

# Frequency of Thyroid Dysfunction in Patients with Non-Alcoholic Fatty Liver Disease

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## ABSTRACT

**Objectives:** To determine the frequency of thyroid dysfunction in patients with non-alcoholic fatty liver disease.

**Methodology:** This cross-sectional study was conducted at Rawal Institute of Health Sciences, Medicine Department, Islamabad, Pakistan, from August 2025 to February 2026. A total of 370 patients with non-alcoholic fatty liver disease were included; they were screened for the presence of any abnormality in the thyroid function (overt/subclinical hypothyroidism and hyperthyroidism). Thyroid dysfunction stratification was done based on confounding variables. Post-stratification analysis was done using the chi-square test.

**Results:** Median age was 54.00 (22.00) years. There were 197 (53.20%) male and 173 (46.80%) female patients. Median BMI was 30.46 (8.15) kg/m<sup>2</sup>. History of smoking, diabetes, and hypertension was positive in 274 (74.10%), 186 (50.30%), and 187 (50.50%), respectively. Among non-alcoholic fatty liver disease patients, the frequency of thyroid dysfunction was 92 (24.90%). A total of 46 (12.43%) patients had subclinical hypothyroidism, 29 (7.84%) had overt hypothyroidism, and 17 (4.59%) had hyperthyroidism.

**Conclusion:** Thyroid dysfunction was found in 24.9% of the patients suffering from non-alcoholic fatty liver disease, with subclinical hypothyroidism being the most common type of dysfunction.

**Keywords:** Hyperthyroidism, Hypothyroidism, Non-Alcoholic Fatty Liver Disease,

### Authors' Contribution:

<sup>1,2</sup>Conception; Literature research; manuscript design and drafting; <sup>3,4</sup>Critical analysis and manuscript review; <sup>5,6</sup>Data analysis; Manuscript Editing.

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## Introduction

Non-alcoholic fatty liver disease (NAFLD) is a prevalent liver condition characterised by presence of hepatic inflammation and ballooning due to steatosis, which may or may not accompany fibrosis, in the absence of alcoholism or obvious cause of chronic liver disease (CLD).<sup>1,2</sup> Globally, this condition has been reported to have an approximated prevalence of 30% and this rising prevalence is attributed to obesity which is prevailing in both the

adult and paediatric populations.<sup>3,4</sup> It has now been considered as a leading cause of cirrhosis and hepatocellular carcinoma.<sup>5</sup> Due to strong association of NAFLD with obesity, genetic and socioeconomic factors, the prevalence of this condition varies substantially in different geographical regions of the world.<sup>6</sup> Additionally, studies have found that this hepatic condition may also be associated with dysfunctional thyroid gland.<sup>7</sup> In this instance, a study reported that among patients suffering from this condition, thyroid

dysfunction (ThD) existed only in the form of hypothyroidism with a reported frequency of 18%.<sup>7</sup> In another study it was reported that the frequency of hypothyroidism in patients with NAFLD was 22.4%.<sup>8</sup> In one study, it was found that ThD being observed in patients with NAFLD was hyperthyroidism instead of hypothyroidism with a reported frequency of 11.97%.<sup>9</sup> In one study, it was found that among patients who presented with NAFLD, 67% cases were euthyroid, 29% cases had subclinical hypothyroidism, and 4% cases had overt hypothyroidism.<sup>10</sup>

In general, there is a common belief that NAFLD is associated exclusively with hypo-functioning of the thyroid gland. However, emerging evidence indicates that hyperthyroidism may also play a role in its development. Considering these recent findings, the present study was aimed to determine the frequency of thyroid dysfunction (both hypothyroidism and hyperthyroidism) in patients with NAFLD. Establishing this frequency will help clarify the actual burden of each type of thyroid dysfunction among NAFLD patients and contribute to correcting the widespread perception that this liver condition is linked only to hypothyroidism.

