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# Lipid abnormalities and Insulin Resistance Among Patients with Hypothyroidism

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## Abstract

**Background**: Hypothyroidism is a clinical syndrome caused by thyroid hormone deficiency due to reduced production, deranged distribution, or lack of thyroid hormone effects. Thyroid hormones have multiple effects on the regulation of lipid digestion, absorption, synthesis, and catabolism. The thyroid hormones are known to have a stimulating effect on maturation of the insulin secreting beta cells, and thyroid hormone receptors have been detected in these cells.

**Aim of study:** To detect the level of lipid abnormalities and insulin resistance in both overt and subclinical hypothyroidism.

**Methods:** A prospective study was conducted on 54 persons. They were divided into 3 groups: group I included 18 patients with overt hypothyroidism (OH), group II included 18 patients with subclinical hypothyroidism (SCH) and group III (Control group) included 18 apparently healthy volunteers. For all groups: history and examination were done. For newly diagnosed patients follow up was done after 6 months after levothyroxine therapy.

**Results:** there was a significant difference in the insulin resistance and hyperlipidemia among (OH) and (SCH) in comparison to healthy subjects. Improvement of parameters in insulin resistance and hyperlipidemia in patients with OH and SCH after levothyroxine therapy **Conclusion:** Hypothyroidism is associated with insulin resistance and dyslipidaemia, which are atherosclerotic risk indicators. TSH had maximum impact on the improvement of insulin resistance and hyperlipidaemia in hypothyroid patients after 6 months of levothyroxine therapy. **Keywords:** hypothyroidism, hyperlipidemia, insulin resistance .

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## Introduction

Thyroid hormones have multiple effects on the regulation of lipid digestion, absorption, synthesis, and catabolism (1). Cumulative evidence shows that both (OH) and (SCH) can result in hyperlipidemia ; elevated cholesterol, and low density lipoprotein cholesterol(LDL-c), with variable levels of triglyceride (TG) and high density lipoprotein (HDL-c); leading to increase the risk of atherosclerosis (2). Thyroid hormones regulate lipoprotein lipase (LPL), the key enzyme involved in the breakdown of TG to generate free fatty acids (FFA). LPL activity regulates TG clearance and its availability for other tissues such as heart and muscle. LPL hyperactivity has been associated with decreased plasma TG level and decreased cardiovascular risks while its loss of function resulted in severe hypertriglyceridemia (3). The thyroid hormones are known to have a stimulating effect on maturation of the insulin secreting beta cells, and thyroid hormone receptors have been detected in these cells (4). These hormones enhance gluconeogenesis and glycogenolysis in an opposing effect to insulin (5), whereas, they are known to facilitate the cellular glucose uptake by expressing the glucose transporter-4 (GLT-4) isozyme (6). Insulin resistance is a pathological condition in which the target cell fail to respond to ordinary level of circulating insulin. This leads to increase insulin secretion to maintain normoglycemia (7).

## Aim of the study

To investigate the possible changes in the lipid profile and insulin resistance in both overt hypothyroidism and subclinical hypothyroidism patients after levothyroxine treatment .

## Patients and Methods

This study was conducted on 54 persons, they are three groups overt hypothyroidism , subclinical hypothyroidism and healthy subjects were selected from outpatient clinic of endocrinology and diabetes unit at Minia University Hospital from December 2017 to April 2020.The research protocol was approved by the local Medical Ethics Committee and congruent with the Declaration of Helsinki. This study included three groups:

**Group (I):**18 patients with (OH) diagnosed by free T4 level (< 0.89 pg/dl), free T3 level (<1.4pg/dl) and TSH level (>5.0pg/dl) according to **ATA, 2018**. The patients with OH group were newly diagnosed from attendants of the Endocrinology and Diabetes Unit and they did not start any treatment yet. They were followed up on thyroxin therapy for about six months and the ideal thyroxine dose which is 1.7 mcg/kg was given for these patients.

**Group (II):** 18 patients with (SCH) diagnosed by normal free T4 level (0.89 - 1.76 pg/dl), normal free T3 level (1.4 - 4.2 pg/dl) and TSH level (> 5.0 pg/dl) according to **ATA, 2018**.

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**Group III (Control group) :** 18 apparently healthy volunteers, their age and BMI matched with patient groups.

**All patients were subjected to:**

**Clinical history**:

**Personal history**: with special attention to age, sex, marital state, special habits, history of medication, history of diabetes or hypertension.

