

Original Article

## Estimation Of Lipid Profile In Patients Of Thyroid Dysfunction

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### ABSTRACT

**Introduction:** Thyroid dysfunction is the commonest medical challenge among all endocrine disorders globally. It can cause impairment of the lipid profile, which may increase the risk of endothelial dysfunction, hypertension and cardiovascular disease. **Aim:** To determine the association between thyroid dysfunction and dyslipidemias. **Methods:** It is a cross-sectional study, in this after estimation of T3, T4 and TSH by Enzyme-linked immunosorbent assay (ELISA) a total of 80 thyroid dysfunction patients and 40 healthy subjects (control group) were taken, among 40 were having hypothyroidism (group-A) and 40 were having hyperthyroidism (group-B). Venous blood samples were collected from all the participants and subjected for the estimation of total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL-C), and high-density lipoprotein (HDL-C) using a fully automatic analyzer. The data were analyzed by using SPSS software version 16.0. **Results:** When data of hypothyroid (group-A) patients were compared with hyperthyroid patients (group-B) and control group, the mean TC, TG, LDL and VLDL levels were significantly high in group-A ( $p < 0.05$ ), whereas HDL levels were significantly low ( $p < 0.05$ ). **Conclusion:** Hypothyroidism patients had shown significantly high levels of TC, TG, LDL and VLDL and low HDL levels, which may be the predisposing factor for high risk of endothelial dysfunction, hypertension and cardiovascular disease.

### INTRODUCTION

Thyroid dysfunction, both hypo and hyperthyroidism is the commonest endocrine disorder worldwide. It has become a significant burden in India too<sup>1</sup>. It has been estimated that currently, about 42 million population in India suffer from thyroid diseases<sup>1</sup>. NHANES III Study was done for 6 years and stated that the prevalence of hypothyroidism was 4.6% and of hyperthyroidism was 1.3%. Thyroid dysfunction mainly depends on age and gender in the population aged at least 12 years<sup>2</sup>. The incidence of hypothyroidism is relatively more common in females<sup>3</sup> especially those who live in remote and mountainous areas in South-East Asia, Latin America and Central Africa<sup>4</sup>. The deficiency of iodine still exists predominately in a few parts of India even after wide coverage

by the National iodine deficiency diseases control Programme (NIDDCP)<sup>5</sup>. Hypothyroidism is a condition in which the thyroid gland produces a lesser amount of thyroid hormones such as triiodothyronine (T3) and thyroxine (T4). The regulation of lipid metabolism is mainly governed by thyroid hormones. The absence/ low levels of T3 and T4 results in low metabolic rate, fatigue, overweight depression and dislipidemias, which may increase the risk of endothelial dysfunction cardiovascular disease<sup>6</sup>.

The crucial effects of thyroid hormone are to increase cholesteryl ester transfer protein, lipoprotein lipase and receptors for low-density lipoprotein (LDL). Because of all these effects, thyroid hormone can lower triglycerides (TG), total cholesterol (TC) and low-density lipoprotein cholesterol (LDL) and increases high-density lipoprotein cholesterol (HDL-C). Inadequate thyroid function as in the case of hypothyroidism results in an unfavorable lipid profile, especially elevated TC and LDL-C compared with euthyroid individuals<sup>7,8</sup>.

However, previous studies have shown that the lipid profile in people with thyroid dysfunction varies between individuals and between countries<sup>9,10,&11</sup>. Hence the present study is designed to determine the pattern of lipid profile in patients with thyroid dysfunction and healthy controls and to find out if there is an association between serum lipids and thyroid hormones.

## **MATERIALS AND METHODS**

A cross-sectional study was carried out in the Department of Biochemistry on patients visiting the general medicine department during the period from February to May 2023 at Chalmeda Anand Rao Institute of medical sciences, Karimnagar, Telangana, India.

