ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

*International Journal of Medical Science and Innovative Research (IJMSIR)*
*IJMSIR : A Medical Publication Hub*
*Available Online at: www.ijmsir.com*
*Volume – 7, Issue – 4, August – 2022 , Page No. : 98 – 108*

# Study of relationship between abnormal thyroid function and lipid levels in subclinical and overt hypothyroidism patients in rural tertiary care hospital

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**Citation this Article:** Nimrah Fathima, Prathvi Nandalike, Machandrareddy, Madhu G, Vasudha K V, "Study of relationship between abnormal thyroid function and lipid levels in subclinical and overt hypothyroidism patients in rural tertiary care hospital", IJMSIR- August - 2022, Vol – 7, Issue - 4, P. No. 98 – 108.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

## Abstract

**Background:** Thyroid diseases are one of the commonly occurring endocrine disorders worldwide. The prevalence in an unselected Indian community population is found to be 1.4%, with an estimated annual incidence rate of one to two per 1000 women.[1] Thyroid hormones significantly affect lipoprotein metabolism as well as some CVD risk factors, thus influencing the overall CVD risk.[2] In spite of high incidence of hypothyroidism in South India, very few studies have been done to find its relation with lipid profile specially in rural population and hence the study has been conducted.

**Aim:** To find relation between abnormal thyroid functions and lipid levels

**Materials and methods:** Cross-sectional study, carried out at Rural Tertiary hospital on 70 patients attending to the out-patient and in-patient clinical services with abnormal thyroid function tests, during the period from November 2020 to August 2021 in the department of General medicine JSS Medical College, Mysuru, Karnataka India

**Statistical Analysis:** All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, standard deviation (SD) were used. Bivariate correlation analysis using Pearson's correlation coefficient (r) was used to test the strength and direction of relationships between the interval levels of variables. The results were considered to be statistically significant with p-value < 0.05. Data were analyzed using SPSS software v.23.0. and Microsoft office.

**Results:** A total number of 70 subjects were included in this study, of which 35 were subclinical hypothyroidism cases and 35 were overt hypothyroid cases. In all the cases, the concentrations of TC, TG, LDL and HDL were estimated. In both study groups females dominated with 72.9% of total population. Mean age in subclinical group

was 41 ± 4.9 years with maximum incidence between 31-40 years. Mean age in overt group was 37.9 ± 2.7 years with maximum incidence between 31-40 years. The mean TC and LDL levels in subclinical group were 221 ± 10.98 and 150.3 ± 4.59.

These were significantly increased, whereas mean TG was 185.7 ± 22.65 and not significantly increased. The mean HDL was 42.89 ± 5.90 and was significantly decreased. In overt group mean TC, TG and LDL levels were 240.21 ± 21.76, 217.8± 21.91 and 154.87 ± 14.46, these were significantly raised, mean HDL was 32.36 ± 5.8 and was significantly decreased. In subclinical group correlation of TSH with TC and LDL was statistically significant. In overt group correlation of TSH with all lipid parameters (TC, TG, HDL and LDL) was statistically significant. The difference in mean values of TC, TG, LDL and HDL among subclinical and overt was statistically significant.

**Conclusion:** The study has demonstrated that both subclinical and overt hypothyroidism is associated with dyslipidemia. It can be concluded that both subclinical hypothyroidism and overt hypothyroidism are associated with abnormal serum lipid profile and these abnormalities increase with serum TSH levels. Such altered lipid profile may increase the risk of atherosclerosis and coronary artery disease. So monitoring of serum lipid profile in subclinical and overt hypothyroidism patients should be done to reduce or prevent the risk of development of atherosclerosis and cardiovascular diseases.

Prudent substitution therapy with L-thyroxine is indicated in patients with hypothyroidism, with or without angina, to counteract the cardiovascular risk resulting from dyslipidemia.