**Present history:** symptoms of overt hypothyroidism as weakness, skin changes, lethargy, slow speech, cold sensation, decreased sweating, facial edema, constipation.

**History of thyroidal operation**.

**Family history**: of thyroid or other autoimmune diseases, endocrine or systemic autoimmune diseases.

**Exclusion criteria:** Subjects were excluded if they had acute illness , chronic illness such as DM, renal diseases, liver diseases ,coronary heart disease, heart failure, peripheral artery disease, cerebrovascular event , malignancy , inflammatory diseases , intake of alcohol and any hormonal therapy or hypolipidemic agents or insulin sensitizer. Pregnant women also were excluded .

**Biochemical assay:**

After about 10 hours of overnight fasting, 10 ml of venous blood samples were withdrawn from each subject.The concentrations of serum fasting insulin were assayed by Epitope Diagnostics, Inc, USA) which used for calculation of HOMA-IR and HOMA-B equations , thyroid function tests: free T3, free T4 and TSH levels by ELISA (Eagle, bioscience, Columbia), Serum blood glucose level ( fasting , 2 hour post prandial blood glucose and random blood glucose), total cholesterol (TC) , triglyceride (TG), high density lipoprotein cholesterol (HDL-c) and low density lipoprotein cholesterol (LDL-c) were estimated .All tests were done using fully automated clinical chemistry auto-analyzer system Konelab 20i (Thermo-Electron Incorporation, Finland).The low density lipoprotein (LDL) level was calculated by Friedewald equation LDL= TC – (HDL - (TG /5) ) (8). The estimated **HOMA IR** % (Homeostatic model for assessment of insulin resistance) was calculated by the following equation: Fasting insulin (m I u / ml) X fasting plasma glucose (mg/dl) /405. **HOMA B**% (Homeostatic model for assessment of beta cell function) was calculated by the following equation: 20 X fasting insulin (mIu /ml) / (fasting plasma glucose (mg/dl) – 3.5 ***)***.The normal range of fasting insulin concentration is (5-15 m U / ml) and the higher values indicated insulin resistance (9).

**Statistical analysis:**

Statistical analysis was done using Statistical Package For Social Sciences Software (for windows 16.0, SPSS Inc. Chicago, IL,USA) . For comparison between parametric data, unpaired t-test was used to compare between two independent study groups. For comparison of non-parametric data, statistical

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chi-square test was used. ANOVA test was used for parametric quantitative data between the three groups followed by Post hocTukey test between each two groups. Kruskal Wallis test for non-parametric quantitative data between the three groups using followed by Mann Whitney test between each two groups. For comparison of parametric quantitative data between pre & post-treatment within the same group using Paired samples T test, and for non-parametric quantitative data using Wilcoxon Signed Rank test .Also, analyses were done for parametric quantitative data between the two groups post-treatment using Independent samples T test. Non-parametric quantitative data between the two groups post-treatment using Mann Whitney test. P value less than 0.5 was considered statistically significant.

## Results

**Table (1): Baseline Demographic Data of all Studied Groups**

| Variables | Control (I) | SCH (II) | OH (III) | P value | | | |
|---|---|---|---|---|---|---|---|
| | N=18 | N=18 | N=18 | *P* | *P1* | *P2* | *P3* |
| **Age (years)** *Mean ± SD* | **36 ± 9.9** | **40 ±8.6** | **41 ±9.9** | **0.193** | **0.329** | **0.208** | **0.958** |
| **Sex** *Male n (%)* *Female n (%)* | **1(5.6%)** **17(94.4%)** | **2(11.1%)** **16(88.9%)** | **3(16.7%)** **15(83.3%)** | **0.861** | **1** | **0.603** | **1** |
| **Residence** *Urban n (%)* *Rural n (%)* | **10(55.6%)** **8(44.4%)** | **10(55.6%)** **8(44.4%)** | **4(22.2%)** **14(77.8%)** | **0.067** | **1** | **0.086** | **0.086** |
| **Offspring** *Mean ± SD* *Median/IQR* | **1.9±1.3** **2/(0.8-3)** | **2 ±1.3** **2/(1-3.5)** | **2 .5 ±1.3** **3/(2-3)** | **0.185** | **0.310** | **0.052** | **0.525** |

OH: Overt Hypothyroidism , SCH: Subclinical Hypothyroidism . Results are expressed as mean ± standard deviation and compared by ANOVA *test for parametric quantitative data between the three groups* . Results are expressed as frequency (percentage), compared by Chi square test *for qualitative data (expressed as number ( %)) between the groups.* P: P value when three groups compared; P1: P value when healthy control Group compare to SCH group, P2: P value when healthy control Group compare to OH Group, P3: P value when SCH Group compare to OH Group . **: Significant level at p value < 0.05*.