### **Inclusion criteria:**

- Any adult subject between 18 and 60 years irrespective of gender
- Patients with thyroid dysfunction both hypothyroidism /hyperthyroidism
- Patients willing to participate in the study

### **Exclusion criteria:**

- Patients on antithyroid drugs and any other medication which might alter serum lipid levels include hypolipidaemic drugs, diuretics and  $\beta$  blockers.
- Patients not willing to participate
- Chronic illness
- Excessive alcohol consumption
- History of heart surgery or other cardiovascular interventions
- Pregnancy
- Chronic kidney disease

Written informed consent was taken from all the participants before the initiation of the study. According to inclusion criteria, a total of 80 patients diagnosed with thyroid dysfunction (40 hyperthyroidism patients and 40 hypothyroidism patients) and 40 healthy controls were taken. Detailed information of all subjects was collected that included age, sex and family or personal history of chronic diseases. 6 ml of venous blood was withdrawn from every participant after<sup>12</sup> hours of overnight fasting; serum was separated and subjected for the estimation of T3, T4 and TSH Enzyme-linked immunosorbent assay (ELISA). Similarly, lipid profile parameters such as serum TC, TG, LDL-C, VLDL-C and HDL-C were estimated by using a fully automatic analyzer.

### **Statistical analysis**

Data was collected and has been entered into Microsoft Excel and analyzed by using SPSS software version 16.0. Student 't' test was used for calculation. Results were expressed as mean  $\pm$  SD standard deviation (SD). P value <0.05 was considered statistically significant.

## RESULTS

A total of 80 thyroid dysfunction patients including 40 hypothyroidism and 40 hyperthyroidism patients and 40 healthy subjects participated in the present study. Among 80 thyroid dysfunction patients, 58 (72.5%) were females and 22(27.5%) were males. The majority of thyroid dysfunction patient i.e. 61.25% (49) belongs to the age group between 46-55 years followed by 38.75% (31) age group between 36-45 years.

In the present study, it has been found that the mean value of T3, T4 and TSH in group-A was  $0.9 \pm 0.1$  pg/ml,  $5.1 \pm 0.141$  ng/dl and  $9.16 \pm 0.658$   $\mu$ IU/ml respectively, whereas in group B the mean value of T3, T4 and TSH was  $5.18 \pm 0.109$  pg/ml,  $9.86 \pm 0.44$  ng/dl and  $1.2 \pm 0.1871$   $\mu$ IU/ml respectively. Similarly in control group, the mean values of T3, T4 and TSH were  $1.28 \pm 0.23$  pg/ml,  $6.1 \pm 0.18$  ng/dl and  $2.14 \pm 0.1817$   $\mu$ IU/ml respectively. **Table-1, 2& 3**

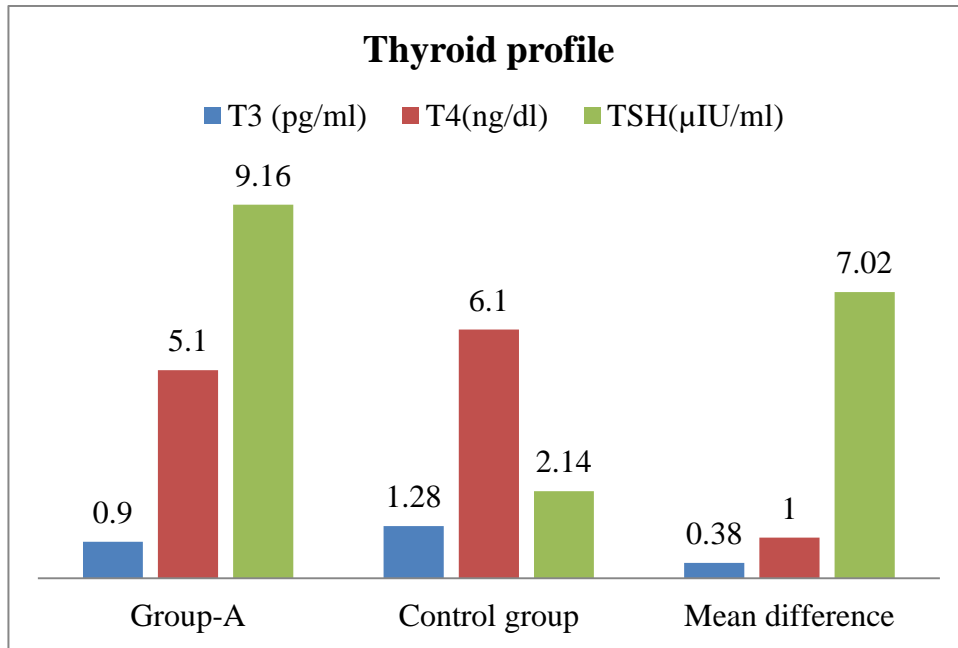
When comparison was done between group-A and control group, the mean values of T3 and T4 were low whereas TSH was higher in group-A, which is statistically significant( $p < 0.05$ ). **Table-1** When a comparison was done between group B and the control group, the mean values of T3 and T4 was higher whereas TSH was low in group B, which is statistically significant ( $p < 0.05$ ). **Table-2** When a comparison was done between group-A and group B, the mean values of T3 and T4 were higher whereas TSH was lower in group B, which is statistically significant ( $p < 0.05$ ). **Table-3**