## Methodology

This cross-sectional study was carried out at Rawal Institute of Health Sciences, Medicine Department, Islamabad, Pakistan from August-2025 to February-2026. A sample size of 370 was calculated by inputting 2% precision, 95% confidence interval and anticipated frequency of ThD (hyperthyroidism) in NAFLD patients of 4%,<sup>10</sup> in WHO sample size calculator software. The sample selection process was based on non-probability consecutive sampling technique. Before inclusion, it was ensured that all the patients gave their explicit informed consent in written form for which a dedicated pre-printed form was used. Patients of either gender aged between 30 and 75 years who presented with NAFLD were included. Diagnosis and grading of NAFLD was based

on ultrasonographic assessment. Patients with history of alcoholism, CLD, taking therapy for thyroid disease, hand radio-iodine therapy or surgery of thyroid gland, use of hepatotoxic drugs and use of drugs that affect thyroid hormone metabolism were excluded. Baseline characteristics including age, body mass index (BMI), gender, history of smoking, diabetes (DM) and hypertension (HTN) were documented by the researcher. After this, 5ml blood sample was collected from the patient following all aseptic precautions and it was sent to laboratory to assess for presence of ThD based on levels of thyroid stimulating hormone (TSH), free T4 (fT4) and free T3 (fT3) which included subclinical hypothyroidism (TSH > 5.0mIU/L but normal fT4 and fT3), overt hypothyroidism (TSH > 5.0mIU/L, fT4 < 0.7 ng/dl and fT3 < 260 pg/ml) and hyperthyroidism (TSH < 0.35mIU/L, fT4 > 1.53 ng/dl, fT3 > 480 pg/ml) In case of ThD appropriate treatment will be provided as per standard protocols.

All the collected data were entered and analysed with SPSS version 30.0.0. Descriptive statistics was collected for qualitative and quantitative variables. Qualitative variables (gender, history of smoking, DM, HTN, grade of NAFLD and presence of ThD) were measured as frequency and percentage. Quantitative variables (age and BMI) were measured as median interquartile range (IQR) since Shapiro-Wilk test revealed data to be non-normal. Stratification of ThD was done by age, gender, BMI, history of smoking, diabetes & hypertension and grade of NAFLD and post-stratification analysis was done through Chi-square test. A p-value ≤ 0.05 was considered as significant.

**Ethical approval** was taken from the institutional review board of Rawal Institute of Health Sciences, Islamabad [Ref No. RIHS/IRB/79/2025] on 25-08-2025

## Results

In this study, 370 patients were included. Median age was 54.00 (22.00) years. There were 197 (53.20%) male and 173 (46.80%) female patients.

Median BMI was 30.46 (8.15) kg/m<sup>2</sup>. History of smoking, DM and HTN was positive in 274 (74.10%), 186 (50.30%) and 187 (50.50%), respectively. Demographic characteristics of the patients is given in Table-I:

| Table I: Demographic characteristics of the patients (n = 370) |                     |
|----------------------------------------------------------------|---------------------|
| Characteristics                                                | Median (IQR); n (%) |
| Median age (years)                                             | 54.00 (22.00) years |
| <b>Age groups</b>                                              |                     |
| < 50 years                                                     | 145 (39.20)         |
| ≥ 50 years                                                     | 225 (60.80)         |
| <b>Gender</b>                                                  |                     |
| Male                                                           | 197 (53.20)         |
| Female                                                         | 173 (46.80)         |
| Median BMI (kg/m <sup>2</sup> )                                | 30.46 (8.15)        |
| <b>BMI groups</b>                                              |                     |
| < 30 kg/m <sup>2</sup>                                         | 170 (45.90)         |
| ≥ 30 kg/m <sup>2</sup>                                         | 200 (54.10)         |
| Smoking                                                        | 274 (74.10)         |
| DM                                                             | 186 (50.30)         |
| HTN                                                            | 187 (50.50)         |
| <b>NAFLD grade</b>                                             |                     |
| 1                                                              | 130 (35.10)         |
| 2                                                              | 115 (31.10)         |
| 3                                                              | 125 (33.80)         |