Table 1: shows the demographic data of patients with healthy control subjects, SCH and patients with OH respectively. In our study , there are 54 subjects 6 male and 48 female , (18 in each groups) . Their age ranges from 19 years to 50 years. 24 patients live in city and 30 patients live in village. As regard

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sex , in control group ( males were 5.6% where females 94.4%). SCH group (males 11.1% , females 88.9%) .OH group (males16.7% ,females 83.3%).No significant statistical differences between all three groups as regard age, sex, incidence and off springs numbers

## Table (2): Baseline laboratory Data of The study Groups

| *Variables* | Control (I) | Subclinical Hypothyroidism (II) | Overt Hypothyroidism (III) | P value | | | |
|---|---|---|---|---|---|---|---|
| | N=18 | N=18 | N=18 | *P* | *P1* | *P2* | *P3* |
| FBG (mg/dl) *Mean ± SD* | 77±3.5 | 78 ±5 | 82 ±6.6 | 0.024* | 0.373 | 0.018 | 0.308 |
| 2hpp BG (mg/dl) *Mean ± SD* | 109 ±10.9 | 117 ±9.2 | 122 ±7.4 | 0.008* | 0.045* | 0.009* | 0.805 |
| RBG (mg/dl) *Mean ± SD* | 108.6±16.1 | 131.8±12.6 | 127.8±21.1 | <0.001* | <0.001* | 0.004* | 0.760 |
| HOMA-B *Mean ± SD* *Median/IQR* | 102.1/ (60.5-134.6) | 151±105.2 127.8/ (80-192.4) | 6.4 140.6/ (101.5-284.2) | 0.057 | 0.242 | 0.015* | 0.268 |
| HBA1C % *Mean ± SD* | 4.7 ±0.3 | 4.9 ±0.2 | 5.8 ±0.2 | 0.001* | 0.014* | 0.001* | 0.532 |
| insulin (mIU / mL) *Mean ± SD* *Median/IQR* | 3.1±1.6 4/ (2.5-4.6) | 5.6 ±2.8 7.1/ (3.2-8.9) | 9 ±3.9 8.2 / (5.5-10.6) | <0.001* | 0.018* | <0.001* | 0.103* |
| HOMA-IR *Mean ± SD* *Median/IQR* | 0.6 ±0.3 0.7/ (0.5-0.9) | 0.9 ±0.6 1.4/ (0.6-1.7) | 2 ±0.7 1.7/ (1.2-2.1) | <0.001* | 0.015* | <0.001* | 0.040* |

ANOVA *test for parametric quantitative data between the three groups* followed by Post hoc test for normally distributed data *between each two groups.* Three groups were compared by Kruskal Wallis test followed by Mann Whitney test between each two groups for not normally distributed data. **: Significant level at P value < 0.05.*, FBG: fasting blood glucose , 2 hpp BG: 2 hour postprandial blood glucose , HOMA-B = Homeostatic Model Assessment to quantify beta-cell function , H b A1c; hemoglobin A1c, HOMA IR=Homeostatic Model Assessment of Insulin Resistance. P: P value when three groups compared; P1: P value when healthy control group compare to SCH group , P2: P value when healthy control group compare to OH Group, P3: P value when SCH Group compare to OH Group .

