl or any specific treatment. 2. Reduced HDL cholesterol < 40 mg/dl in males and < 50 mg/dl in females. 3. Raised blood pressure ≥ 130/85 mm Hg or medication. 4. Raised fasting glucose ≥ 100 mg/dl or previously diagnosed type 2 diabetes.

Statistical analysis calculation done using open epi software version 2.3.1 at 95% confidence level and 80% power of the study. All the data was collected and managed on a Microsoft Excel Spreadsheet. Student's t test was used to compare mean of continuous variables. Chi-square test was used to compare discrete variables. Associations between patient characteristics (mean systolic blood pressure, mean diastolic blood pressure, BMI, waist circumference, total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, fasting blood sugar) and thyroid profile in the study group were analysed using bi-variate correlate analysis. P-value of < 0.05 was considered statistically significant. All analysis was performed with SPSS software version 16.

**Definitions**

Sub-clinical hypothyroidism: elevated TSH and normal FT4 levels.
Hypothyroidism: elevated TSH and low FT4 levels.
Sub-clinical Hyperthyroidism: low TSH and normal FT4 levels.
Hyperthyroidism: low TSH and elevated FT4 levels.

## 4. Results

Descriptive statistics: gender distribution

| Gender | Age | | | | |
|---|---|---|---|---|---|
| | No | Minimum | Maximum | Mean | SD |
| Male | 17 | 30 | 62 | 46.18 | 9.05 |
| Female | 23 | 33 | 62 | 44.61 | 8.08 |
| Total | 40 | 30 | 62 | 45.28 | 8.43 |

Age Wise Thyroid Dysfunction

| Age | TSH group Euthyroid | | Subclinical hypothyroid | | Hypothyroid | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | Count | % | Count | % |
| ≤ 35 | 3 | 9.1 | 0 | 0.0 | 1 | 50.0 | 4 | 10.0 |
| 36-40 | 13 | 39.4 | 3 | 60.0 | 1 | 50.0 | 17 | 42.5 |
| 46-55 | 11 | 33.3 | 2 | 40.0 | 0 | 0.0 | 13 | 32.5 |
| >55 | 6 | 18.2 | 0 | 0.0 | 0 | 0.0 | 6 | 15.0 |
| Total | 33 | 100.0 | 5 | 100.0 | 2 | 100.0 | 40 | 100.0 |

Distribution of Number of metabolic syndrome parameters with respect to sex

| No. of metabolic syndrome parameters | Gender | | | | Total | |
|---|---|---|---|---|---|---|
| | Male | | Female | | | |
| | Count | % | Count | % | Count | % |
| 3 | 7 | 41.2 | 13 | 56.5 | 20 | 50.0 |
| 4 | 6 | 35.3 | 6 | 26.1 | 12 | 30.0 |
| 5 | 4 | 23.5 | 4 | 17.4 | 8 | 20.0 |
| Total | 17 | 100.0 | 23 | 100.0 | 40 | 100.0 |

Distribution of metabolic parameters in euthyroid and thyroid dysfunction patients

| Variables | Thyroid status | Mean | Standard deviation | t | P |
|---|---|---|---|---|---|
| Age | Thyroid Dysfunction | 46.2 | 8.5 | 1.59 | 0.11 |
| | Euthyroid | 40.7 | 7.0 | | |
| BMI | Thyroid Dysfunction | 27.2 | 1.6 | 0.86 | 0.39 |
| | Euthyroid | 26.6 | 2.0 | | |
| WC | Thyroid Dysfunction | 99.2 | 6.9 | 1.03 | 0.3 |
| | Euthyroid | 96.3 | 6.0 | | |
| SBP | Thyroid Dysfunction | 139.9 | 17.1 | 1.07 | 0.28 |
| | Euthyroid | 132.3 | 16.1 | | |
| DBP | Thyroid Dysfunction | 86.8 | 11.1 | 1.10 | 0.27 |
| | Euthyroid | 82.0 | 6.0 | | |
| FBS | Thyroid Dysfunction | 142.5 | 26.5 | 2.1 | 0.04* |
| | Euthyroid | 121.0 | 6.6 | | |
| TC | Thyroid Dysfunction | 190.8 | 34.4 | 0.74 | 0.46 |
| | Euthyroid | 201.0 | 23.7 | | |
| HDL | Thyroid Dysfunction | 44.4 | 6.2 | 1.23 | 0.22 |
| | Euthyroid | 47.5 | 5.2 | | |
| TG | Thyroid Dysfunction | 175.5 | 61.1 | 0.77 | 0.44 |
| | Euthyroid | 156.6 | 44.8 | | |

