Section: Physiology

Original Research Article

COMPARISON OF LIVER FUNCTION TESTS IN HYPOTHYROID AND EUTHYROID FEMALES ATTENDING A TERTIARY CARE HOSPITAL - A COMPARATIVE STUDY

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Abstract

Background: Thyroid hormones are essential for metabolism, which includes liver function. Hepatic physiology is known to be impacted by hypothyroidism, which may result in changes to liver function tests (LFTs). Still up for debate, though, is how much these modifications differ from those of euthyroid people. This study aims to compare liver function test parameters between hypothyroid and euthyroid females attending a tertiary care hospital. **Materials and Methods:** A comparative study was conducted among female patients diagnosed with hypothyroidism (47) and euthyroid controls (47). Thyroid profile and Liver function parameters, were assessed and compared between two groups and analysed statistically. **Result:** The study revealed significant differences in LFT parameters between hypothyroid and euthyroid females. Hypothyroid patients exhibited elevated ALP, ALT, AST and total bilirubin level indicating a potential impact of thyroid dysfunction on hepatic function. On comparing Hypothyroid and Euthyroid we found Statistically significant results between LFT parameters and Thyroid profile ($p<0.05$). **Conclusion:** Significant changes in liver function are linked to hypothyroidism, which highlights the necessity of routine LFT monitoring in those who are affected. Complications may be avoided if hepatic abnormalities in hypothyroid patients are identified and treated early.

INTRODUCTION

Thyroid gland is essential for controlling metabolism, development and other physiological processes, including liver function. There is an intricate link between the thyroid and liver which is shown by the fact that thyroid hormones affect hepatic metabolism, bilirubin clearance, and enzyme function. Liver also controls metabolism of thyroid hormones, activation, and degradation. Studying the interplay between liver and thyroid is vital because any dysfunction in one can significantly affect the functioning of other.[1,2]

Globally, a significant percentage of people suffer from hypothyroidism.

Depending upon the iodine intake, age, and heredity, the incidence can vary significantly. In India, hypothyroidism is a serious public health concern. According to studies, India has a far greater frequency than many developed countries.[3]

A study found that among the adult study population in eight Indian cities, the total prevalence of hypothyroidism was found to be 10.95%.[4] It is also commonly known that women are significantly more likely than men to have hypothyroidism.[5]

Among the biochemical alterations associated with hypothyroidism, a condition characterised by decreased thyroid hormone synthesis, are changes in liver function tests (LFTs). Alkaline phosphatase (ALP), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) have been found to be elevated in hypothyroid people in a number of investigations, suggesting potential hepatic dysfunction. Moreover, changes in protein synthesis and anomalies in bilirubin metabolism have also been noted. These alterations are thought to be caused by

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a number of causes, including altered bile flow, building up of fat, and impaired hepatic metabolism, however the precise mechanisms are still being studied. As there is little data comparing the liver function parameters of hypothyroid and euthyroid females, especially in the Indian population, despite these correlations, we aimed to measure the biochemical markers of hepatic function in hypothyroid and euthyroid females attending a tertiary care and to compare these parameters.

MATERIALS AND METHODS

After obtaining Institutional Ethics Committee approval this Comparative study was conducted among the 94 patients at a tertiary care hospital to compare liver function test (LFT) parameters between hypothyroid (47) and euthyroid (47) females.

Inclusion Criteria

Female patients between 18 – 50 years, newly diagnosed with hypothyroidism and those with normal thyroid function (euthyroid), attending the endocrinology OPD or attending the hospital for routine check-ups or Master Health checkup and those who have given written informed consent were included in the study.

Exclusion Criteria

Previous liver diseases, taking hepatotoxic drugs, alcoholism, adults with known psychiatric illness, acutely ill patients, diabetes, hypertension, pregnant and lactating mothers were excluded from the study.

After obtaining relevant clinical history, demographic details and thyroid function test results (TSH and T4) were collected. Under aseptic precautions 4 ml of blood samples were collected for analyzing LFT parameters, using fully automated cobas 6000 analyzer. Serum bilirubin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total protein, and albumin levels were measured. Unpaired t test was used as Statistical test to compare the LFT values between the two groups.

