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Examining the relationship between non-alcoholic fatty liver disease and hypothyroidism

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Abstract

One of the most prevalent endocrine system disorders with lifetime repercussions on health is hypothyroidism. Due to inadequate thyroid secretion, this illness results in thyroid dysfunction. One of the common liver ailments, non-alcoholic fatty liver disease (NAFLD), denotes the buildup of fat in the liver without consuming alcohol. NAFLD and hypothyroidism frequently coexist, and the development of NAFLD may be influenced by the condition.

Keywords: Hypothyroidism, Non-alcoholic fatty liver disease, Endocrine abnormalities

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Introduction

The liver is a crucial organ for the body's various physiological functions, including the regulation of blood volume, immune system function, fat and cholesterol balance, and the metabolism of macronutrients (1). Protein synthesis and the metabolism of several hormones both depend on the liver. As a result, several endocrine abnormalities are linked to liver ailments (2). The largest gland in the body, the liver is primarily in charge of the environmental conversion of tetraiodothyronine (T₄) to triiodothyronine (T₃), which is a crucial step in the metabolism of thyroid hormones (3). Thyroid hormones (T₃ and T₄) are responsible for regulating various functions of the body, including the metabolism of lipids and carbohydrates, oxygen consumption, and some physiological functions such as reproduction and growth (4). The rate of metabolism of liver cells is regulated by thyroxine and triiodothyronine. On the contrary, thyroid hormone metabolism occurs in the liver, which also controls the systemic effects of these hormones. As a result, liver disease may interfere with the metabolism of thyroid hormones whereas thyroid dysfunction may affect liver function (5). One of the most prevalent chronic liver illnesses is a non-alcoholic fatty liver disease (NAFLD) (6). Thyroid dysfunction, especially hypothyroidism, has been associated with it (7). It has been shown that decreased thyroid hormone concentrations may cause hyperlipidemia and obesity, thereby causative to NAFLD (8). Despite the exact physiological mechanism of

NAFLD development, the correlation between NAFLD and hypothyroidism is unclear (9). In the current study, we investigate the association between NAFLD and hypothyroidism.

Materials and Methods

In this article, we review recently published works that inspect the correlation between NAFLD and hypothyroidism. Articles were searched in PubMed, Google Scholar, and ScienceDirect databases with related keywords such as thyroid gland, liver, non-alcoholic fatty liver disease, and hypothyroidism.

Hypothyroidism

Failure of the thyroid gland is referred to as hypothyroidism; it is more common in women than in males and gets worse with age (10). The inability of the thyroid gland to produce enough thyroid hormone to satisfy the body's metabolic requirements is known as hypothyroidism. Thyroid-stimulating hormone levels rise and blood T₄ and T₃ levels fall in the clinical hypothyroidism (11).

Non-alcoholic fatty liver disease

It is known as NAFLD when there is no alcohol consumption and fat build up in liver cells (12). The NAFLD affects more than a quarter of adults worldwide (13). NAFLD is a term for a variety of illnesses, such as nonalcoholic simple fatty liver disease (NASFL), non-alcoholic steatohepatitis, liver cirrhosis, and hepatocellular

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■ Implication for health policy/practice/research/medical education

Hypothyroidism and non-alcoholic fatty liver disease have been recognized as two main public health complications. Early diagnosis of these diseases can delay the progress of the disease and thus increase the property of life of these patients.

carcinoma. NAFLD is a more common cause of liver cirrhosis and is also one of the main causes of liver cancer (14). Several extrahepatic organ systems are affected by the multisystem illness known as NAFLD (6).

