Lipid Profile variation in subclinical and clinical Hypothyroidism and their correlation with BMI.

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ABSTRACT:

Objective: The present study aimed to compare the variation in lipid profiles between patients with subclinical and clinical hypothyroidism and their correlation with BMI.

Methodology: A cross-sectional study carried out on 120 patients (aged 20-60 years) in the Department of Medicine, Pakistan Institute of Medical Science, Islamabad from December 2024 to September 2025. All the patients were categorized into three groups; Group-I euthyroid controls (n=40), Group-II subclinical hypothyroidism (n=40), and clinical hypothyroidism (n=40). Blood sample was taken and analyzed for lipid profiles and thyroid functions. Lipid profiles, Thyroid function tests, and body mass index (BMI) recorded for each individual. SPSS v28 used for statistical analysis.

Results: Of the total 120 patients, there were 18 (15%) male and 102 (85%) female. The overall mean age (years) and BMI (Kg/m2) were 29.88±5.89 and 29.68 (25-34), respectively. Both hypothyroid groups showed higher levels of lipid profiles compared to euthyroid controls ($p<0.01$), with the clinical hypothyroid group showing the highest levels. Lower HDL-C levels observed in hypothyroid groups, but the difference was not statistically significant. Lipid profile and body mass index showed a positive correlation in both hypothyroid groups, especially in clinical group.

Conclusion: The present study observed that increased body mass index and variations in lipid profile in hypothyroidism are established risk factors. Subclinical hypothyroidism exhibits lower BMI and dyslipidemia than clinical hypothyroidism, underling the routine BMI monitoring and lipid profile measurement to manage cardiovascular disease risk at earliest.

Keywords: Hypothyroidism, Subclinical Hypothyroidism, Lipid Profile, Body Mass Index, Dyslipidemia, Cardiovascular Risk.

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Introduction:

Hypothyroidism is a prevalent endocrine disorder resulting from reduced secretion of triiodothyronine (T3) and thyroxine (T4) leading to reduction in metabolic rate and thyroid activities. The regulation and growth of metabolism mainly depend on the critical role of thyroid hormones. Lipid homeostasis and energy balance variations comes from thyroid hormones, significantly affected by the cholesterol synthesis, absorption, and degradation in lipid metabolism.[1] Hypothyroidism, defined as thyroid hormones deficiency mainly categorized into two types: clinical and subclinical. Although subclinical hypothyroidism is often asymptomatic, but described as a condition with potential long-term, cardiovascular and metabolic effect Women are more susceptible to hypothyroidism than men.[2] The thyroid gland intrinsic dysfunction causing hypothyroidism, leads to inadequate hormones production. Globally, the most prevalent cause of hypothyroidism is the iodine deficiency, its prevalence range varies from 2% to 5%.[3, 4] The reported prevalence of clinical and subclinical hypothyroidism in Pakistan is approximately 4.2% and 5.3%, respectively.[5] Biochemically, the elevated secretion of the thyroid stimulating hormone (TSH) from anterior pituitary caused by the decreased levels of circulating T4 and T3.[6] Thyroid dysfunction, notably hypothyroidism, is strongly linked to dyslipidemia, with thyroid hormones serving as major modulators of intermediate metabolism.[7] The decreased fractional clearance of LDL caused by LDL receptors reduced number in liver leading to low density lipoprotein (LDL) and increased total cholesterol (TC) biochemically defined by clinical hypothyroidism.[8] Earlier studies found that the increased serum triglycerides (TG) and decreased high-density lipoproteins (HDL) in subclinical hypothyroidism accompanied with dyslipidemia.[9] Numerous studies mainly focused on the correlation of lipid profile, obesity, and thyroid dysfunction. [10, 11] An earlier study reported that higher lipid abnormalities found in obese patients.[12] Recently, increased trend of obesity observed in urban population of Pakistan.[13]

Objective:

The present study aimed to compare the variations in lipid profile of hypothyroidism groups and their correlation with body mass index.