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Table 2: shows the laboratory data of patients with healthy control subjects , SCH group and patients with OH group respectively. FBG increase in OH group in comparison to SCH and control group. This change is statistically significant differences between three groups as regard pretreatment FBG (P value = 0.024). Also, FBG increase in OH group in comparison to control group and this change is statistically significant differences (P value = 0.018). 2 h pp BG increase in OH group in comparison to SCH and control group and these changes are statistically significant differences between three groups (P value = 0.008 ) .2hppBG increase in SCH group in comparison to control group and this change is statistically significant (P = 0.045).Also, 2hppBG increase in OH group in comparison to control group and this change is statistically significant differences as regard pretreatment 2hppBG (P = 0.009). RBG increase in OH group in comparison to SCH group and control group. Also, these changes are statistically differences between three groups (P< 0.001).Pretreatment RBG increase in SCH group in comparison to control group and this change is statistically significant (P < 0.001). Also, pretreatment RBG increase in OH group in comparison to control group and this change is statistically significant (P = 0.004). HA1C increase in OH group in comparison to SCH and control group . Also, these changes are statistically significant differences between three groups (P = 0.001). Pretreatment HA1C increase in OH group in comparison to control group and this change is statistically significant (P = 0.001). HA1C increase in SCH group in comparison to control group and this change is statistically significant (P = 0.014). Fasting insulin increase in OH group in comparison to SCH group and control group . Also, these changes are statistically significant differences between three groups as regard to pretreatment insulin (P value < 0.001). In SCH group, HA1C increase in comparison to control group and this change is statistically significant (P = 0.014). In OH group , fasting insulin increase in comparison to SCH group and control group . Also, these changes are statistically significant differences between three groups as regard to pretreatment insulin (P value < 0.001). Fasting insulin increase in SCH group in comparison to control group and this change is statistically significant (P value = 0.018). Fasting insulin increase in OH group in comparison to control group and these changes are statistically significant (P value < 0.001). Fasting insulin increase in OH group in comparison to SCH group and this change is statistically significant differences (P value = 0.103).In OH group , HOMA-B increase in comparison to SCH group and control group , but this change is not statistically significant differences ( P value < 0.057). In OH group , HOMA-B increase in comparison to control group and this change is not statistically significant differences ( P value = 0.015).In OH group, HOMA-IR increase in comparison to SCH group and control group . Also, these changes are statistically significant differences between three groups (P < 0.001). HOMA-IR increase in SCH group in comparison to control group and these changes are statistically significant differences between three groups (P = 0.015). HOMA-IR

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increase in OH group in comparison to control group and these changes are statistically significant differences between three groups (P < 0.001). HOMA-IR increase in OH group in comparison to SCH group and this change is statistically significant differences (P = 0.040).

**Table (3): The Baseline lipid profile data of the studied groups**

| *Variables* | **Control (I)** | **SCH (II)** | **OH (III)** | **P value** | | | |
|---|---|---|---|---|---|---|---|
| | **N=18** | **N=18** | **N=18** | ***P*** | ***P1*** | ***P2*** | ***P3*** |
| **HDL (mg/dl) *Mean ± SD*** | **53 ±5** | **48 ±5.3** | **46.8 ± 5.3** | **0.005*** | **0.056** | **0.005*** | **0.625** |
| **LDL (mg/dl) *Mean ± SD*** | **80 ±9.2** | **141±38.8** | **154 ± 28.9** | **<0.001*** | **<0.001*** | **<0.001*** | **0.268** |
| **TC (mg/dl) *Mean ± SD*** | **139 ±13.6** | **198 ±11.56** | **235 ±25.05** | **< 0.001*** | **< 0.001*** | **<0.001*** | **0.004*** |
| **TG (mg/dl) *Mean ± SD*** | **94 ±30** | **142 ±21.7** | **176 ±22.7** | **<0.001*** | **<0.001*** | **<0.001*** | **0.001*** |

ANOVA *test for parametric quantitative data between the three groups* followed by Post hoc test for normally distributed data *between each two groups.* Three groups were compared by *Kruskal Wallis* test followed by Mann Whitney test between each two groups for not normally distributed data -*: *Significant level at P value < 0.05.* OH: overt hypothyroidism , SCH: subclinical hypothyroidism , *HDL : high density like protein , LDL :low density like protein , TC :total cholesterol , TG :triglyceride..*

P: P value when three groups compared; P1: P value when healthy control group compare to SCH group, P2: P value when healthy control Group compare to OH Group, P3: P value when SCH Group compare to OH Group.

Table 3: shows the baseline lipid profile data of the studied groups. In OH group , HDL decrease in comparison to SCH group and control group and this change is statistically significant between three groups ( P value = 0.005 ) .HDL increase in OH group in comparison to healthy group and this change is statistically significant (P = 0.005) . LDL *increase* in OH group in comparison to SCH group and control group. This change is statistically significant between three groups (P <0.001) . LDL increase in OH group in comparison to healthy group and this change is statistically significant (P <0.001).Also , LDL increase in SCH group in comparison to healthy group and this change is statistically significant (P <0.001).TC *increase in* OH group in comparison to SCH group and control group and this change is statistically significant between three groups (P < 0.001). TC increase in OH group in comparison to healthy group and this change is statistically significant (P <0.001).Also , TC increase in SCH group in

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comparison to healthy group and this change is statistically significant (P <0.001). TC increase in OH group in comparison to SCH group and this change is statistically significant (P = 0.004) TG *increase in* OH group in comparison to SCH group and control group and this change is statistically significant between three groups (P < 0.001). Also , TG increase in SCH group in comparison to healthy group and this change is statistically significant (P <0.001). TG increase in OH group in comparison to SCH group and this change is statistically significant (P = 0.001).