*Significant

## 5. Discussion

The metabolic syndrome is a cluster of metabolic abnormalities where in people are obese and have hypertension, high triglyceride level, low high density lipoprotein cholesterol and abnormal fastingglucose levels[2]. People with metabolic syndrome are at high risk for developing cardiovascular disease and type-2 diabetes. Hypothyroidism is associated with lipid abnormalities like high triglycerides and low HDL, weight gain, glucose intolerance and hypertension. Thus hypothyroidism mimics the parameters of metabolic syndrome.

**Age and Sex Distribution**

In our study, the mean age of patients with metabolic syndrome was 45.28 ± 11.56 years. In our study maximum number of patients with metabolic syndrome are in 36 – 45 years age group. This observation is comparable to similar findings as observed by Uzunlulu et al[11]and Ghanshyam et al[18]. There were 23 females (57.3%) and 17(42.5%) males in the metabolic syndrome group. There was statistically insignificant difference in the gender distribution between the two groups (p > 0.05). Majority of the patients with metabolic syndrome were females, a finding similar to other studies Uzunlulu et al[11], Punia et al[16]and Ghanshyam et al study[18]. A higher prevalence in women might be due to higher incidence of obesity in them.

The components of metabolic syndrome in our study population in decreasing order were increased waist circumference (100%), lower HDL (90%), higher SBP (84%), higher TG (60%), higher DBP (54%) and lastly elevated FBS (43%). In comparison Kumar et al[15] found increased waist circumference (81%), lower HDL (74%), higher Blood Pressure (10%), higher TG (37%), and elevated FBS (25%). Punia et al[16] found increased waist circumference (65%), lower HDL (83.8%), higher BP (61.3%), and higher TG (62.2%) and elevated FBS (53%). Our study suggests that as in various other Indian studies the increased waist circumference and low HDL are the most common components of metabolic syndrome. Whereas Ghanshyam et al[18] found increased waist circumference and elevated FBS as the most common components.

In our study mean BMI in patients with metabolic syndrome was 27.2 ± 1.6 (kg/m2). The mean BMI in patients with metabolic syndrome is 27.2 ± 1.6(kg/m2) compared to 29.9±3.8 kg/m2 in a study by Kumar et al[15].The central obesity measured as mean waist circumference is 99.2 ±6.9cm in euthyroid and 96.3±6.0 in thyroid dysfunction patients. In comparison Kumar et al[15]found the mean waist circumference as 96.2 ± 8.5 cm with 81% having increased

waist circumference, whereas Sudhakar et al[17] observed 97% having increased waist circumference with mean being of 94.4 ± 4.75 cm.

Mean SBP is 139.9 ± 17.1 mmHg in euthyroid and 132.3±16.1 in thyroid dysfunction patients. Mean Diastolic BP in metabolic syndrome group was 86.8 ± 11.1 mm Hg in euthyroid and 82.0±6.0 in thyroid dysfunction patients. Uzunlulu et al[11]and Ghanshyam et al[18] also found similarly higher SBP and higher DBP in patients with metabolic syndrome.

The mean FBS among patients was 142.5 ± 26.5 mg/dl in euthyroid and 121.0±6.6 in thyroid dysfunction patients. It is statistically significant ($p < 0.05$). Past history of diabetes is also higher in metabolic syndrome patients (6%). Studies by Uzunlulu et al[11] , Ghanshyam et al[18] , Kumar et al[15], Punia[16] also noted elevated FBS in metabolic syndrome patients than those without metabolic syndrome.