**Keywords:** Thyroid disorder and dyslipidemia Hypo thyroidism and cardio pvascular diseases Sub clinical hypo thyroidism

**Introduction**

Thyroid diseases are one of the commonly occurring endocrine disorders worldwide. In India about 42 million people suffer from varied thyroid disorders.[3] Data from the third National Health and Nutrition Examination Survey (NHANES III) showed a 4.6% prevalence of hypothyroidism in the general population. Deficiency of thyroid hormone secretion results in hypothyroidism. When TSH is elevated to compensate for impaired thyroid output and free thyroid hormones are normal called subclinical hypothyroidism. As thyroid damage continues, TSH levels rise further but T4 levels fall. The TSH at this stage is usually greater than 10 mU/l, symptoms become apparent, and the patient is said to have overt or clinical hypothyroidism.[4] Hypothyroidism is a spectrum of disorders with abnormal thyroid function tests which may or may not be associated with clinical signs and symptoms. Both subclinical and overt hypothyroidism are associated with altered lipid profile. A linear positive association has been seen between thyroid stimulating hormone (TSH) values in the reference range and concentrations of total serum cholesterol, LDL (low density lipoprotein) cholesterol, non-HDL cholesterol and TG (Triglycerides), and a linear negative association with HDL (High density lipo protein) cholesterol.[5,6] Thyroid hormones significantly affect lipoprotein metabolism as well as some CVD risk factors, thus influencing the overall CVD risk.[2]

Many studies have been conducted and shown a significant relation between hypothyroidsm and lipid profile, but many of these are conducted in western countries and significant data is lacking in Indian population with special reference to effect of subclinical hypothyroidsm on lipid profile. In spite of high incidence of hypothyroidism in South India, very few studies have

been done to find its relation with lipid profile and hence the study was conducted.

**Materials and methods**

**Study site**

Patients attending to the out-patient and in-patient clinical services in the department of General medicine JSS Medical College, Mysuru, Karnataka India

**Study period**

Study carried out during the period from November 2020 to August 2021

**Study type:** Cross-sectional study

**Source of data/Sampling method**

Patients attending to the out-patient and in-patient clinical services with abnormal thyroid function tests, during the period from November 2020 to August 2021 in the department of General medicine JSS Medical College, Mysuru, Karnataka India. Purposive sampling of total 70 patients was done with following inclusion and exclusion criteria.

**Sample size**

A total of 70 patients (35 subclinical hypothyroid and 35 overt hypothyroid cases) were selected for the study after applying inclusion and exclusion criteria.

**Inclusion criteria**

1. Age more than 18 years .
2. Patients with Abnormal thyroid function tests.

**Exclusion criteria**

1. Age less than 18 years.
2. Patients with known chronic disease (Diabetes Mellitus, Chronic Renal failure, cirrhosis, SLE, rheumatoid arthritis, HIV/AIDS).
3. Pregnant Women.
4. Patients who are on drugs which causes dyslipidemia. (Beta blockers, steroids, OCPs)
5. Patients on hypolipidemic drugs.
6. Patients with secondary hypothyroidism.
7. Patients who are not willing to give an informed consent.

**Selected Patients Are Subjected for The Following Investigations**

- Thyroid Profile (T3, T4 and TSH)
- Fasting Lipid Profile (TC, TG, HDL, LDL, VLDL).
- Complete blood count
- Random Blood Sugar (RBS)
- Free Thyroxine (FT4) if required
- Thyroperoxidase (TPO) antibody if require

**Data Collection**

Detailed present, past, personal and family history noted and clinical examination done specially looking for any signs of hypothyroidism, cardiovascular disorders and dislipedemia. All these findings were properly entered in proforma. A 10-hour fasting blood sample was collected and processed for lipid profile estimation and other investigations whenever necessary. Fasting lipid profile included estimation of Total cholesterol (TC), Triglycerides (TG), Low density lipoproteis (LDL), High density lipoproteins (HDL). Fully automated ERBA MANNHEIMEM 200 system was used to determine the lipid profile. Normal reference range for lipid profile has been considered as Sr. Total Cholesterol (150-200 mg/dl); Sr. Triglycerides (80-200 mg/dl); Sr. HDL (40-60 mg/dl), Sr. LDL (90-130 mg/dl). The normal reference range considered is TSH (0.34 TO 5 microIU/ml), T3 (77 to 135 nanogram/dl), T4 (4.5 to 11.7 microgram/dl). Subclinical hypothyroid is TSH level more than 5.1 microIU/L and T4 level more than or equal to 4.5 µg/dL; overt hypothyroidism is TSH level more than 5.1 microIU/L and T4 level less than 4.5 µg/dL.