Studies on the link between hypothyroidism and NAFLD

Chung et al. In a study to establish the link between hypothyroidism and NAFLD, from the years 2006 to October 2009, several 4648 people (2324 cases with hypothyroidism compared to the age- and sex-matched control group) were investigated in Seoul. The average age of the subjects studied was 48.6 ± 11.8 years and 62.4% were women. The results of this study showed that NAFLD was observed in 30.2% of hypothyroid patients (15). Lee et al in a retrospective investigation to ascertain the frequency of NAFLD in patients with hypothyroidism between January 2008 and December 2012, including 18,544 patients with hypothyroidism (9,878 men and 8,666 women) with an age range of 65-20 years in South Korea. They found that 2348 subjects (12.7%) developed NAFLD over 4 years (16). Pagadala et al in a study aimed at determining the link hood of having hypothyroidism in patients with NAFLD between October 2006 and June 2009 included two hundred and forty-six patients (131 women and 115 men) with NAFLD with a median age of 50.4 years and 430 Age-, sex-matched control individuals were studied in the United States. They reported that hypothyroidism was common in 21% of patients (7). In a study aimed at determining the incidence of hypothyroidism in patients with NAFLD in India between September 2011 and September 2013, Parikh et al. Examined 500 NAFLD patients with a mean age of 44.3 years and 300 matched controls. The prevalence of hypothyroidism in these patients was 16.8% (17). In a study to ascertain the prevalence of NAFLD in patients with hypothyroidism, Gökmen et al evaluated 115 people, including 75 women and 40 men with hypothyroidism, from 2014 to 2015 in Turkey. NAFLD was found in 69 patients (18). In a study between 2014 and 2016, D'Ambrosio et al examined 52 NAFLD patients (58 percent female) with a mean age of 54 years in Italy to determine the prevalence of hypothyroidism in those with the disease. The findings of this investigation revealed that hypothyroidism affected 14 persons (27%) in total (19). In a study to assess the occurrence of hypothyroidism in patients with NAFLD, Almomani et al reviewed 2320 patients with NAFLD during 2015-2020 in the United

States. The results of this study showed that 520 patients (22.4%) had hypothyroidism (20).

Conclusion

The current investigation revealed a link between NAFLD and hypothyroidism. The importance of early risk patient identification stems from the fact that treatment of hypothyroidism may lower the risk of NAFLD and its possible consequences. It is yet unclear how NAFLD and hormonal problems are related. Endocrinologists frequently ignore NAFLD, and hepatologists are the only ones who assess it. NAFLD has a long-term clinical impact, so endocrinologists and hepatologists need to be aware of its variations linked to endocrine disorders.

Authors' contribution

Conceptualization: KT and SP. Methodology: KT and SP. Investigation: KT, SP, KA. Resources: KT, SP, KA. Data Curation: KT, SP, KA. Writing—Original Draft Preparation: KT, SP, KA. Writing—Review and Editing: KT, SP, KA. Supervision: KT, SP, KA. Project Administration: KT, SP, KA.

Conflicts of interest

There are no conflicts of interest declared by the authors.

Ethical issues

Ethical concerns (including plagiarism, data fabrication, and double publication) are fully respected by the authors.

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References

- Trefts E, Gannon M, Wasserman DH. The liver. *Curr Biol*. 2017;27:R1147-r51. doi: 10.1016/j.cub.2017.09.019.
- Bebars GM, Sayed MA, Hamdy L, Abdel Aziz RA. Effect of acute and chronic liver diseases on the thyroid function in children. *BMC Pediatr*. 2021;21:361. doi: 10.1186/s12887-021-02816-8.
- Kharb S, Garg MK, Puri P, Brar KS, Pandit A, Srivastava S. Assessment of thyroid and gonadal function in liver diseases. *Indian J Endocrinol Metab*. 2015;19:89-94. doi: 10.4103/2230-8210.131761.
- Messarah M, Boumendjel A, Chouabia A, Klibert F, Abdennour C, Boulakoud MS, et al. Influence of thyroid dysfunction on liver lipid peroxidation and antioxidant status in experimental rats. *Exp Toxicol Pathol*. 2010;62:301-10. doi: 10.1016/j.etp.2009.04.009.
- Burra P. Liver abnormalities and endocrine diseases. *Best Pract Res Clin Gastroenterol*. 2013;27:553-63. doi: 10.1016/j.bpg.2013.06.014.
- Targher G, Byrne CD, Lonardo A, Zoppini G, Barbui C. Non-alcoholic fatty liver disease and risk of incident cardiovascular disease: A meta-analysis. *J Hepatol*. 2016;65:589-600. doi: 10.1016/j.jhep.2016.05.013.
- Pagadala MR, Zein CO, Dasarathy S, Yerian LM, Lopez R, McCullough AJ. Prevalence of hypothyroidism in nonalcoholic fatty liver disease. *Dig Dis Sci*. 2012;57:528-34. doi: 10.1007/s10620-011-2006-2.
- Zeng X, Li B, Zou Y. The relationship between non-alcoholic fatty liver disease and hypothyroidism: A systematic review and meta-analysis. *Medicine (Baltimore)*. 2021;100:e25738. doi: 10.1097/md.00000000000025738.