IQR = Interquartile range, BMI – Body Mass Index, DM = Diabetes, HTN = Hypertension, NAFLD = Non-alcoholic Fatty Liver Disease

| Table II: Frequency and distribution of types of ThD in NAFLD patients (n = 370) |              |
|----------------------------------------------------------------------------------|--------------|
| ThD                                                                              | n (%)        |
| Yes                                                                              | 92 (24.90%)  |
| No                                                                               | 278 (75.10%) |
| <b>ThD types</b>                                                                 |              |
| Subclinical hypothyroidism                                                       | 46 (12.43%)  |
| Overt hypothyroidism                                                             | 29 (7.84%)   |
| Hyperthyroidism                                                                  | 17 (4.59%)   |

ThD = Thyroid Dysfunction, NAFLD = Non-alcoholic Fatty Liver Disease

| Table III: Stratification of ThD frequency based on confounding variables (n = 370) |                      |                      |                   |           |
|-------------------------------------------------------------------------------------|----------------------|----------------------|-------------------|-----------|
| Age stratification                                                                  |                      |                      |                   |           |
|                                                                                     | < 50 years (n = 145) | ≥ 50 years (n = 225) | p-value †         |           |
| ThD                                                                                 | 38 (26.21%)          | 54 (24.00%)          | 0.632             |           |
| Gender stratification                                                               |                      |                      |                   |           |
|                                                                                     | Male (n = 197)       | Female (n = 173)     | p-value †         |           |
| ThD                                                                                 | 51 (25.89%)          | 41 (23.70%)          | 0.627             |           |
| BMI stratification                                                                  |                      |                      |                   |           |
|                                                                                     | < 30 kg/m2 (n = 170) | ≥ 30 kg/m2 (n = 200) | p-value †         |           |
| ThD                                                                                 | 43 (25.29%)          | 49 (24.50%)          | 0.860             |           |
| History of smoking stratification                                                   |                      |                      |                   |           |
|                                                                                     | Yes (n = 274)        | No (n = 96)          | p-value †         |           |
| ThD                                                                                 | 64 (23.36%)          | 28 (29.17%)          | 0.257             |           |
| History of DM stratification                                                        |                      |                      |                   |           |
|                                                                                     | Yes (n = 186)        | No (n = 184)         | p-value †         |           |
| ThD                                                                                 | 49 (26.34%)          | 43 (23.37%)          | 0.508             |           |
| History of HTN stratification                                                       |                      |                      |                   |           |
|                                                                                     | Yes (n = 187)        | No (n = 183)         | p-value †         |           |
| ThD                                                                                 | 52 (27.81%)          | 40 (21.86%)          | 0.186             |           |
| NAFLD grade stratification                                                          |                      |                      |                   |           |
|                                                                                     | Grade-1 (n = 130)    | Grade-2 (n = 115)    | Grade-3 (n = 125) | p-value † |
| ThD                                                                                 | 34 (26.15%)          | 36 (31.30%)          | 22 (17.60%)       | 0.045     |

IQR = Interquartile range, BMI – Body Mass Index, DM = Diabetes, HTN = Hypertension, NAFLD = Non-alcoholic Fatty Liver Disease, ThD = Thyroid Dysfunction, † = Chi-square test

Among NAFLD patients, frequency of ThD was 92 (24.90%). A total of 46 (12.43%) patients had subclinical hypothyroidism, 29 (7.84%) had overt hypothyroidism and 17 (4.59%) had

hyperthyroidism. Frequency and distribution of types of ThD in NAFLD patients is given in Table-II.

## Discussion

NAFLD is a rising morbidity globally which is associated with a variety of other conditions including obesity and metabolic syndrome.<sup>11,12</sup> Another such association which was the focus of present study is the disturbance in the physiologic function of thyroid gland. Pathophysiological process that drives ThD in patients with this hepatic morbidity is the impairment in the lipid metabolism which serves as a major risk of not only the development but also the progression of NAFLD.<sup>13,14</sup> Owing to such significant association, present study was conducted to determine the frequency of ThD in these patients.