**Statistical analysis**

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, standard deviation (SD) were used. For categorical data,

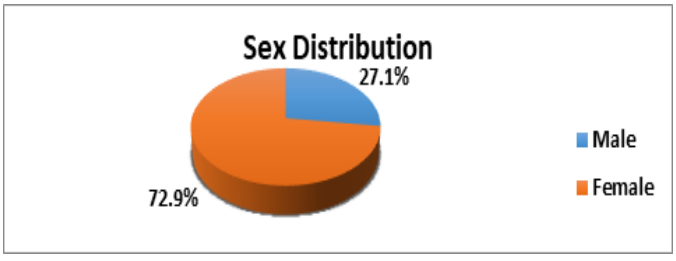
the number and percentage were used in the data summaries. Chi-square ($\chi^2$)/ Freeman-Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. The difference of the means of analysis variables between two independent groups was tested by unpaired t test. The difference of the means of analysis variables between more than two independent groups was tested by ANOVA and F test of testing of equality of Variance. Bivariate correlation analysis using Pearson's correlation coefficient (r) was used to test the strength and direction of relationships between the interval levels of variables. If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23.0 and Microsoft office.

**Results**

Table 1: Distribution of cases according to Sex

| **Sex** | **N** | **%** |
|---|---|---|
| Male | 19 | 27.1 |
| Female | 51 | 72.9 |
| Total | 70 | 100.0 |
| M/F ratio | | 0.4 |

Figure 1: Distribution of cases according to Sex




It was observed that majority of patients were females (72.9%) and males were (27.1%)

Table 2: Distribution of Sex between Subclinical and Overt Hypothyroid group

| Sex | Subclinical Hypothyroid | | Overt Hypothyroid | | p value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Male | 12 | 34.3 | 7 | 20.0 | 0.179 |
| Female | 23 | 65.7 | 28 | 80.0 | |
| Total | 35 | 100.0 | 35 | 100.0 | |

A total number of 70 subjects are included in this study. Among them 35 are subclinical hypothyroid cases and 35 are overt hypothyroid cases.

Among 35 subclinical hypothyroid 23 (65.7%) were females and 12(34.3%) were males.

Among 35 overt hypothyroid 28 (80%) were females and 7 (20%) were males.

Table 3: Distribution of cases according to Age

| **Age (Yrs)** | **N** | **%** |
|---|---|---|
| 18-30 | 14 | 20.0 |
| 31-40 | 26 | 37.1 |
| 41-50 | 19 | 27.1 |
| 51-60 | 8 | 11.4 |
| >60 | 3 | 4.3 |
| Total | 70 | 100.0 |

The above table shows distribution of patients according to age. It was observed that majority of patients were in age group of 31-40 years (37.1%) followed by 41-50 years (27.1%).

Table 4: Distribution of Symptoms between Subclinical and Overt Hypothyroid group

| Symptom | Subclinical Hypothyroid | | Overt Hypothyroid | |
|---|---|---|---|---|
| | N | % | N | % |
| Weakness, Tiredness | 25 | 71.4 | 32 | 91.4 |
| Weight gain | 7 | 20.0 | 31 | 88.6 |

| | | | | |
|---|---|---|---|---|
| Cold intolerance | 9 | 25.7 | 24 | 68.6 |
| Dry skin | 5 | 14.3 | 20 | 57.1 |
| Menstrual irregularities | 0 | 0.0 | 4 | 11.4 |
| Constipation | 3 | 8.6 | 14 | 40.0 |

Table 5: Distribution of TC (Total cholesterol) between Subclinical and Overt Hypothyroid group

| TC | Subclinical Hypothyroid | | Overt Hypothyroid | | p value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Normal | 11 | 31.4 | 10 | 28.6 | 0.844 |
| Increasing | 21 | 60.0 | 23 | 65.7 | |
| Decreasing | 3 | 8.6 | 2 | 5.7 | |
| Total | 35 | 100.0 | 35 | 100.0 | |

In Subclinical Hypothyroid Group, Total cholesterol was increased in 60% patients, decreased in 8.6% patients and normal in 31.4% patients.