In the present study, it has been found that in group-A, the mean value of TC:  $227.4 \pm 5.72$ (mg/dl); TG:  $188.6 \pm 3.91$ (mg/dl); LDL-C:  $163.2 \pm 2.38$  (mg/dl); HDL-C:  $33.8 \pm 2.77$ (mg/dl); and VLDL-C:  $36.4 \pm 1.14$  (mg/dl), whereas in group-B the mean value of TC:  $167.2 \pm 2.16$ (mg/dl); TG:  $115.4 \pm 10.24$ (mg/dl); LDL-C:  $126 \pm 1.87$ (mg/dl); HDL-C:  $39.6 \pm 1.14$ (mg/dl); VLDL-C:  $24 \pm 1.58$  (mg/dl). The mean value of TC:  $166.6 \pm 1.34$  (mg/dl); TG:  $112.8 \pm 2.049$  (Mg/dl); HDL-C:  $47.2 \pm 0.83$ (mg/dl); LDL-C:  $101.6 \pm 2.408$ (mg/dl); VLDL-C;  $22.6 \pm 2.40$  (mg/dl) was observed in the control group. **Table-4, 5 & 6**

When group-A was compared with the control group, there was a significant mean difference found in TC, TG, HDL-C, LDL-C and VLDL-C levels, which is statistically significant( $p < 0.05$ ). **Table-4** When group B was compared with the control group, there was a significant mean difference found in HDL-C and LDL-C levels, which is statistically significant ( $p < 0.05$ ). **Table-5** When group-A was compared with group B, there was a significant mean difference found in TC, TG, HDL-C, LDL-C and VLDL-C levels, which is statistically significant( $p < 0.05$ ). **Table-6**

**Table-1:** Showing mean  $\pm$  SD of T3, T4, and TSH of hypothyroidism and control subjects

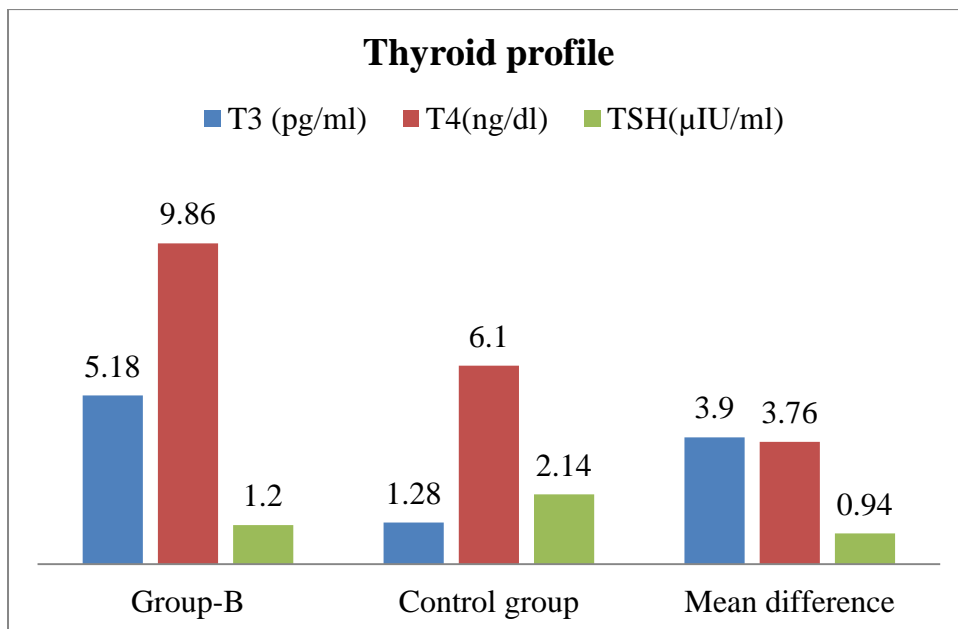
|                    | Group-A (Mean $\pm$ SD) | Control group (Mean $\pm$ SD) | Mean difference | P value |
|--------------------|-------------------------|-------------------------------|-----------------|---------|
| T3 (pg/ml)         | $0.9 \pm 0.1$           | $1.28 \pm 0.23$               | $0.38 \pm 0.11$ | 0.011   |
| T4 (ng/dl)         | $5.1 \pm 0.14$          | $6.1 \pm 0.18$                | $1 \pm 0.09$    | 0.000   |
| TSH ( $\mu$ IU/ml) | $9.16 \pm 0.65$         | $2.14 \pm 0.18$               | $7.02 \pm 0.30$ | 0.000   |



