

THYROID DYSFUNCTION AND ITS EFFECT ON SERUM LIPIDS

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ABSTRACT

Objectives: To evaluate the incidence of thyroid dysfunction and to investigate the chemical changes in serum lipids under the influence of thyroid dysfunctions.

Material and Methods: This study was conducted in Pakistan Medical Research Centre (PMRC), Khyber Medical College, Peshawar, Pakistan from January 2011 to August 2014. Blood samples and data were collected from patients attending the Institute of Radioactive Nuclear Medicine (IRNUM) Peshawar, Pakistan. A Total of 600 cases were included in this study out of which 214 were euthyroid, 195 and 191 were hyperthyroid and hypothyroid respectively.

Results: The study subjects are divided into three groups on the basis of hormonal assay for the three parameters i.e. thyroid stimulating hormone (TSH), tri-iodo thyronine (T3), tetra-iodo thyronine (T4). The Euthyroid group which includes healthy individuals serves as control. The level of significance chosen as 0.05 and p-values were calculated.

Conclusion: Thyroid dysfunctions are more prevalent in females, total Cholesterol (TC), Triglyceride (TG) and Low Density Lipo Protein Cholesterol (LDL-C) levels are positively correlated with hyperthyroidism as well as hypothyroidism, whereas High Density Lipo Protein Cholesterol (HDL-C) has no significant relation with thyroid dysfunction.

Key Words: Thyroid dysfunction, Lipid profile, Hyperthyroid, Hypothyroid, Euthyroid.

INTRODUCTION

Lipid metabolism is affected by thyroid diseases. The structure of lipoproteins will undergo change if thyroid function is altered in any way. Similarly, the transport of lipoproteins will also be affected in consequence of thyroid dysfunction.¹ It was suggested that the values of cholesterol, triglyceride and LDL-C were elevated in hypothyroidism when compared with hyperthyroidism or euthyroidism, however no difference was found in HDL-C between hypothyroidism and Euthyroidism.²

Thyroid dysfunction of hypothyroid state is related to high levels of TG, lipoprotein i.e. LDL-C, and lower HDL-C value. Further correlation between serum TSH and serum TG, HDL-C are highly significant.³ Thyroid dysfunction affects lipid profile, such that in hyperthyroidism, LDL and serum TG levels are much lower, whereas in hypothyroidism the TG and LDL-C values are elevated.⁴ Studies have established a significant link between thyroid diseases and serum lipids. This is so because the synthesis, composition and transport of lipids are greatly dependent on the thyroid hormone.

Thus, thyroid diseases significantly alter the mobilization and composition of lipids.⁵

A linear increase in TG, LDL -C and TG and a linear decrease in HDL-C has been observed with increasing TSH. It is well known that alterations in thyroid function result in changes in composition and transport of lipoproteins. Thyroid function significantly affects lipoproteins.⁶ In hyperthyroidism a decrease in HDL-C levels is observed, due to increased mediated transfer of cholesterol esters from HDL to VLDL and enhanced HL-mediated catabolism of HDL.⁷ Cholesterol level tend to increase in hyperthyroidism due to augmented excretion of cholesterol by bile together with enhanced receptors mediated catabolism of LDL particles.⁸

Furthermore, in hyperthyroid illness there is an increase in LDL oxidability which depends on serum T4 levels, however TG levels remain unaltered.⁹ Variation observed in TG levels could be due to the action of VLDL, accelerated in hyperthyroidism which is probably related to changes in activity of lipoprotein lipase and hepatic TG lipase.⁹ LDL-C and TG values were decreased while HDL-C value was increased.¹⁰

MATERIAL AND METHODS

This study was conducted in Pakistan Medical Research Centre (PMRC), Khyber Medical College, Peshawar, Pakistan. Blood samples and data were collected from patients attending IRNUM Peshawar, Pakistan.

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Serum TG, TG was assayed through Peroxidase Amino Antipyrine (PAP) enzymatic colorimetric method whereas, HDL-C was measured through precipitation of VLDL-C using kit provided by MERCK and LDL-C was determined by the homogenous enzymatic calorimetric method using Cobass C-III auto analyzer system. The student "t" and "z" test are being used to find out the significance between two values, in various diseased groups. Frequencies, p-value, and other descriptive analysis were used to compare different parameters, using computer software SPSS version 16.

RESULTS

The selected cases were distributed on the basis of thyroid function tests (TSH, T3 and T4) which shows a statistically considerable variation in T3 in hypothyroid (3.31 ± 0.128 pmol/L) and in hyperthyroid (6.98 ± 0.367 pmol/L) when compared to the mean in controls i.e. euthyroid (3.92 ± 0.143 pmol/L). The results show statistically major variance in T4 in hypothyroid (10.71 ± 0.637 pmol/L) and in hyperthyroid (34.75 ± 1.640 pmol/L) compared to the mean in controls i.e. euthyroid (17.10 ± 0.332 pmol/L). The study also shows transformations in TSH i.e. in hypothyroid (31.47 ± 1.628 uIU/ml) and in hyperthyroid (0.25 ± 0.003 uIU/ml) compared to the mean in controls i.e. euthyroid (1.77 ± 0.130 uIU/ml).

TSH shows non significant relation with all the parameters of lipid profile except in the case of HDL-C. However a positive correlation was observed between T3 and TG, TG and VLDL-C. TSH shows a positive co-relation with HDL-C. The association of thyroid function tests with lipid profile of hypothyroid patients, is considered highly significant. The TSH and T4 both are significantly associated with TG and LDL- C, conversely T3 shows non significant association with all the parameters of lipids.