Table 6: Distribution of TG(TRIGLYCERIDE) between Subclinical and Overt Hypothyroid group

| TG | Subclinical Hypothyroid | | Overt Hypothyroid | | p value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Normal | 26 | 74.3 | 9 | 25.7 | 0.002* |
| Increasing | 6 | 17.1 | 25 | 71.4 | |
| Decreasing | 3 | 8.6 | 1 | 2.9 | |
| Total | 35 | 100.0 | 35 | 100.0 | |

Note: *means significant at 5% level of significance ($p<0.05$)

In subclinical hypothyroid group, triglyceride was normal in in 74.3% patients, invreased in 17.1% patients and decreased in 3% patients.

In overt hypothyroid group, triglyceride was increased in 71.4% patients, decreased in 2.9% and normal in 25.7% patients.

Table 7: Distribution of LDL between Subclinical and Overt Hypothyroid group

| LDL | Subclinical Hypothyroid | | Overt Hypothyroid | | p value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Normal | 11 | 31.4 | 14 | 40.0 | 0.197 |
| Increasing | 17 | 48.6 | 19 | 54.3 | |
| Decreasing | 7 | 20.0 | 2 | 5.7 | |
| Total | 35 | 100.0 | 35 | 100.0 | |

In subclinical hypothyroid group the LDL was increased in 48.6% patients, decreased in 20% patients and normal in 31.4% patients.

In overt hypothyroid group the LDL was increased in 54.3% patients, decreased in 5.7% patients and normal in 40%.

Table 8: Distribution of HDL between Subclinical and Overt Hypothyroid group

| HDL | Subclinical Hypothyroid | | Overt Hypothyroid | | p value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Normal | 12 | 34.3 | 9 | 25.7 | 0.674 |
| Increasing | 5 | 14.3 | 7 | 20.0 | |
| Decreasing | 18 | 51.4 | 19 | 54.3 | |
| Total | 35 | 100.0 | 35 | 100.0 | |

In subclinical hypothyroid group the HDL was increased in 14.3% patients, decreased in 51.4% and normal in 34.3%.

In overt hypothyroid group the HDL was increased in 20% patients, decreased in 54.3% and normal in 25.7% patients.

Table 9: Comparison of Mean Lipid profile parameters between Subclinical and Overt Hypothyroid group

| TC | Subclinical Hypothyroid | Overt Hypothyroid | p value |
|---|---|---|---|
| Mean± SD | 221 ± 10.98 | 240.21 ± 21.76 | <0.001* |
| Range | (268 – 130) | (296 – 140) | |
| TG | | | |
| Mean± SD | 185.7 ± 22.65 | 217.8± 21.91 | <0.001* |
| Range | (200 -33) | (200 – 30) | |
| LDL | | | |
| Mean± SD | 150.3 ± 4.59 | 154.87 ± 14.46 | <0.001* |
| Range | (198 – 56) | (185 – 50) | |
| HDL | | | |
| Mean± SD | 42.89 ± 5.90 | 32.36 ± 5.8 | <0.001* |
| Range | (95 – 12) | (70 – 15) | |

Note: *means significant at 5% level of significance ($p<0.05$)

Table 10: Correlation of TSH & lipid profile

| Parameters | Subclinical Hypothyroid | | Overt Hypothyroid | |
|---|---|---|---|---|
| | Correlation coefficient | p value | Correlation coefficient | p value |
| TSH v/s TC | 0.383 | 0.044* | 0.433 | 0.029* |
| TSH v/s TG | 0.156 | 0.564 | 0.352 | 0.009* |
| TSH v/s HDL | -0.074 | 0.644 | -0.346 | 0.045* |
| TSH v/s LDL | 0.402 | 0.037* | 0.478 | 0.037* |

Note: *means significant at 5% level of significance ($p<0.05$)

In subclinical group correlation of TSH with TC and LDL was statistically significant.