RESULTS

Table 1: Characteristics of patients.

Variables	Euthyroid (n = 47)	Hypothyroid (n = 47)	p-value
Age (years)	45.04 ± 3.68	45.37 ± 3.48	0.6562
FT4 (mg/dL)	1.37 ± 0.17	0.62 ± 0.18	0.0001*
TSH (mIU/mL)	2.60 ± 0.83	28.69 ± 24.32	0.0281*

*p = <0.05 considered as significant

The [Table 1] shows the Characteristics of patients. The mean & SD of age among Euthyroid and hypothyroid are 45.04 ± 3.68 and 45.37 ± 3.48 years respectively. The mean & SD of FT4 and TSH among Euthyroid are 1.37 ± 0.17 and 2.60 ± 0.83. The mean & SD of FT4 and TSH among Hypothyroid are 0.62 ± 0.18 and 28.69 ± 24.32. On comparing Euthyroid and hypothyroid individuals we found statistically significant with FT4 (0.0001), TSH (0.0281).

Table 2: Liver Function test among Euthyroid and Hypothyroid

Variables	Euthyroid (n = 47)	Hypothyroid (n = 47)	p-value
Total Bilirubin (mg/dl)	0.53 ± 0.90	0.84 ± 0.37	0.0315*
ALT (IU/L)	24.82 ± 1.21	33.56 ± 4.21	0.0267*
AST (IU/L)	28.12 ± 3.52	35.85 ± 0.17	0.0061*
ALP (IU/L)	73.91 ± 0.79	95.07 ± 0.25	0.0011*
Total Serum protein (g/dl)	8.96 ± 1.04	10.18 ± 1.32	0.0401*
Albumin (g/dl)	4.34 ± 1.25	4.28 ± 0.91	0.0600

*p = <0.05 considered as significant

Liver Function test among Euthyroid and Hypothyroid were demonstrated in the table 2. The liver function test parameters like Total serum Bilirubin, ALT, AST, ALP and Total serum protein were increased among the hypothyroid patients than the Euthyroid patients. In our study only Serum Albumin was elevated more in Euthyroid individuals than the hypothyroid patients. On comparing two groups we found statistical significance for Total serum Bilirubin (0.0315), ALT (0.0267), AST (0.0061), ALP (0.0001) and Total Serum protein (0.0401).

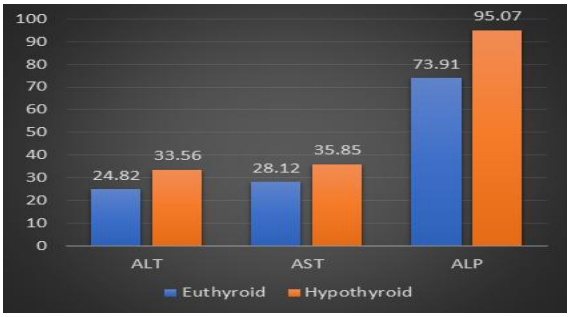

Figure 1: shows AST, ALT, ALP among two groups

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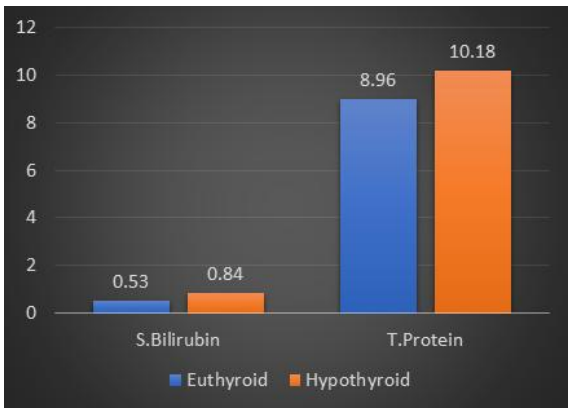

Figure 2: shows Serum Bilirubin and Total serum protein among two groups

DISCUSSION

Our study compared the liver function test (LFT) parameters in hypothyroid and euthyroid females who were attending a tertiary care hospital. Thyroid hormones are peculiar in the fact that they are the only amine hormones containing iodine in the vertebrates. These hormones greatly control oxygen consumption and rate of metabolism of all cells including hepatocytes.[6] Hepatic metabolism is known to be impacted by thyroid dysfunction, and our results are consistent with previous research that links hypothyroidism to changes in liver function. Our study observed significantly elevated levels of serum ALT, AST, ALP, total serum protein and total bilirubin in hypothyroid females compared to their euthyroid counterparts.

