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ASSESSING THE CORRELATION OF THYROID STIMULATING HORMONE WITH DYSLIPIDMIA IN HYPOTHYROIDISM PATEINTS IN LAHORE

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Abstract

Background: *Hypothyroidism is a common endocrine disease which is often linked with dyslipidemia that is a major cause of cardiovascular disease. Thyroid-Stimulating Hormone (TSH) is the key in lipid metabolism, yet the concrete relationship between the levels of TSH and the lipid profile abnormality in the hypothyroid population of Lahore, Pakistan, has not been sufficiently investigated.*

Objective: *The aim of the study was to determine the relationship between Thyroid-Stimulating Hormone (TSH) and dyslipidemia in patients with diagnosed hypothyroidism in Lahore.*

Methods: *This research was a cross-sectional study done on 100 hypothyroid patients. To assess variables of serum TSH and lipid profile, the blood samples were taken to measure Lipid profile. Version 21 of SPSS was used to analyze the data. The rank correlation of Spearman was employed to determine the association between TSH and lipid markers as the non-normal data distribution was established.*

Result: *The mean age of the study population was 44.84 +- 17.39 years with a small prevalence of males (57%). Most participants (63% of them) had high levels of TSH. Dyslipidemia was very high, 44 percent of this population is at the high-risk group of Total Cholesterol and 41 percent of LDL and Triglycerides. The statistical significance of positive correlations of TSH and TC, LDL, VLDL, and Triglycerides was found by Spearman correlation analysis ($r = 0.577$ $p<0.001$, $r = 0.534$ $p <0.001$, $r = 0.485$ $p <0.001$ and $r = 0.496$ $p <0.001$, respectively). There was a significant negative correlation between TSH and HDL ($r = -0.354$, $p<0.001$). Conclusion: The research shows that there is a significant and high correlation that exists between high TSH and an atherogenic lipid profile in patients with hypothyroidism. These results provide support to the urgent necessity*

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of regular lipid testing and combined treatment of dyslipidemia in patients with hypothyroidism to reduce the risks linked to cardiovascular diseases.

INTRODUCTION

Hypothyroidism is a general endocrine disorder, which is defined as inappropriate production of thyroid hormones, primarily triiodothyronine (T3) and thyroxine (T4). The Thyroid gland is a butterfly-shaped gland comprising of right and left lobes that are bulbous in shape and joined by a narrow segment known as isthmus at the centre. Located in the neck, the thyroid has been found to surround the anterior trachea just below the larynx in the vertebrae C5 to T1. This secretes and synthesizes these hormones and the weight of these hormones is about 5 cm tall, 5 cm wide, and 20-30 g in an adult, with the thyroid of the female being a little heavier. Thyroid hormones play a major role in many physiological activities, including metabolic, growth and development, thermoregulation, and cardiovascular activities. Poor thyroid hormone concentration leads to slowing down of metabolism, which may generate several clinical phenomena with serious implications on the general health and quality of life of a person.[1]

Hypothyroidism is a disorder in which thyroid hormones T3 and T4 are transported at a reduced rate than normal, and this results in high TSH rates. It may lead to hypercholesterolemia, hyper-LDL, and hypertriglyceridemia increasing the risk of cardiovascular diseases because of bad lipid profiles and metabolic alterations.[2] Signs become seen when TSH rises above 10mIU/L. In subclinical hypothyroidism, the level of TSH increases to a certain degree, and T3 and T4 are found within their normal serum range. Hypothyroidism is more common in women and older people.[3]