**Table (4): Comparison of Glycemic parameters in Subclinical hypothyroidism and Overt Hypothyroidism Before and After Treatment with Levothyroxine Therapy**

| Variables | SCH(II) N=18 | OH(III) N=18 | P value |
|---|---|---|---|
| **Pre-ttt FBG (mg/dl) Mean ± SD** | **78 ±5** | **82 ±6.6** | **0.308** |
| **Post ttt FBG (mg/dl) Mean ± SD** | **76.2±5.1** | **77 ±6.4** | **0.549** |
| **P value** | ***0.022*** | ***0.008**** | |
| **Pre-ttt 2hppBG (mg/dl) Mean ± SD** | **117 .1±9.2** | **120±7.4** | **0.805** |
| **Post ttt 2hppBG (mg/dl) Mean ± SD** | **115.1±10.7** | **113.8±9.6** | **0.709** |
| **P value** | ***0.110*** | ***0.003**** | |
| **Pre-ttt RBG (mg/dl) Mean ± SD** | **132 ±12.6** | **130 ±21.1** | **0.760** |
| **Post ttt RBG (mg/dl) Mean ± SD** | **127 ±10.8** | **126±18.7** | **0.450** |
| **P value** | ***0.404*** | ***0.323*** | |

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|---|---|---|---|
| **Pre-ttt HOMA-B**<br>***Mean ± SD***<br>***Median/IQR*** | **152 ±105.2**<br>**127.8/ (80-192.4)** | **204 ±166.4**<br>**140.6/ (101.5-284.2)** | **0.268** |
| **Post ttt HOMA-B**<br>***Mean ± SD***<br>***Median/IQR*** | **90 ±57.3**<br>**73.6/ (40.1-134.6)** | **100.4±74**<br>**82.2/ (44-155.3)** | **0.752** |
| **P value** | ***0.008**** | ***<0.001*** | |
| **Pre-ttt HBA1C%**<br>**Mean ± SD** | **4.5 ±0.2** | **5 ±0.2** | **0.532** |
| **Post ttt HBA1C%**<br>**Mean ± SD** | **4.0 ±0.2** | **4.2 ±0.2** | **0.268** |
| **P value** | ***0.020**** | ***0.004**** | |
| **Pre-ttt HOMAIR**<br>***Mean ± SD***<br>***Median/IQR*** | **1.2±0.6**<br>**1.4/ (0.6-1.7)** | **1.7±0.7**<br>**1.7/ (1.2-2.1)** | **0.040*** |
| **Post- ttt HOMAIR**<br>***Mean ± SD***<br>***Median/IQR*** | **0.5 ±0.3**<br>**0.5/ (0.4-0.7)** | **0.8 ±0.3**<br>**0.7/ (0.4-0.9)** | **0.194** |
| **P value** | ***<0.001**** | ***<0.001**** | |

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|---|---|---|---|
| **Pre-ttt Insulin (m U /mL)**<br>***Mean ± SD***<br>***Median/IQR*** | **5.8 ±2.8**<br>**7.1/ (3.2-8.9)** | **7.7±3.9**<br>**8.2/ (5.5-10.6)** | **0.103** |
| **Post ttt Insulin (m U /mL)**<br>***Mean ± SD***<br>***Median/IQR*** | **2.9 ±1.6**<br>**2.7/ (1.9-3.6)** | **3.1±1.9**<br>**3.7/ (2.3-4.6)** | **0.350** |
| **P value** | ***0.001**** | ***<0.001**** | |

Analyses were done for parametric quantitative data between pre & post-treatment within the same group using Paired samples T test, and for non-parametric quantitative data using Wilcoxon Signed Rank test. Analyses were done for parametric quantitative data between the two groups post-treatment using Independent samples T test. Non-parametric quantitative data between the two groups post-treatment using Mann Whitney test. P value: significant if less than 0.05. OH: overt hypothyroidism , SCH: subclinical hypothyroidism , FBG: fasting blood glucose, 2hppBG: 2 hours postprandial blood glucose, RBG: random blood glucose, HOMA-B = Homeostatic Model Assessment to quantify beta-cell function. H b A1c; hemoglobin A1c, HOMA IR=Homeostatic Model Assessment of Insulin Resistance.