9. Duntas LH, Brenta G. The effect of thyroid disorders on lipid levels and metabolism. *Med Clin North Am.* 2012;96:269-81. doi: 10.1016/j.mcna.2012.01.012.
10. Leng O, Razvi S. Hypothyroidism in the older population. *Thyroid Res.* 2019;12:2 .doi: 10.1186/s13044-019-0063-3.
11. Gong LL, Liu H, Liu LH. Relationship between hypothyroidism and the incidence of gestational diabetes: A meta-analysis. *Taiwan J Obstet Gynecol.* 2016;55:171-5. doi: 10.1016/j.tjog.2016.02.004.
12. Grewal H, Joshi S, Sharma R, Mittal P, Goel A. Non-alcoholic fatty liver disease in patients with hypothyroidism presenting at a rural tertiary care centre in north India. *Trop Doct.* 2021;51:181-4. doi: 10.1177/0049475520945058.
13. Sanyal AJ, Van Natta ML, Clark J ,Neuschwander-Tetri BA, Diehl A, Dasarathy S, et al. Prospective Study of Outcomes in Adults with Nonalcoholic Fatty Liver Disease. *N Engl J Med.* 2021;385:1559-69. doi: 10.1056/NEJMoa2029349.
14. Petta S, Craxì A. Hepatocellular carcinoma and non-alcoholic fatty liver disease: from a clinical to a molecular association. *Curr Pharm Des.* 2010;16:741-52. doi: 10.2174/138161210790883787.
15. Chung GE, Kim D, Kim W, Yim JY, Park MJ, Kim YJ, et al. Non-alcoholic fatty liver disease across the spectrum of hypothyroidism. *J Hepatol.* 2012;57:150-6. doi: 10.1016/j.jhep.2012.02.027.
16. Lee KW, Bang KB, Rhee EJ, Kwon HJ, Lee MY, Cho YK. Impact of hypothyroidism on the development of non-alcoholic fatty liver disease: A 4-year retrospective cohort study. *Clin Mol Hepatol.* 2015;21:372-8. doi: 10.3350/cmh.2015.21.4.372.
17. Parikh P, Phadke A, Sawant P. Prevalence of hypothyroidism in nonalcoholic fatty liver disease in patients attending a tertiary hospital in western India. *Indian J Gastroenterol.* 2015;34:169-73. doi: 10.1007/s12664-015-0541-z.
18. Gökmen FY, Ahabab S, Ataoğlu HE, Türker B, Çetin F, Türker F, et al. FT3/FT4 ratio predicts non-alcoholic fatty liver disease independent of metabolic parameters in patients with euthyroidism and hypothyroidism. *Clinics (Sao Paulo).* 2016;71:221-5. doi: 10.6061/clinics/2016(04)08.
19. D'Ambrosio R, Campi I, Maggioni M, Perbellini R, Giammona E, Stucchi R, et al. The relationship between liver histology and thyroid function tests in patients with non-alcoholic fatty liver disease (NAFLD). *PLoS One.* 2021;16:e0249614. doi: 10.1371/journal.pone.0249614.
20. Almomani A, Hitawala AA, Kumar P, Alqaisi S, Alshaikh D, Alkhayyat M, et al. Prevalence of hypothyroidism and effect of thyroid hormone replacement therapy in patients with non-alcoholic fatty liver disease: A population-based study. *World J Hepatol.* 2022;14(3):551-8. doi: 10.4254/wjh.v14.i3.551.