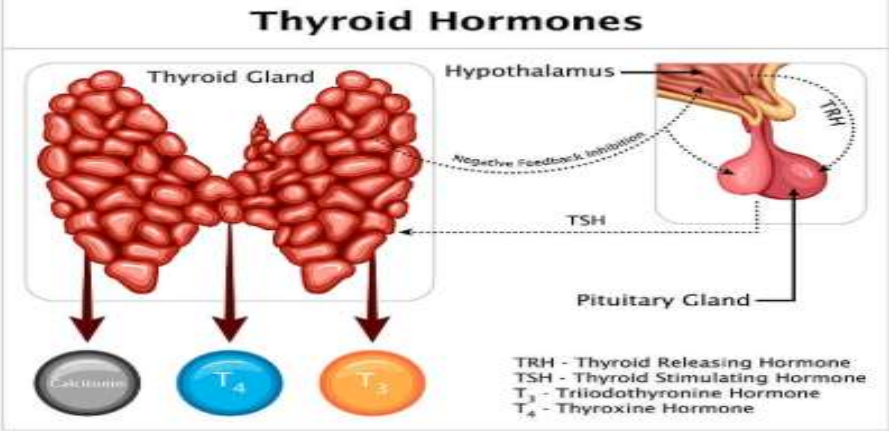

Figure 1 Thyroid Gland Releasing Thyroid Hormones

Hypothyroidism is broadly classified into primary, secondary, and tertiary types. **Primary hypothyroidism**, the most common form, results from thyroid gland disease and appears as either overt (high TSH typically >10 mU/L with low free T4) or subclinical (elevated TSH with normal T3/T4), both showing reduced thyroid hormones with compensatory TSH elevation. **Secondary hypothyroidism** arises from pituitary damage often due to adenomas leading to low TSH and low thyroid hormones. **Tertiary hypothyroidism** stems from hypothalamic or portal system dysfunction, causing low TRH, low TSH, and low thyroid hormone levels. Hypothyroidism is especially common worldwide, particularly among elderly individuals and women, with reported prevalence rates of about 10.95% in India and 4.1% in Pakistan.[4]

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ASSOCIATION BETWEEN HYPOTHYROIDISM AND DYSLIPIDEMIA

The intestines absorb lipids, which consist of cholesterol and triglycerides, and carry them all around the body (with the help of lipoproteins) to either produce energy, make steroids, or produce bile acids. These pathways are facilitated by lipid parameters. When any of these factors is imbalanced as a result of organic or non organic factors, it may lead to dyslipidaemia which refers to an imbalance in the circulating lipids.[5]

The most prevalent thyroid condition is known as primary hypothyroidism and thyroid in itself is known to cause a large concentration of serum Thyroid Stimulating Hormones (TSH) and a reduced amount of Thyroxine (T4) hormone. In this way the hypothyroidism will also lead to decreased LDL-C.[6]

Abnormalities in lipids in hypothyroid patients are characterized by high concentrations of total lipids, LDL and triglycerides. Further, there is a possible change in the HDL and VLDL further complicating the lipid profile. Lipid abnormalities in hypothyroidism are complicated in their mechanisms. The first one is the reduced expression of the hepatic LDL receptors that impede the clearance of LDL-C leading to its build-up in the bloodstream. Moreover, a decrease in the lipoprotein lipase activity causes the inability to hydrolyze lipoproteins with triglyceride concentrations, which is a result of hypertriglyceridemia. Hypothyroidism compromises the production of bile acids and slows the elimination of lipoproteins containing cholesterol, which worsens dyslipidaemia in people with hypothyroidism.[7]

Several changes in the body cause hypothyroidism, including decreased LDL receptor activity, which slows LDL-C clearance, decreased lipoprotein lipase activity, which elevates triglycerides, and decreased bile acid production, which exacerbates cholesterol buildup. Even in subclinical hypothyroidism, where TSH is elevated but thyroid hormones are normal, moderate increases in LDL-C and total cholesterol can occur, implying that even minor thyroid malfunction can have a deleterious impact on lipid metabolism. Because these alterations may raise the risk of atherosclerosis and cardiovascular disease, early detection and treatment of thyroid-related lipid abnormalities is critical.[8,9]

Two studies indicate that dyslipidemia in hypothyroidism is associated with increased risk of heart disease (CVD)[10]; in certain cases, TSH in the upper reference range is positively correlated with total cholesterol (TC) and LDL-C, and negatively correlated [11] with HDL.[12] It was demonstrated that total cholesterol (TC) and LDL-C decreased the treatment with thyroxine in people whose TSH was in the upper reference range.[13]

The purpose of this study is to assess the change in lipid profiles of the patients with hypothyroidism taking into account the substantial effect of a condition on lipid metabolism and its consequences on the heart health. The study aims at finding out co-relations among TSH and some lipid measures including triglycerides, total cholesterol, HDL-C, LDL-C, and VLDL-C. This study will explain the lipid abnormalities that are specific to thyroid dysfunction and thus enhance our understanding of metabolic consequences of hypothyroidism and guide clinical practice of dyslipidaemia in elderly individuals.

MATERIALS AND METHODS

4.1 Study Design:

The study was cross-sectional observational study.