Table 4: shows comparison of the glycemic parameters among OH group and SCH group before and after treatment with L-thyroxine. Decrease in FBG and 2h pp BG in OH and SCH group after treatment. Also, there is significant difference in level of FBG and 2hpp BG in patients with OH group only (P value 0.008, 0.003 of FBG and 2hpp BG respectively). Pretreatment 2hpp BG increase in OH group in comparison to SCH group ,but this change is not statistically significant. Decrease in RBG in OH group and SCH group after treatment , but this change is not statistically significant . Pretreatment HOMA- B increase in OH group in comparison to SCH group , but this change is not statistically significant . Also , post treatment HOMA- B increase in OH group in comparison to SCH group , but this change is not statistically significant. HOMA - B decrease in OH group and SCH group after treatment in comparison to before treatment and these changes are statistically significant (P value 0.008, <0.001in SCH and OH group respectively). Pretreatment HBA1c increase in OH group in comparison to SCH group and this change is not statistically significant . Posttreatment HBA1c increase in OH group in comparison to SCH group and this change is not statistically significant. Decrease in HBA1c in in OH group and SCH group after treatment in comparison to before treatment and these changes are statistically significant (P value 0.02, 0.004 in SCH and OH group respectively). Pretreatment fasting insulin increase in OH group in comparison to SCH group , but, this change is not statistically significant. Also, posttreatment fasting insulin increase in OH group in comparison to SCH group , but this change is not statistically significant. Fasting insulin decrease in OH group and SCH group after treatment in comparison to before treatment and these changes are statistically significant

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(P value 0.001, <0.001 in SCH and OH group respectively) . Pretreatment HOMAIR increase in OH group in comparison to SCH group and this change is statistically significant (P value 0.040). Posttreatment HOMAIR increase in OH group in comparison to SCH group , but this change is not statistically significant . HOMAIR decrease in OH group and SCH group after treatment in comparison to before treatment and these changes are statistically significant (P value 0.001, <0.001 in SCH and OH group respectively) .

**Table (5): Comparison of Lipid Profile in Subclinical hypothyroidism and Overt Hypothyroidism Before and After Treatment with Levothyroxine Therapy.**

| **Variables** | **SCH (II) N=18** | **OH (III) N=18** | **P value** |
|---|---|---|---|
| **Pre-ttt HDL (mg/dl) Mean ± SD** | **49 ±5.3** | **45 ± 5.3** | **<0.001*** |
| **Post ttt HDL (mg/dl) Mean ± SD** | **54.5±4.7** | **53.9±4.4** | **0.716** |
| **P value** | ***<0.001 **** | ***<0.001**** | |
| **Pre-ttt LDL (mg/dl) *Mean ± SD*** | **141 ±38.8** | **154 ± 28.9** | **<0.001*** |

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|---|---|---|---|
| **Post ttt LDL (mg/dl)** ***Mean ± SD*** | **95.2±27** | **118.2±27.4** | **0.270** |
| **P value** | ***0.001**** | ***<0.001**** | |
| **Pre-ttt TC (mg/dl)** ***Mean ± SD*** | **198 ±11.56** | **235 ± 25.05** | ***0.001**** |
| **Post ttt TC (mg/dl)** ***Mean ± SD*** | **177.5 ± 15.1** | **184.18 ± 16.8** | **0.202** |
| **P value** | ***<0.001**** | ***<0.001**** | |
| **Pre ttt TG (mg/dl)** ***Mean ± SD*** | **142 ±21.7** | **176 ± 22.7** | **<0.001*** |
| **Post ttt TG (mg/dl)** ***Mean ± SD*** | **120.4±23.7** | **132.1±26.6** | **0.183** |
| **P value** | ***0.001**** | ***<0.001**** | |

Analyses were done for parametric quantitative data between the two groups post-treatment using Independent samples T test. Non-parametric quantitative data between the two groups post-treatment using Mann Whitney test. Analyses were done for parametric quantitative data between pre & post-treatment within the same group using Paired samples T test. For non-parametric quantitative data using Wilcoxon Signed Rank test.