**Figure-1:** Mean thyroid profile in group-A and control subjects

**Table-2:** Showing mean± SD of T3, T4, and TSH of hypothyroidism and control subjects

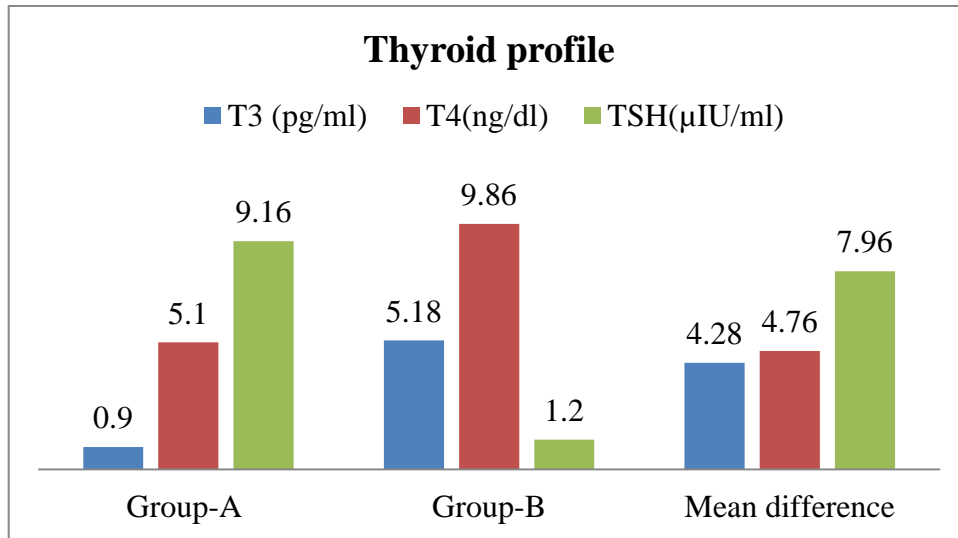
|             | Group-B (Mean± SD) | Control group (Mean± SD) | Mean difference | P value |
|-------------|--------------------|--------------------------|-----------------|---------|
| T3 (pg/ml)  | 5.18 ± 0.10        | 1.28 ± 0.2387            | 3.9 ± 0.11      | 0.000   |
| T4 (ng/dl)  | 9.86± 0.44         | 6.1±0.18                 | 3.76±0.19       | 0.000   |
| TSH(μIU/ml) | 1.2 ± 0.18         | 2.14 ± 0.1817            | 0.94 ± 0.11     | 0.000   |