The means of TC and TG in metabolic syndrome group is 190.8 ± 34.4 mg/dl (euthyroid),201.0±23.7mg/dl (thyroid dysfunction) and 175.5±61.1mg/dl (euthyroid) 156.6 ± 44.8 mg/dl (thyroid dysfunction) patients respectively. The mean HDL level in metabolic syndrome group is 44.4 ± 6.2 mg/dl in euthyroid and 47.5±5.2mg/dl in thyroid dysfunction. Moreover, more number of patients with the metabolic syndrome are characterized by raised TG levels (61%), low HDL levels (90%). Earlier studies by Cinziasartia[5] , Uzunlulu et al[11], Kumar et al[15], Punia et al[16]and Ghanshyam et al[18] had also found similar lipid abnormalities in the metabolic syndrome patients.

**Metabolic Syndrome and Thyroid Profile**

In our study among patients with metabolic syndrome, 33(82.5%) were Euthyroid, Hypothyroidism was present in 2(5%) patients and Subclinical Hypothyroidism in 5(12.5%) patients. Hyperthyroidism was not detected. Out of hypothyroid patients four were female & one male. In the study by Uzunlulu et al[11] subclinical hypothyroidism was found in 16.4% cases in the MS group. Female gender was more associated with the subclinical hypothyroidism. Sudhakar et al[17] found that subclinical hypothyroidism was present in 53% patients and overt hypothyroidism was present in 25% of the patients with metabolic syndrome. A high prevalence of subclinical hypothyroidism (21.9%) and overt hypothyroidism (7.4%) in patients with metabolic syndrome was also found by Ghanshyam et al[18]. This study shows that the prevalence of thyroid dysfunction in metabolic syndrome patients is higher than in normal subjects. One sixth of metabolic syndrome patients had hypothyroidism either overt or subclinical. This finding indicates a need for investigating the presence of Thyroid dysfunction during managing metabolic syndrome patients. As shown in previous evidences, managing these hypothyroid in metabolic syndrome patients are rewarding by improvement in the metabolic parameters and reducing cardiovascular risk.

## 6. Conclusions

1) Thyroid dysfunction is seen in about 17.5% of metabolic syndrome patients.
2) Prevalence of Subclinical hypothyroidism is 12.5% in metabolic syndrome patients which is higher than that of general population.
3) Prevalence of Overt Hypothyroidism is 5.0% in metabolic syndrome patients which is higher than that of general population.
4) One sixth of metabolic syndrome patients had Subclinical Hypothyroidism.
5) Prevalence of thyroid dysfunction is much more common in Females than males.6.Hence there is a need toexclude the presence of Thyroid dysfunction while managing metabolic syndrome patients.

## 7. Summary

Patients with metabolic syndrome have many symptoms and signs suggestive of thyroid dysfunction. It is very difficult to exclude the diagnosis of hypothyroidism on clinical grounds. So a study was conducted in metabolic syndrome patients to study the prevalence and types of thyroid dysfunction. Based on IDF (2005) criteria for Metabolic Syndrome, forty newly detected metabolic syndrome patients in SNMC and HSK Hospital, Bagalkot were studied, after taking consent. A detailed history and clinical examination were done. Investigations including metabolic syndrome criteria parameters and serum free T4, TSH were done.

According to thyroid function test results, 33 patients found to have euthyroid and two patients were hypothyroid. Five patients had sub clinical hypothyroidism. No one in our study had either sub clinical or overt hyperthyroidism. The thyroid dysfunction is 17.5% prevalent in metabolic syndrome patients. Among the thyroid dysfunction, sub clinical hypothyroidism is highly prevalent – 12.5%. The overt hypothyroidism is 5.0% prevalent in metabolic syndrome patients. Thyroid dysfunction is much more prevalent in women with metabolic syndrome than men. Five (21.7%) out of 23 women had thyroid dysfunction (1 hypothyroid and 4 subclinical hypothyroid). Two (11.8%) out of 17 men had thyroid dysfunction (one hypothyroid and one subclinical hypothyroid).In this study clearly shows that the prevalence of thyroid dysfunction in metabolic syndrome patients is higher than normal subjects. One sixth of metabolic syndrome patients had Subclinical Hypothyroidism. This finding indicates a need for investigating the presence of Thyroid dysfunction during managing metabolic syndrome patients.

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