In present study, diagnostic test which was used to diagnose and grade the severity of this liver disease was abdominal ultrasonography. This test was chosen owing to its proven reliability, easy accessibility and reproducibility in diagnosing and grading NAFLD.<sup>15,16</sup> In this study, average age of the NAFLD patients was 54 years with higher percentage of the sufferers being males making up 53.2% indicating a slight male predominance. Upon comparison of the disease distribution trends reported in previous literature, it was found that the risk of this condition increases with increasing age while gender distribution is highly variable globally.<sup>17</sup> One possible reason for male predominance in present study can be attributed to the high proportion of male patients being indulged in the habit of smoking, outdoors eating and being careless about their health, all of which are major contributors to this disease.<sup>18</sup> BMI of the NAFLD sufferers in present study average above 30 kg/m<sup>2</sup> which lies in the obesity range. In addition, a large proportion of patients were found to have a positive history of smoking (74.1%), DM (50.3%) and HTN (50.5%), all of which are well known risk factors of developing this disease.<sup>17,18</sup>

Upon analysis of the frequency of ThD among the diagnosed cases of NAFLD, a significant proportion of patients (24.9%) were found to have ThD with the most common type of ThD being subclinical hypothyroidism followed by overt hypothyroidism and hyperthyroidism. Compared to this, a study conducted with similar aim reported ThD frequency, hypothyroidism in particular, among sufferers of this condition at 18%.<sup>7</sup> Similarly, in another study, it was found that the predominant type of ThD in NAFLD patients was hypothyroidism with a frequency of 22.4%.<sup>8</sup> In one study, similar to present study, the predominant variety of ThD was subclinical hypothyroidism with a frequency of 19.9%, followed by overt hypothyroidism which was found in 14.2% of the patients.<sup>19</sup> In another study, frequency of ThD in NAFLD patients was 19.5%.<sup>20</sup> In contrast, one study found that hyperthyroidism was the predominant ThD with a frequency of 11.97% rather than hypothyroidism, among NAFLD patients.<sup>9</sup> This variability in the frequency of ThD can be attributed to the difference in the demographic regions where these studies were conducted.

Upon stratification of ThD frequency based on confounding variables, it was observed that only grade of NAFLD had a significant impact with highest frequency of ThD being observed in grade-2 (31.3%) followed by grade-1 (26.15%) and grade-3 (17.6%); ( $p = 0.045$ ). no other variables had any significant impact on the frequency of ThD including age ( $p = 0.632$ ), gender ( $p = 0.627$ ), BMI ( $p = 0.860$ ), history of smoking ( $p = 0.257$ ), DM ( $p = 0.508$ ) and HTN ( $p = 0.186$ ). Similar to this, a study stratified this ThD frequency of some of the confounding variables and did not find any significant impact of age ( $p = 0.35$ ) or gender ( $p = 0.17$ ).<sup>20</sup>

Based on the results of present study, it is evident that ThD is highly prevalent among patients of NAFLD and any type of ThD can exist in these patients. This necessitates appropriate and regular screening of these patients for presence of ThD. Therefore, it is strongly recommended that any patient who suffers from NAFLD should be screened

for ThD irrespective of prior euthyroid status. There were no limitations of present study.

## Conclusion

In conclusion, thyroid dysfunction was identified in 24.9% of patients suffering from non-alcoholic fatty liver disease (NAFLD), with subclinical hypothyroidism emerging as the most common type of dysfunction. These findings suggest a significant association between thyroid abnormalities and NAFLD, highlighting the importance of routine thyroid function screening in affected patients. Early detection and appropriate management of thyroid dysfunction may help improve clinical outcomes and prevent further metabolic complications. Further large-scale studies are recommended to better understand the underlying mechanisms and causal relationship between thyroid dysfunction and NAFLD.

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