Methodology:

A cross-sectional study carried out in the Department of Medicine, Pakistan Institute of Medical Sciences (PIMS), Islamabad between December 2024 to September 2025.A hospital-based cross-sectional study enrolled 120 adults' patients aged 20-60 years and categorized into three

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groups: Group I Euthyroid controls (N=40), group II Subclinical hypothyroidism (N=40), and group III clinical (overt) hypothyroidism (N=40). A non-probability consecutive (convenience) sampling approach used for the required sample size. Written informed consent taken from each individual and study protocol approval taken from ERB, PIMS. Participants with known history of cardiovascular disease such as myocardial infarction and stroke, renal failure, under treatment with thyroxine/anti-thyroid drugs, pancreatitis, and pregnant women excluded.

Demographic and clinical details recorded for each participant. Physical examination carried out for blood pressure, pulse, and anthropometry. All the tools and instruments for measurement checked and calibrated. Participants instructed to fast for 8-12 hours (water allowed) before blood sampling to standardize lipid measurements. Venous blood (typically 8-10 mL) drawn from the antecubital vein into appropriate vacutainer tubes: plain (clot) tubes for lipid profile and serum separation; serum separator tube for thyroid testing. Samples allowed to clot (for serum) and then centrifuged according to the standard operation procedure (SOP) of the laboratory (e.g., 3000 rpm for 10 min). Serum aliquots for immediate testing analyzed on the same day. If a sample required delayed analysis, sera were stored at -20 °C (or according to laboratory SOP) for a short period, the freeze-thaw cycle minimized. SPSS v28 used for data analysis. Lipid profile values presented as median (IQR). Shapiro Wilk test used for normality of variables and showed skewness. Mann-Whitney U test used for comparing the lipid profile and parameters in three groups. Spearman's correlation used for the correlation of lipid profile and obesity. All the data analysis done by considering the $p < 0.05$ statistically significant.

Results:

Of the total 120 patients, there were 18 (15%) male and 102 (85%) female. The overall mean age and BMI (Kg/m2) were 29.88±5.89 and 29.68 (25-34) years, respectively. Both hypothyroid groups showed higher levels of lipid profiles compared to euthyroid controls ($p<0.01$), with the clinical hypothyroid group showing the highest levels. Lower HDL-C levels observed in hypothyroid groups, but the difference was not statistically significant. Lipid profile and body mass index showed a positive correlation in both hypothyroid groups, especially in clinical group. Demographic details of the participants presented in table No 1. Comparison of lipid profile and thyroid function tests among study groups shown in table No 2; while table No 3 showed the Correlation between BMI and lipid parameters in hypothyroid subjects.

Table No 1: Demographic characteristics of study participants (n = 120).

Variable	Euthyroid (n=40)	Subclinical Hypothyroidism (n=40)	Clinical Hypothyroidism (n=40)	Overall (n=120)	p-value
Age (years)	29.35 ± 5.42	30.02 ± 6.01	30.28 ± 6.23	29.88 ± 5.89	0.68
Gender (M/F)	6 / 34	5 / 35	7 / 33	18 / 102	–
BMI (kg/m²)	27.42 ± 4.36	29.83 ± 5.01	31.78 ± 5.28	29.68 (25-34)	0.03

Table No 2: Comparison of lipid profile and thyroid function tests among study groups.

Parameter	Euthyroid (n=40)	Subclinical Hypothyroidism (n=40)	Clinical Hypothyroidism (n=40)	p-value
TSH (µIU/mL)	2.24 ± 0.75	7.86 ± 1.12	18.43 ± 3.96	<0.001*
FT4 (ng/dL)	1.21 ± 0.19	1.04 ± 0.21	0.68 ± 0.18	<0.001*
FT3 (pg/mL)	3.34 ± 0.46	3.11 ± 0.39	2.58 ± 0.34	<0.001*
Total Cholesterol (mg/dL)	176.48 ± 22.17	206.27 ± 24.63	229.56 ± 27.15	<0.001*
LDL-C (mg/dL)	106.35 ± 18.12	132.62 ± 20.57	148.43 ± 23.08	<0.001*
HDL-C (mg/dL)	46.58 ± 6.91	44.82 ± 7.13	43.57 ± 6.48	0.09 (NS)
Triglycerides (mg/dL)	130.41 ± 29.83	158.27 ± 34.62	176.18 ± 39.24	<0.01*

Table No 3. Correlation between BMI and lipid parameters in hypothyroid subjects.