In overt group correlation of TSH with all lipid parameters (TC, TG, HDL and LDL) was statistically significant.

**Discussion**

Hypothyroidism is the second most common endocrine disease after diabetes mellitus, but often under diagnosed. A number of studies have demonstrated various lipid abnormalities in hypothyroidism.

Thyroid hormone influences all metabolic pathways including lipid metabolism. Untreated hypothyroidism can lead to premature atherosclerosis and its complications. Atherosclerosis, as the underlying cause particularly of CAD, is a leading cause of human mortality and morbidity.

The present study is done among the hypothyroid patients attending Al- ameen medical college. The possible correlation between TSH, T4, T3 and lipid profile was evaluated. The patients were divided into subclinical and overt hypothyroid based on the lab values and change in lipid parameters relation to thyroid state was observed in both subclinical and overt hypothyroid groups.

**Age and Sex**

Present study showed female predominance with 72.9% females and 27.1% males. This was similar to the study by Vanderpump et al[7] and Agarwal et al[8]. According to A. Regmi et al, higher prevalence of thyroid dysfunction in females may be due to a sex difference in the prevalence of autoimmune diseases.[9]

In subclinical hypothyroid females were 65.7% and males were 34.3%. This finding is in accordance with the other studies. In study by Ashraf et al[10] females constituted 72.79% of study populations. Studies by Desmukh V. et al[11] and Raj Kumar Yadav et al[12] also showed female predominance.

In overt hypothyroid females were 80% and males were 20%. This was in accordance with study by Ashraf et al[13] in which 72.2% were females. Al-Farttoosi et al[14] showed

female preponderance with 86.1% of females and 13.9% of males.

In present study 34.3% cases of SCH were in the age group of 31-40 which is more than that seen in study of Raj Kumar Yadav et al[12], Ashraf et al[13] but similar to the study by Tunb ridge et al[15]. In present study 27.5% cases were in age group of 41-50 years which is similar to that seen in study of Raj Kumar Yadav et al[12].

In present study mean age of patients was 41 ± 4.9 years. This is similar to the study by Ashraf et al[10] in which mean age in SCH was 41 ± 12 years.

In present study among overt hypothyroid patients 40.0% were in age group 31-40 years which was is more that seen in studies by Tunb ridge et al[15] and Ashraf et al[13].In present study mean age among overt hypothyroid patients was 37.9 ± 2.7 which was in accordance to study done by Ashraf et al[13], Tunb ridge et al[15] and Vargas et al[16].

Table 11: Showing General symptoms of subclinical hypothyroid subjects in various studies

| Symptom | Present study (%) (n = 35) | Martin et al[17] (%) (n =104) | Deshmukh Vet al[11] (%) (n = 26) | Sureshbabu KP et al[18] (%) (n = 38) |
|---|---|---|---|---|
| Weakness, Tiredness | 71.4 | 74 | 69.2 | 39.5 |
| Cold intolerance | 25.7 | _ | 33.8 | 7.8 |
| Weight gain | 20.0 | 26 | 61.2 | 23.7 |
| Constipation | 8.6 | _ | 18.5 | _ |

In present study most common symptom in subclinical hypothyroid patients was weakness and tiredness 25 (71.4%) followed by cold intolerance 9 (25.7%), weight gain 7 (20%).

Weakness and weight gain were common symptoms in study by Vaishali Deshmukh et al[11], Sureshbabu KP et al[18] and Martin et al[17]. The incidence of weakness in present study correlated with study by Martin et al[17] and Deshmukh et al[11].

The incidence of weight gain in present study correlatd with study by Martin et al[17] and Sureshbabu KP et al[18].