The associations developed for different parameters of total lipids when compared with hyperthyroid state, as the results were found to be highly significant. The only non significant result i.e. $p > 0.005$ was observed for High Density Lipoprotein Cholesterol. The positive correlation was observed between Low Density Lipoprotein Cholesterol, Triglyceride and Very Low Density Lipoprotein Cholesterol. Where as in case of Total Cholesterol, High Density Lipoprotein Cholesterol the correlation is positive but not significant. The correlation values of hypothyroid subjects and lipid profile were found to be negative for TG and LDL-C. However the r-value is positive for the other three parameters.

DISCUSSION

The aspiration of this research was to compare the values of TSH, T3 and T4 with thyroid dysfunction. This study also demonstrates the descriptive statistics of lipid profile, in hyperthyroid and hypothyroid patients respectively.

In our study the mean difference was significant for TSH and T4 and non significant for T3 in the same group. These findings are in accordance with the study of Tayal. D. et al.¹¹ The association of TFTs with hypothyroidism which is statistically significant ($p=0.005$) for T3. The difference is highly significant for TSH and T4 as ($p=0.000$). Hypothyroidism is an observable fact. Due to the deficiency of thyroid hormone, a biochemical abnormality is present but is asymptomatic. Although in some severe cases the danger exists resulting in life-threatening illness. According to these results, lipid metabolism is remarkably affected in hypothyroidism, especially in patients with increased TSH level comparable with the studies suggesting that even a minor increase in the TSH level is associated with significant changes in lipid profile. Thus Hyperlipidemia is a direct consequence of Hypothyroidism which is also confirmed by the present study.

The association of Hypothyroidism with lipid disorders is confirmed by achieving improvement in the altered conditions of lipid parameter characterized by normal or increased TSH, LDL-C and decreased HDL-C levels, when treated with thyroxin suppressive dose. According to the research of Prakash and Constantini, the hypothyroid state is related to increased level of TG, TG and LDL-C and lower HDL-C, when compared with Euthyroidism or hyperthyroidism.^{2,3} T4 and TSH is negatively correlated with TG, TG, LDL-C and VLDL-C, whereas T3 has positive relation with TG, TG and VLDL-C and is negatively correlated with HDL-C and LDL-C.

The descriptive of lipid profile and TFTs found significant variation of TSH with TG and LDL-C ($p=0.001$). These findings are alike with the study of Nananda, F et al.¹⁴ The current study demonstrates that there was no statistical significance in the mean difference of T3 ($p>0.005$) for all the parameters of total lipids. While the association between T4 and lipid profile is highly significant with TG ($p=0.000$) and with LDL-C ($P = 0.002$). Studies confirm the occurrence of a contrary association between T4 and cholesterol. The present data pertaining to an explicit association/correlation linking thyroid hormones and triglyceride is more controversial to the Study of Prieur, X et al.¹² This study articulates that there is increase of triglycerides in

hypothyroidism differentiated by reduced content of VLDL-C, TG which is appropriate to bargain movement of lipoprotein lipase and of hepatic triglyceride lipase. A general correlation between thyroid hormones and lipid metabolism is well established. Studies confirm the presence of inverse relationship between T4 and TG. Other studies demonstrate the influence of T3 on the catabolism of VLDL showing increase in LDL and VLDL fractions. However the data concerning a definite correlation between thyroid hormones and TG is more controversial, suggesting that there is elevation of TG in hypothyroidism characterized by decreased clearance of VLDL-C, TG.¹

According to this study the comparison of lipid profile is highly significant in case of hyperthyroidism when compared with the control group except for HDL-C which is highly non-significant. Whereas in case of hypothyroidism the results for TG and LDL-C are highly significant whereas HDL-C, VLDL-C and TG have non-significant results. These results are agreeing with other studies^{16,17,18,19}. This study was carried out to establish the effect of hyperthyroidism on cholesterol metabolism. At the same time thyroid dysfunction can alter the different lipoprotein cholesterol fractions LDL-C. A similar result has been reported beforehand by Sachs, Wolfman, and Murth and Scottolini et al.^{20,21}

There was reduction of blood cholesterol level and HDL in patients suffering from hyperthyroidism as compared to euthyroidism. But this extent of reduction was statistically significant except in the case of HDL-C. Interestingly, we got a significant increase in concentration of blood cholesterol and LDL-C in subjects having hypothyroidism. These findings are clashing with the study output of Gaitan, E²², but were in accordance to the findings of Saha, M et al²³ and Prakash, A³. Furthermore, level of triglycerides has been found to be slightly increased in patients of hypothyroidism as compared to hyperthyroidism. These results are comparable.²⁴

CONCLUSION

There is a significant association between hypothyroidism and lipid disorders having normal or raised total cholesterol levels, elevated LDL-C and lower HDL-C. This may be due to genetic factors, lack of physical exercise, metabolic disorders like hypothyroidism and hyperthyroidism, severe stress and socioeconomic conditions. Sex may also be the contributory factors for this dysfunction.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Attaullah S: Conceived the idea, manuscript writing.

Mohammadzai I: Drafting the manuscript.

Ahmad J: Data collection.

Haq BS: Critical revision.

Wadood U: Statistical analysis.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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