**Figure-2:** Mean thyroid profile in group-B and control subjects

**Table-3:** Showing mean± SD of T3, T4, and TSH of hypothyroidism patients and hyperthyroidism patients

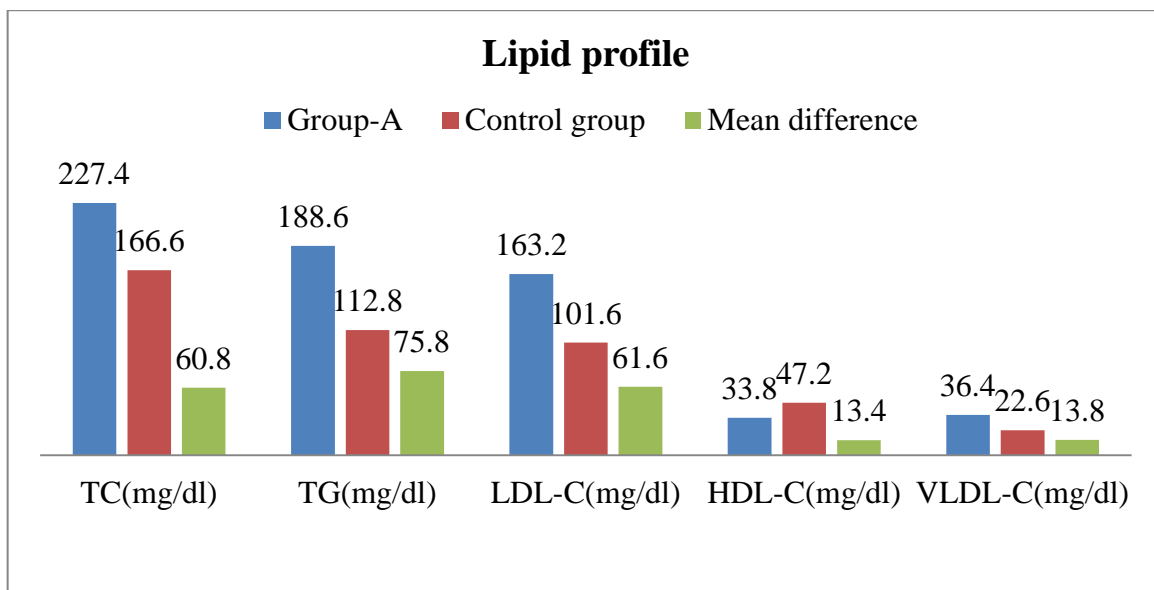
|             | Group-A (Mean± SD) | Group-B (Mean± SD) | Mean difference | P value |
|-------------|--------------------|--------------------|-----------------|---------|
| T3 (pg/ml)  | 0.9± 0.1           | 5.18 ± 0.10        | 4.28±0.066      | 0.000   |
| T4 (ng/dl)  | 5.1±0.14           | 9.86±0.44          | 4.76±0.18       | 0.000   |
| TSH(μIU/ml) | 9.16 ± 0.65        | 1.2 ± 0.187        | 7.96± 0.30      | 0.000   |



**Figure-3:** Mean thyroid profile in group-A and group-B

**Table-4:** Showing lipid levels of hypothyroidism patients and control subjects

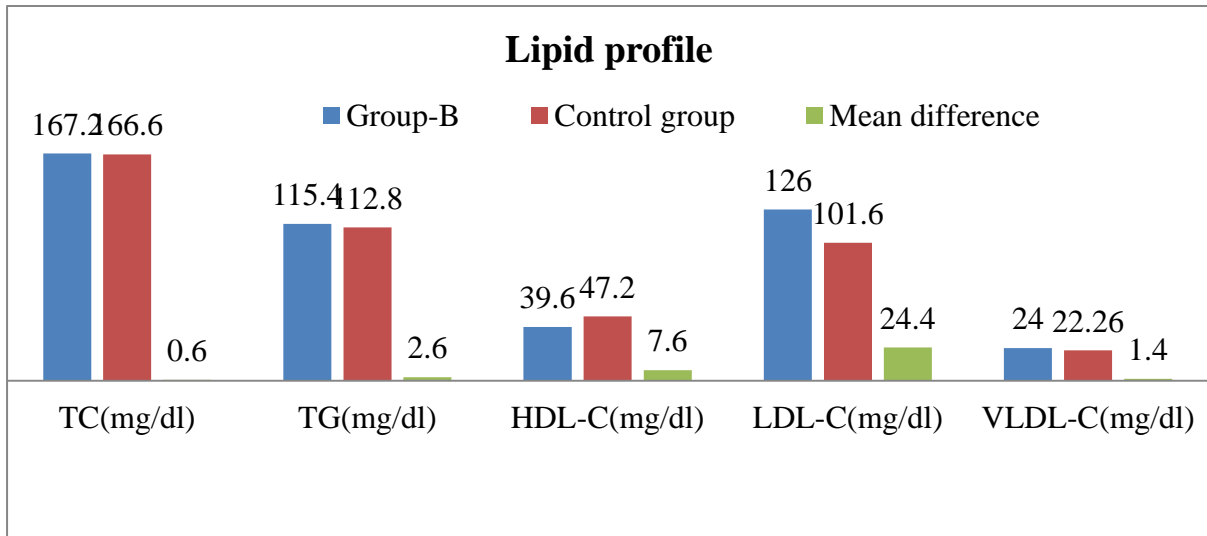
|               | Group-A (Mean± SD) | Control group (Mean± SD) | Mean difference | P value |
|---------------|--------------------|--------------------------|-----------------|---------|
| TC(mg/dl)     | 227.4 ± 5.72       | 166.6± 1.34              | 60.8± 2.63      | 0.000   |
| TG(mg/dl)     | 188.6 ± 3.91       | 112.8 ± 2.04             | 75.8 ±1.97      | 0.000   |
| LDL-C(mg/dl)  | 163.2 ±2.38        | 101.6 ±2.40              | 61.6± 1.51      | 0.000   |
| HDL-C(mg/dl)  | 33.8 ±2.77         | 47.2 ±0.83               | 13.4 ±1.29      | 0.000   |
| VLDL-C(mg/dl) | 36.4±1.14          | 22.6±2.40                | 13.8±1.19       | 0.000   |