Table 12: Showing General symptoms in overt hypothyroid subjects in various studies

| Symptom | Present study (%) (n= 78) | Al farttoosi et al[14] (%) (n= 36) | Allan et al[19] (%) (n= 140) | Rajkumar Yadav et al[12] (%) (n = 34) |
|---|---|---|---|---|
| Weakness, Tiredness | 91.4 | 88.9 | 81 | 74 |
| Weight gain | 88.6 | 66.7 | 72.3 | 50 |
| Cold intolerance | 68.6 | 58.1 | - | 12.9 |
| Dry skin | 57.1 | - | - | - |
| oligomenorrhea | 11.4 | - | - | 33.5 |
| Constipation | 40.0 | - | - | - |

In present study most common symptom in overt hypothyroid patients was weakness and tiredness 91% followed by weight gain 88.6% these findings in present study were consistent with findings in studies of Al Farttoosi et al[14] and Allan et al[19] and incidence was less as compared to that seen in study by Rajkumar Yadav et al[12].

Incidence of Oligomenorrhea was found in 12% in present study which is less than study by Rajkumar Yadav et al[12].

Correletation of Lipid parameters in sub clinical and overt hypothyroid

Subclinical hypothyroid group:

Table 13: 6.10: Showing Mean lipid values of subclinical hypothyroid subjects in various studies

| Parameters | Present study [mg/dl] (n =35) | Efstathiadou et al[20] [mg/dl] (n= 66) | Shrestha N[21] [mg/dl] (n= 19) | LA way BA et al[22] [mg/dl] (n= 70) |
|---|---|---|---|---|
| Total Cholesterol | 221 ± 10.98 | 222 +45 | 202.88 ± 50.74 | 182.91 ± 41.01 |
| TG | 185.7 ± 22.65 | 104+56 | 184.02 ± 85.7 | 173.79 ± 99.00 |
| LDL | 150.3 ± 4.59 | 139+28 | 123.62 ± 47.25 | 105.45 ± 38.07 |
| HDL | 42.89 ± 5.90 | 57+16 | 42.24 ± 10.51 | 42.27 ± 7.77 |

Mean TC in present study was 221 ± 10.98 mg/dl. Mean values in studies by Efstathiadou et al[20], Shrestha N[21] were significantly above the normal levels which is similar to that seen in present study. There was statistically significant increase in TC in SCH patients in present study, which was in accordance with study by Efstathiadou et al[20] and Shrestha N[21].

Mean TG in present study was 185.7 ± 22.65mg/dl. Mean TG level was comparable to study by Shrestha N[21] and LA way BA et al[22]. In present study 74.3% SCH patients had normal TG levels. This was comparable to study by Efstathiadou et al[20], Shrestha N[21] and Chan et al[23], these studies also had TG within normal range in majority of patients with SCH.Mean LDL in present study was 150.3 ± 4.59 mg/dl. Mean LDL was slightly higher in present study as compared to study by Efstathiadou et al[20], Shrestha N[21] and LA way et al[22]. There was statistically significant increase in LDL in SCH patients, which is in accordance with study by Efstathiadou et al[20], Shrestha N[21] and la way et al[22].

Mean HDL in present study was 42.89 ± 5.90 mg/dl. Mean HDL level was comparable to study by Shrestha N[21] and LA way B et al[22], where as it was lower than that seen in studies by Efstathiadou et al[20] and Chan et al[23]. There was decrease in HDL in SCH patients, which was in accordance with study by Efstathiadou et al[20], Chan et al[23], LA way et al[22]. In present study among patients with subclinical hypothyroidism we found increased level of TC and LDL, decreased level of HDL and TG were within normal range.