**: Significant level at p value < 0.05.*OH: overt hypothyroidism , SCH : subclinical hypothyroidism , *HDL : high density like protein , LDL :low density like protein , TC :total cholesterol , TG :triglyceride*

.Table 5: shows comparison of lipid profile among OH and SCH group respectively before and after treatment with L-thyroxin. Pretreatment HDL increase in SCH group in comparison to OH group and this change is statistically significant (P value < 0.001). Post treatment HDL increase in OH group and SCH group in comparison to pretreatment HDL and these changes are statistically significant (P value of both <0.001). Also, post treatment HDL increase in SCH group in comparison to OH group, but this this change is not statistically significant. Pretreatment LDL decrease in SCH group in comparison to OH group and this change is statistically significant (P value < 0.001). Post treatment LDL decrease significantly in SCH and OH group in comparison to pretreatment LDL and these changes are statistically significant (P value of both value 0.001 < 0.001 respectively). Post treatment LDL decrease

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in SCH group in comparison to OH group, but this change is not statistically significant. Pretreatment TC increase in OH group in comparison to SCH group (P value = 0.001). TC decrease in OH group and SCH group after treatment in comparison to before treatment and these changes are statistically significant (P value of both < 0.001). Also, post treatment TC increase in OH group in comparison to SCH group, but this change is not statistically significant . Pretreatment TG increase in OH group in comparison to SCH group (P value < 0.001). Also, post treatment TG in OH group in comparison to SCH group , but this change is not statistically significant .TG decrease in OH and SCH group after treatment in comparison to before treatment and these changes are statistically significant (P value < 0.001 , 0.001 respectively).

## Discussion

Thyroid dysfunction alters glucose and lipid metabolism which is an important risk factor for cardiovascular disorders. In our study, we found a significant increase in level of serum insulin in SCH group in comparison to control group This is in agreement with **vyakaranam et al., (2014)** who found statistically significant difference in serum insulin level between euthyroid group and SCH group . We found also in our study statistically significant difference between control group and SCH group as regard level of HOMA-IR between three groups. This is also consistent with **vyakaranam et al., (2014 )** who found that HOMA-IR was significantly elevated in SCH than control group .Also this was in accordance with study done by **Maratou etal., (2009) , Sayed etal., (2006), Lekakis etal., (1997) and Tuzcu et al., (2005)** who found the same results .

Hypothyroidism is one of the most common cause of secondary hyperlipidemia. It has been reported that 95 % of newly diagnosed hypothyroidism patients had increased level of cholesterol . . Hypothyroidism leads to a decrease of LDL receptor expression on fibroblasts and hepatocytes , a decrease of LDL – cholesterol uptake and consequent increase in serum LDL – cholesterol levels (15). In our study, we reported a significant increase in the values of LDL , TC , TG ( the highest level was in OH patients and the lowest in control group) , and decrease in HDL ( the lowest in OH patients and the highest in control group). These results were in agreement of **Yang, etal ., (2019)** who studied 29 patients with OH groups , 30 patients with SCH and 29 control group .Also , it was in agreement with **Han et al ., (2016)** who studied 31 patients with overt hypothyroid groups , 30 patients with SCH and 31 control group , significant reduction in values of TG , LDL –C were noticed after three months of treatment with L - thyroxine replacement , but no significant difference was noticed as regard of levels of both HDL – C

and TC . Also **AKarsu et al., (2019)** found similar results when studying 44 patients with overt hypothyroid groups, 40 healthy control and found a significant difference in levels of TG between two groups .In our study, we found a significant reduction in values of lipid profile after six months therapy with L-thyroxine in both overt hypothyroid groups and subclinical hypothyroidism groups as follows as regard HDL – C , LDL – C ,TC and TG .

This was in agreement with **Gluvic et al ., (2015)** who studied 30 female patients with newly diagnosed hypothyroidism vs 15 healthy control group and follow up was done after three months of treatment with L - thyroxine replacement , significant reduction in values of TC , LDL –C were noticed after three months of treatment with L - thyroxine replacement , but no significant changes in the level of TG and HDL-C in hypothyroid patients

## Conclusion

Hypothyroidism is associated with insulin resistance and dyslipidemia, which are atherosclerotic risk indicators. TSH had maximum impact on the improvement of insulin resistance and hyperlipidaemia in hypothyroid patients after 6 months of levothyroxine therapy.

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