**Figure-4:** Lipid levels in group-A and control subjects

**Table-5:** Showing lipid profile of hyperthyroidism patients and control subjects

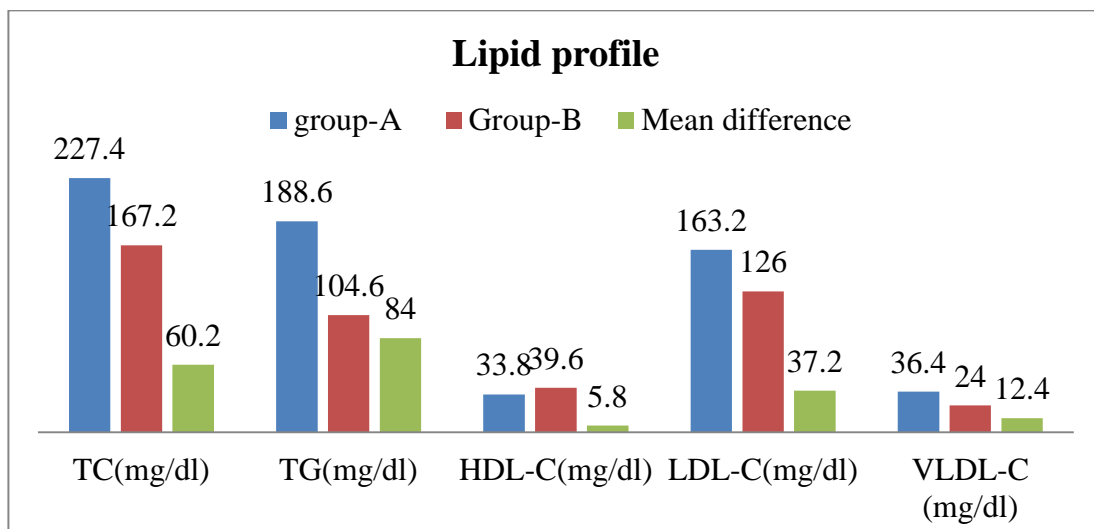
|               | Group-B (Mean± SD) | Control group (Mean± SD) | Mean difference | P value |
|---------------|--------------------|--------------------------|-----------------|---------|
| TC(mg/dl)     | 167.2 ±2.168       | 166.6 ±1.341             | 0.6±1.14        | 0.613   |
| TG(mg/dl)     | 115.4 ±10.24       | 112.8±2.049              | 2.6± 4.66       | 0.593   |
| HDL-C(mg/dl)  | 39.6±1.14          | 47.2 ± 0.8366            | 7.6 ± 0.63      | 0.000   |
| LDL-C(mg/dl)  | 126 ± 1.871        | 101.6± 2.408             | 24.4 ±1.36      | 0.000   |
| VLDL-C(mg/dl) | 24±1.58            | 22.26±2.40               | 1.4±1.28        | 0.309   |