4.2 Study Setting:

The study was conducted at different hospitals. The study was included both inpatients from the hospital wards and outpatients from the OPD. After obtaining written informed consent, a detailed medical history was recorded for each participant. A thorough clinical, biochemical, and radiological assessment was performed to correlate TSH with dyslipidemia in hypothyroid patients.

4.3 Study Duration:

The study was conducted after the approval of synopsis.

4.4 Sample Size:

The sample size was consisting of 150 participants.

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4.5 Inclusion Criteria:

Adults (18-70 years) with hypothyroidism (OH: TSH above 10 mIU/L, low fT4, SCH: TSH 4.5-10 mIU/L, normal fT4) will be identified.

- None taking lipid lowering therapy.
- Patients who are ready to give an informed consent to take part in the study.

4.6 Exclusion Criteria

- Those patients that did not give consent.
- Those patients who have severe left ventricular dysfunction, chronic kidney disease (CKD) stage 3-4, decompensated chronic liver disease (CLD), or malignancies will be excluded.
- Pregnant women, diabetics and statin users.

A total of **100 hypothyroid patients** were included in the study. The mean age of the participants was **44.8 ± 17.3 years**, and **57% were male**, while **43% were female**. Elevated TSH levels were found in **63%** of the study population.

Distribution of TSH Levels

Among the 100 participants, 63 patients had high TSH levels, and 37 Patients have normal TSH indicating that more than half study population fell within the hypothyroid range. This distribution shows the individuals with elevated TSH, making it suitable for assessing the relationship between thyroid dysfunction and other biochemical parameters.

RESULTS

Table :1 Distribution of TSH Levels

TSH	Frequency	Percent %
Normal	37	37.0
High	63	63.0
Total	100	100.0

Distribution of Lipid Profile Parameters

The lipid profile distribution shows most hypothyroid patients fall into the borderline or high-risk categories for all lipid parameters, with fewer remaining normal. Total Cholesterol, HDL, LDL, and Triglycerides all show high-risk percentages above 40%, indicating a strong presence of dyslipidemia in this population and suggesting that hypothyroidism is associated with significant lipid abnormalities

Table 2 Distribution of Lipid Profile Parameters

Lipid Parameter	Normal	Borderline	High Risk	Total
Total Cholesterol	27	29	44	100
Triglyceride	44	15	41	100
HDL	36	19	45	100
LDL	44	15	41	100
VLDL	43	23	34	100

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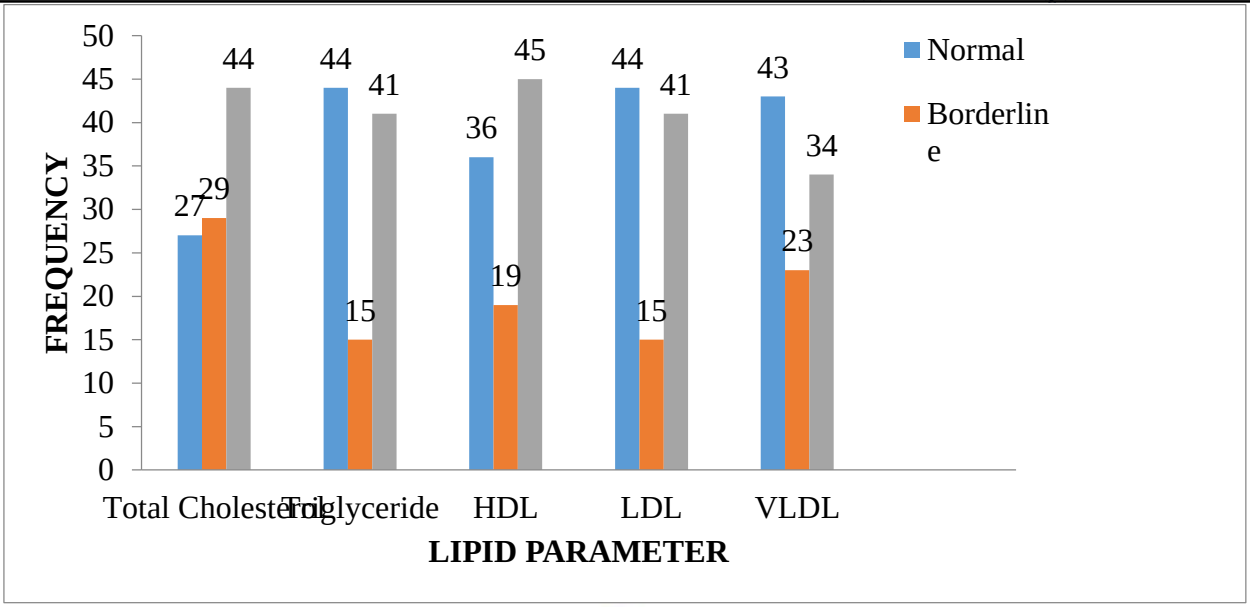