A similar comparative study by Hasan AH et al found that the levels of ALT, ALP, and AST are elevated among hypothyroid patients.[7] Another similar comparative study by Tamang B et al found that compared to euthyroids, hypothyroids had noticeably greater levels of liver enzymes and blood bilirubin which is exactly same as our present study results. In both the study, the serum albumin levels were significantly lower in the hypothyroid group.[8]

Yadav A et al did a study and found Serum ALT, AST, ALP, and total protein levels were considerably higher in subjects with overt hypothyroidism than in controls, while subclinical hypothyroid patients also had significantly higher levels of these parameters. Furthermore, in overt hypothyroidism, FT3 and FT4 had a negative connection with AST, while TSH demonstrated a strong positive correlation with both AST and ALP readings.[9]

Another study by Ajala MO et al found Total Bilirubin among the Hypothyroid were increased when compared with Euthyroid and the same finding were observed in our study with statistical significance p = (0.0315).[10]

Other studies by Chung GE et al and D'Ambrosio R et al showed liver function test parameters are increased among hypothyroid group and also indicated that most of the hypothyroid patients had associated Non-alcoholic fatty liver disease.[11,12] Yet another study by He W et al also reported the same findings.[13]

Abnormalities of liver enzymes in hypothyroidism occurs due to alteration in metabolism of lipids, hypothyroid myopathy or because of hepatic steatosis.[7] Thyroxine deficiency can cause decrease in mitochondrial oxidative capacity, glycogenolysis becomes abnormal and the cells become resistant to insulin. All these factors result in atrophy of type 2 muscle fibres selectively which are dependent on glycolysis for energy. As a compensatory mechanism to this loss, there occurs increased accumulation of glycosaminoglycans in the muscle, increase in connective tissue and increase in muscle fibres occur which results in muscle hypertrophy. Decreased ATP turnover, decreased myosin ATPase activity and decreased contractility of actin myosin units can lead to muscle involvement. Due to changes in permeability of muscle cell membrane the serum muscle enzyme levels get increased even in the absence of symptoms or abnormalities in the structure of the muscle.[14]

There are several reasons for the changes in liver function measures observed in hypothyroid people, such as reduced hepatic blood flow, modified lipid metabolism, and a general decline in metabolic rate. Hepatic dysfunction may result from a lack of thyroid hormones, which are essential for preserving healthy liver function.[15,16]

In hypothyroidism due to increased ratio between membrane cholesterol and phospholipid, the fluidity of cell membrane gets altered resulting in changes the number of transporters in canalicular membrane and the changes are also seen in the enzymes, including sodium potassium ATPase which results in increased ALP levels.[9]

In hypothyroidism activity of hepatic bilirubin UDP glucuronyl transferase is increased while activity of p-nitrophenol transferase is decreased. There occurs a 50% decline in bile flow, excretion of bile salts and an increased serum levels of conjugated bilirubin occurs.[17]

CONCLUSION

Our study highlighted the relationship between thyroid dysfunction and hepatic health. In contrast to their euthyroid counterparts, the results show that hypothyroid participants had higher levels of liver enzymes, including ALT, AST, and ALP, as well as different bilirubin and protein profiles. These data show that hypothyroidism may contribute to subclinical hepatic impairment, presumably due to metabolic derangements, lower hepatic blood flow, or downstream consequences such as non-alcoholic fatty liver disease (NAFLD). In the end, treating hypothyroidism holistically—that is, by addressing hepatic and endocrine health—may enhance patient outcomes and lessen systemic problems.