**Figure-5:** Mean lipid levels in group-B and control subjects

**Table-6:** Showing lipid profile of hypothyroidism and hyperthyroidism

|                | Group-A (Mean± SD) | Group-B (Mean± SD) | Mean difference | P value |
|----------------|--------------------|--------------------|-----------------|---------|
| TC(mg/dl)      | 227.4 ±5.72        | 167.2±2.16         | 60.2± 2.73      | 0.000   |
| TG(mg/dl)      | 188.6 ± 3.91       | 104.6±1.51         | 84 ± 1.87       | 0.000   |
| HDL-C(mg/dl)   | 33.8 ±2.77         | 39.6± 1.14         | 5.8 ±1.34       | 0.003   |
| LDL-C(mg/dl)   | 163.2 ± 2.38       | 126± 1.87          | 37.2 ±1.35      | 0.000   |
| VLDL-C (mg/dl) | 36.4± 1.14         | 24±1.58            | 12.4±0.87       | 0.000   |



**Figure-6:** Mean lipid levels in group-A and group-B

## DISCUSSION

The purpose of conducting the present study was to determine the association between thyroid dysfunction and dyslipidemia's. A total of 80 thyroid dysfunction patients including 40 hypothyroidism and 40 hyperthyroidism patients and 40 healthy subjects were recruited in the present study. The majority of study participants were females 58 (72.5%) and 61.25% (49) of patients belonging to the age group 46-55 years.

It has been found in the present study that, the mean value of thyroid hormones such as T3 and T4 in patients of hypothyroidism (group A) had significantly low when compared with hyperthyroid

(group B) and euthyroid subjects (control group) ( $P < 0.05$ ) which is in line with another study<sup>12</sup>. Similarly, patients of hypothyroidism (Group-A) had shown high levels of TSH when a comparison was done with hyperthyroid and euthyroid subjects ( $p < 0.05$ ), which is in line with another study<sup>12</sup>. When a comparison was done between hyperthyroid patients (group B) and euthyroid subjects (control group), group-B had shown a significant increase in mean T3 and T4 levels, whereas the mean value of TSH was significantly low ( $p < 0.05$ ), results of this study also supported by another study<sup>12</sup>. A significant difference in mean T3, T4 and TSH levels was found between group-A and group-B.

In the present study, it has been observed that the mean value of Serum TC, TG, LDL and VLDL levels were significantly higher in hypothyroidism patients (group-A) when compared with healthy subjects (control group). Whereas mean serum HDL-C was significantly lower in group-A, this is due to decreased levels of thyroid hormones ( $p < 0.01$ ), similar results were found in another study<sup>13, 14</sup>. The rise in serum TG, LDL-C, and VLDL-C in hypothyroidism patients is due to decreasing the clearance of TG-rich lipoprotein<sup>15</sup>.

In the present study, patients of hypothyroidism had shown a significant increase in mean TC, TG, LDL-C VLDL-C levels when compared to hyperthyroidism patients, whereas mean HDL-C values were significantly higher in hyperthyroidism patients ( $p < 0.05$ ), the results of the present study were similar to another study<sup>16</sup>.

In the present study, hyperthyroid patients had shown increased serum TC, TG, LDL, and VLDL levels when compared with control subjects, which is in line with another similar study<sup>17</sup>. This is due to the increased activity of HMG-Co A reductase and reduced excretion of cholesterol by bile. The mean HDL-C levels were decreased in hyperthyroidism patients when compared with control subjects, which is opposed by another study, where HDL-C levels were increased significantly ( $p < 0.05$ ). The reduction of HDL-C in hyperthyroidism patients is due to the increased CETP-mediated transfer of cholesteryl esters from HDL to VLDL<sup>18</sup>.

## CONCLUSION

Thyroid dysfunctions have a deleterious effect on lipid metabolism and are most common in dyslipidemic patients. The present study concludes that patients with hypothyroidism are at high risk of endothelial dysfunction, hypertension and cardiovascular diseases as they have higher levels of serum TC, TG, LDL-C and VLDL-C and low levels of HDL-C.

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