Table 14: Showing Mean lipid values in overt hypothyroid subjects in various studies

| Parameters | Present study [mg/dl] (n= 78) | Shretha N[21] [mg/dl] (n= 26 | Chan et al[23] [mg/dl] (n= 108) | Dipankar et al[24] [mg/dl] (n= 35) |
|---|---|---|---|---|
| Total Cholesterol | 240.21 ± 21.76 (278 – 219) | 213.05 ± 63.8 | 202.1 ± 45.9 | 224.1 ± 36.9 |
| TG | 217.8± 21.91 (266 – 171) | 177.81 ± 61.01 | | 248.3 ± 45.8 |
| LDL | 155.26 ± 15.16 (182 – 120) | 136.14 ± 60.75 | 121.8 ± 37.0 | 165.4 ± 28.4 |
| HDL | 31.50 ± 5.6 (46 – 23) | 39.86 ± 9.45 | 53 ± 14.6 | 30.6 ± 15.2 |

Mean TC in present study was 240.21 ± 21.76 mg/dl. This is comparable to study by Shresth N[21] et al, Chan et al[23] and Dipankar et al[24].

Mean TG in present study was 217.9 ± 21.91 mg/dl. This is comparable to study by Shresth N[21] and Dipankar et al[24].

Mean LDL in present study was 155.26 ± 15.16 mg/dl. This is comparable to study by Shresth N[21], Chan et al[23] and Dipankar et al[24]. Mean HDL in present study was 31.50 ± 5.6 md/dl. This is comparable to study by Shresth N[21], Chan et al[23] and Dipankar et al[24]. In the present study, there was statistically significant increase in TC, TG, and LDL in overt hypo thyroids. These findings are in accordance with study by Efstathiadou Z et al[20] and Costantini F et al[25]. There was statistically significant decrease in HDL cholesterol in overt hypothyroids. This finding is in accordance with study of Costantini F et al[25], Dull art et al[26], Archana et al[27].In present study mean value of TSH in subclinical and overt hypothyroids are 8.1± 1.1 and 78.6± 53.6. In present study the correlation of TSH values with serum TC, and LDL were statistically significant in subclinical hypothyroid. There is positive correlation between TSH and TC and LDL. Similar findings are shown in study by Al Sayed A et al[28].

The Colorado thyroid disease prevalence study showed that Total Cholesterol and LDL-C in SCH were significantly higher than in euthyroidism but Triglyceride and HDL-C were not significantly different. In present study the correlation of TSH values with serum TC, TG, LDL and HDL were statistically significant in overt hypothyroid. There is positive correlation between TSH and TC, TG, LDL and negative correlation with HDL. This is similar to study by Singh et al[29]. Most of the studies there is similar findings to our study suggesting positive correlation between TSH and T Cholesterol, LDL-C and Triglyceride. There is negative correlation between TSH and HDL-C. This finding further suggests that increasing grades of hypothyroidism causes dyslipidemia.

**Conclusion**

The study has demonstrated that both subclinical and overt hypothyroidism are associated with dyslipidemia.

The total cholesterol, LDL and TG were significantly increased in overt hypothyroid, where as in subclinical TC and LDL were significantly high. The HDL levels were significantly decreased in both subclinical and overt hypothyroid patients. These findings show presence of atherogenic lipid profile in both subclinical and overt hypothyroidism. Hence screening and treatment for subclinical hypothyroidism should be done to prevent its adverse effects on lipid metabolism.

The correlation study showed that severity of the lipid abnormality increased with increase in serum TSH levels. Thyroid hormones regulate the expression of enzymes involved in all steps of lipid metabolism leading to the development of qualitative and quantitative changes of lipids, in thyroid disease. Hpyerlipidemia contribute to increased risk of atherogenesis and cardiovascular morbidity.

Thus, it can be concluded that both subclinical hypothyroidism and overt hypothyroidism are associated with abnormal serum lipid profile and these abnormalities increase with serum TSH levels. Such altered lipid profile may increase the risk of atherosclerosis and coronary artery disease. So monitoring of serum lipid profile in subclinical and overt hypothyroidism patients should be done to reduce or prevent the risk of development of atherosclerosis and cardiovascular diseases. Prudent substitution therapy with L-thyroxine is indicated in patients with hypothyroidism, with or without angina, to counteract the cardiovascular risk resulting from dyslipidemia.

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