REFERENCES

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1. Piantanida E, Ippolito S, Gallo D, Masiello E, Premoli P, Cusini C, Rosetti S, Sabatino J, Segato S, Trimarchi F, Bartalena L. The interplay between thyroid and liver: implications for clinical practice. Journal of endocrinological investigation. 2020 Jul;43:885-99.
2. Marino L, Kim A, Ni B, Celi FS. Thyroid hormone action and liver disease, a complex interplay. Hepatology. 2025 Feb 1;81(2):651-69.
3. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian journal of endocrinology and metabolism. 2011 Jul 1;15(Suppl2):S78-81.
4. Unnikrishnan AG, Kalra S, Sahay RK, Bantwal G, John M, Tewari N. Prevalence of hypothyroidism in adults: An epidemiological study in eight cities of India. Indian journal of endocrinology and metabolism. 2013 Jul 1;17(4):647-52.
5. Meng Z, Liu M, Zhang Q, Liu L, Song K, Tan J, Jia Q, Zhang G, Wang R, He Y, Ren X. Gender and age impacts on the association between thyroid function and metabolic syndrome in Chinese. Medicine. 2015 Dec 1;94(50):e2193.
6. Ajayi AF, Akhigbe RE. Implication of altered thyroid state on liver function. Thyroid research and practice. 2012 Sep 1;9(3):84-7.
7. Hasan AH, Abdulzahra MA, Hashim AM, Al-Mawlah YH. Biochemical markers of liver function test (ALT, AST, ALP) in thyroid dysfunction (hyperthyroidism and hypothyroidism). Journal of Biotech Research. 2024;16:167-74.
8. Tamang B, Harijan K, Pokhrel BR, Karki M, Shrestha J, Gautam N, Sharma BK, Yadav T, Sah SK. Liver Function Test Parameters in Hypothyroid Patients Visiting Tertiary Care Center of Western Nepal: A Cross-Sectional Study. Journal of National Medical College. 2023 Jul 30;8(1):68-73.
9. Yadav A, Arora S, Saini V, Arora MK, Singh R, Bhattacharjee J. Influence of thyroid hormones on biochemical parameters of liver function: a case-control study in North Indian population. Internet Journal of Medical Update-EJOURNAL. 2013 Feb 1;8(1).
10. Ajala MO, Ogunro PS, Fasanmade OA. Relationship between liver function tests and thyroid hormones in thyroid disorders. Nigerian Postgraduate Medical Journal. 2013 Jul 1;20(3):188-92.
11. Chung GE, Kim D, Kim W, Yim JY, Park MJ, Kim YJ, Yoon JH, Lee HS. Non-alcoholic fatty liver disease across the spectrum of hypothyroidism. Journal of hepatology. 2012 Jul 1;57(1):150-6.
12. D'Ambrosio R, Campi I, Maggioni M, Perbellini R, Giammona E, Stucchi R, Borghi M, Degasperi E, De Silvestri A, Persani L, Fugazzola L. The relationship between liver histology and thyroid function tests in patients with non-alcoholic fatty liver disease (NAFLD). PLoS One. 2021 Apr 6;16(4):e0249614.
13. He W, An X, Li L, Shao X, Li Q, Yao Q, Zhang JA. Relationship between hypothyroidism and non-alcoholic fatty liver disease: a systematic review and meta-analysis. Frontiers in endocrinology. 2017 Nov 29;8:335.
14. Sindoni A, Rodolico C, Pappalardo MA, Portaro S, Benvenga S. Hypothyroid myopathy: a peculiar clinical presentation of thyroid failure. Review of the literature. Reviews in Endocrine and Metabolic Disorders. 2016 Dec;17:499-519.
15. Yorke E. Co-Morbid Hypothyroidism and Liver Dysfunction: A Review. Clinical Medicine Insights: Endocrinology and Diabetes. 2024 Feb;17:11795514241231533.
16. Malik R, Hodgson H. The relationship between the thyroid gland and the liver. Qjm. 2002 Sep 1;95(9):559-69.
17. Van Steenbergen W, Fevery J, De Vos R, Leyten R, Heirwegh KP, De Groote J. Thyroid hormones and the hepatic handling of bilirubin. I. Effects of hypothyroidism and hyperthyroidism on the hepatic transport of bilirubin mono-and diconjugates in the Wistar rat. Hepatology. 1989 Feb 1;9(2):314-21.

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