Figure 2 Distribution of Lipid Profile Parameters

Table: 3 Correlation Between Thyroid Function and Lipid Profile

Variables	Measure	Total Cholesterol	HDL	LDL	VLDL	Triglyceride	TSH
HDL	Correlation Coefficient	-0.719	1.000	-0.678	-0.714	-0.697	-0.354
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000
	N	100	100	100	100	100	100
Total Cholesterol	Correlation Coefficient	1.000	-0.719	0.715	0.771	0.736	0.577
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000
	N	100	100	100	100	100	100
LDL	Correlation Coefficient	0.715	-0.678	1.000	0.759	0.784	0.534
	Sig. (2-tailed)	.000	.000	.	.000	.000	.000
	N	100	100	100	100	100	100
VLDL	Correlation Coefficient	0.771	-0.714	0.759	1.000	0.774	0.485
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000
	N	100	100	100	100	100	100
Triglyceride	Correlation Coefficient	0.736	-0.697	0.784	0.774	1.000	0.496
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000
	N	100	100	100	100	100	100
TSH	Correlation Coefficient	0.577	-0.354	0.534	0.485	0.496	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.
	N	100	100	100	100	100	100

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DISCUSSION

This study showed a high prevalence of dyslipidemia in hypothyroid patients, with significant correlations between elevated TSH and higher total cholesterol, LDL, VLDL, and triglycerides, along with reduced HDL. These findings confirm that worsening thyroid dysfunction is closely associated with an atherogenic lipid profile. Our results are consistent with previous research showing that hypothyroidism leads to increased TC, LDL, and triglycerides across different populations. Studies have repeatedly reported similar lipid disturbances in thyroid dysfunction, supporting our findings.[14] The physiological mechanisms further explain these associations. Reduced thyroid hormone activity decreases LDL receptors, slows lipid clearance, and lowers lipoprotein lipase activity all contributing to elevated LDL, VLDL, and triglycerides, and reduced HDL.[15] Clinically, the findings highlight the importance of routine lipid screening in hypothyroid patients due to their increased cardiovascular risk. Elevated TSH may serve as an indicator for predicting more severe lipid abnormalities, helping guide early management.[16]

Hypothyroidism, including its mild subclinical form, frequently causes disruptions in lipid metabolism due to decreased LDL receptor activity, lipoprotein lipase function, and bile acid synthesis, all of which produce increases in LDL-C, total cholesterol, and triglycerides. Even when thyroid hormone levels are adequate, such as in subclinical hypothyroidism, high TSH can contribute to lipid abnormalities, potentially increasing the risk of atherosclerosis and cardiovascular disease. Early detection and treatment of thyroid disease is therefore critical to reducing associated cardiovascular risks.

Conclusion

The current research determined the relationship between Thyroid-Stimulating Hormone (TSH) and dyslipidemia in hypothyroid patients in Lahore. It revealed the definite trends of lipid disorders in the whole study population, and most of patients have had an increased level of Total Cholesterol, LDL, VLDL, and Triglycerides and reduced HDL. All these abnormalities indicate an atherogenic lipid profile which is commonly seen in hypothyroidism. The analysis of Spearman correlation showed high positive correlation between TSH and Total Cholesterol, LDL, VLDL, and Triglycerides, and a negative correlation between TSH and HDL. The results of this study may indicate that deterioration of thyroid dysfunction, which may be denoted by higher levels of TSH, correlates with more severe dyslipidemia. The correlations observed are similar to the studies conducted at the international and regional levels, which prove that the interaction between thyroid hormones and lipid metabolism is strong in terms of metabolism. The paper concludes that hypothyroidism is also strongly linked with lipid derangements that can predispose the patients to cardiovascular problems. Lipid profile parameter monitoring needs to be a part of clinical assessment and treatment of hypothyroid patients, then. Timely diagnosis and effective treatment can be used to avert the existence of long-term cardiovascular risks with thyroid dysfunction.

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