Parameter	Subclinical Hypothyroidism (r, p-value)	Clinical Hypothyroidism (r, p-value)
Total Cholesterol	0.36, 0.02	0.52, < 0.01
LDL-C	0.33, 0.03	0.49, < 0.01
Triglycerides	0.29, 0.04	0.45, < 0.01
HDL-C	-0.12, 0.41	-0.18, 0.28

Discussion:

The present study mainly focused on the variations in lipid profile of subclinical and clinical hypothyroidism and their correlation with body mass index (BMI) among adult patients aged 20-60 years and demonstrated significant variations in lipid profiles and thyroid dysfunction association with body mass index. Earlier study conducted in Pakistan strongly support the association of BMI and serum TSH levels.[14] The result of the current study revealed that significantly higher variations of lipid profile observed in both subclinical and clinical hypothyroid groups compared to euthyroid controls ($p < 0.01$), with the highest values observed in the clinical hypothyroid group. Contrarily, hypothyroid groups showed remarkable reduction in HDL-C levels but statistical insignificant. These findings are consistent with several previous studies reporting dyslipidemia as a specific metabolic abnormality in hypothyroidism.[15,16] The increase in total cholesterol and LDL-C in hypothyroid conditions attributed primarily to decreased hepatic LDL receptor expression and decreased LDL clearance due to reduced thyroid hormone activity. The hepatic LDL receptors increased by the T3 thyroid hormones causing the cholesterol removal from the circulation. Their deficiency causes the accumulation of the LDL and total cholesterol particles.[17] The elevated triglyceride levels caused by impaired hepatic lipase function and reduced lipoprotein lipase activity as observed in the current study.[18] The metabolic abnormalities caused by insufficient thyroid comes from a mild increase in TSH levels, despite the FT4 normal

levels in subclinical hypothyroidism. Numerous studies demonstrated that elevated triglycerides and LDL-C in subclinical hypothyroidism, reported adverse effect on lipid profile and metabolism even in mild thyroid hormone deficiency.[19]

Euthyroid group showed higher HDL-C levels statistically insignificant compared to both hypothyroidism groups. Earlier investigations reported contradictory and varying results regarding HDL-C levels in hypothyroidism. A published study reported reduced levels of HDL-C, while others suggest unchanged or slightly increase.[20] These variations and discrepancies in results may reflect difference in sample size, dietary habits, genetic background, and degree of thyroid disease. Hypothyroidism groups showed a significant increase in body mass index compared to euthyroid controls ($p < 0.05$) as observed in the current study. These findings resemble the observations according to which increase water and salt retention, reduced thermogenesis, and slower rate of basal metabolic leads to weight gain (higher BMI) in hypothyroidism. [21]

Lipid profile and body mass index showed a positive correlation in hypothyroid groups compared to control. These results reflect the lipid homeostasis effected by the additive metabolic of hypothyroidism and obesity. Both conditions share mechanisms promoting an atherogenic lipid profile, including decreased LDL receptor activity, insulin resistance, and increased hepatic lipid synthesis.[22] Earlier study reported that normal weight patients had lower lipid abnormalities than overweight or obese hypothyroid patients.[23] Similar findings reported in numerous research conducted in South Asia. In Pakistan, an elevated LDL-C and total cholesterol found in hypothyroid patients, which resemble our results.[24, 25] The higher rate of metabolic disturbance in Pakistan, caused by the higher BMI and prevalence of dyslipidemia in hypothyroid patients caused by the rich dietary pattern in sedentary lifestyle and saturated fat.

Conclusion:

Increased body mass index and variations in lipid profile in hypothyroidism are established risk factors for cardiovascular disease. Subclinical hypothyroidism exhibits lower BMI and dyslipidemia than clinical hypothyroidism, underling the routine BMI monitoring and lipid profile measurement to manage cardiovascular disease risk at earliest.

Abbreviations: BMI (Body mass Index), LDL (Low density Lipids), HDL (High density Lipids), TSH (Thyroid secreting Hormones), TC (Total Cholesterol)

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