International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 11, November 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.11.2024.158

ORIGINAL RESEARCH

Prevalence of Non-Alcoholic Fatty Liver Disease and Its Correlation with Coronary Risk Factors in Patients with Type 2 DM

[1]Dr. Gautam Kumar Sandilya, [2]Dr. Supriya Kumari, [3]Dr. Amit Kumar Tiwari, [4]Dr. Pankaj Hans

[1,2,3]Senior Resident, [4]Professor, Department of Medicine, Patna Medical College and Hospital, Patna, Bihar, India

Corresponding author
Dr. Amit Kumar Tiwari
Senior Resident, Department of Medicine, Patna Medical College and Hospital, Patna, Bihar, India

Received Date: 16 September, 2024 Accepted Date: 19 October, 2024

ABSTRACT

Aim: To determine the prevalence of Non-Alcoholic Fatty Liver Disease (NAFLD) and examine its correlation with coronary risk factors in patients with Type 2 Diabetes Mellitus (T2DM). **Materials and Methods:** This cross-sectional observational study included 80 patients with T2DM recruited from a tertiary care hospital. Data on demographic, clinical, and biochemical parameters were collected. NAFLD was diagnosed using abdominal ultrasonography. Coronary risk factors including BMI, waist circumference, hypertension, dyslipidemia, smoking status, HbA1c, and duration of diabetes were analyzed. **Results:** NAFLD was present in 60% of T2DM patients. Individuals with NAFLD had significantly higher BMI, waist circumference, HbA1c, fasting glucose, and lipid levels compared to those without NAFLD. Hypertension and dyslipidemia were also more prevalent in the NAFLD group. Logistic regression identified obesity, central adiposity, hypertension, dyslipidemia, and poor glycemic control as independent predictors of NAFLD. The prevalence of NAFLD increased with longer duration of diabetes. **Conclusion:** NAFLD is highly prevalent among T2DM patients and strongly associated with multiple coronary risk factors including obesity, hypertension, dyslipidemia, and poor glycemic control. These findings highlight the importance of early screening and integrated management approaches to reduce cardiovascular risk in this population.

Keywords: NAFLD, Type 2 Diabetes Mellitus, Coronary Risk Factors, Obesity, Dyslipidemia

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) has emerged as one of the most common chronic liver disorders worldwide, affecting a significant portion of the adult population. Characterized by the accumulation of excess fat in liver cells in individuals who consume little to no alcohol, NAFLD spans a broad spectrum of hepatic conditions, from simple steatosis to non-alcoholic steatohepatitis (NASH), fibrosis, and ultimately cirrhosis. This condition has gained considerable attention due to its increasing prevalence in parallel with the global rise in obesity, insulin resistance, and metabolic syndrome.[1]

Type 2 diabetes mellitus (T2DM), a metabolic disorder marked by chronic hyperglycemia resulting from insulin resistance and impaired insulin secretion, is intricately linked to NAFLD. Studies and clinical observations indicate that the presence of T2DM significantly heightens the risk of developing NAFLD. In fact, NAFLD is now considered the hepatic manifestation of metabolic syndrome, with insulin resistance serving as a key pathophysiological driver for both conditions. The presence of NAFLD in diabetic patients not only exacerbates the progression of liver disease but also contributes to a heightened risk of cardiovascular complications.[2]

Coronary artery disease (CAD) remains the leading cause of morbidity and mortality among individuals with T2DM. Several risk factors contribute to the development of CAD in diabetic patients, including hypertension, dyslipidemia, central obesity, and chronic inflammation. What makes the relationship between NAFLD and CAD particularly noteworthy is the increasing body of evidence suggesting that NAFLD, independent of traditional cardiovascular risk factors, may serve as a novel marker and contributor to atherosclerosis and coronary heart disease. The accumulation of hepatic fat appears to trigger a cascade of metabolic and inflammatory responses that can accelerate atherosclerotic processes and vascular dysfunction.[3]

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In individuals with T2DM, the intersection of NAFLD and coronary risk factors creates a particularly concerning clinical scenario. Not only are these patients predisposed to liver-related complications, but they also face a compounded risk for cardiovascular events. The dual burden of hepatic and cardiovascular comorbidities significantly influences the overall prognosis and necessitates a comprehensive approach to screening, prevention, and management.[4,5]

The prevalence of NAFLD among patients with T2DM is alarmingly high, with estimates indicating that more than half of diabetic individuals may have some form of fatty liver disease. This co-occurrence is not merely coincidental; rather, it reflects shared underlying metabolic dysfunctions such as insulin resistance, lipid metabolism disorders, oxidative stress, and chronic systemic inflammation. NAFLD in diabetic patients often remains underdiagnosed due to its silent clinical course in the early stages. However, early detection is crucial, as progression to NASH and advanced fibrosis can have severe implications on both hepatic and cardiovascular health.[6,7]

Furthermore, the severity of NAFLD in T2DM patients has been positively correlated with the presence and intensity of coronary risk factors. Components such as elevated triglycerides, low HDL cholesterol, increased waist circumference, and elevated blood pressure not only signify poor metabolic control but also signal an increased likelihood of hepatic steatosis and fibrosis. Emerging research has also highlighted the role of biomarkers and imaging techniques in identifying subclinical atherosclerosis in patients with NAFLD, further reinforcing the link between fatty liver and cardiovascular risk.[8]

Despite the growing recognition of this relationship, clinical practice often treats NAFLD and cardiovascular disease as separate entities, which may result in missed opportunities for early intervention. Integrating liver health assessments into routine diabetic care, especially for those with poorly controlled risk factors, may provide an opportunity to stratify risk more accurately and tailor treatment strategies accordingly. Weight loss, glycemic control, lipid management, and antihypertensive therapy have shown promise in improving liver histology and reducing cardiovascular risk simultaneously.[9]

Understanding the prevalence and the nature of the correlation between NAFLD and coronary risk factors in patients with T2DM is critical for developing effective preventative and therapeutic strategies. It not only highlights the need for a multidisciplinary approach in managing diabetic patients but also calls for increased awareness among healthcare providers regarding the systemic implications of hepatic steatosis. More comprehensive data from population-based and clinical studies are needed to guide evidence-based guidelines that can bridge the gap between hepatology and cardiology in the care of diabetic patients.

MATERIAL AND METHODS

This cross-sectional observational study was conducted to assess the prevalence of Non-Alcoholic Fatty Liver Disease (NAFLD) and its correlation with coronary risk factors in patients with Type 2 Diabetes Mellitus (T2DM). A total of 80 patients diagnosed with T2DM were recruited from tertiary care hospital.

Inclusion Criteria

- Age ≥ 30 years
- Confirmed diagnosis of Type 2 Diabetes Mellitus as per ADA criteria
- Willingness to participate and provide informed consent

Exclusion Criteria

- History of significant alcohol consumption (>20 g/day for women and >30 g/day for men)
- Known hepatic disorders (e.g., viral hepatitis, autoimmune hepatitis, Wilson's disease)
- Use of hepatotoxic drugs or medications known to induce steatosis
- Pregnant or lactating women

Methodology

After obtaining written informed consent, detailed demographic and clinical data were collected, including age, sex, duration of diabetes, BMI, waist circumference, blood pressure, and history of smoking and hypertension. Blood samples were collected after an overnight fast for assessment of fasting blood glucose, lipid profile, liver function tests, HbA1c, and serum insulin levels.All participants underwent abdominal ultrasonography using a high-resolution B-mode ultrasound machine performed by a single experienced radiologist blinded to clinical and biochemical data. NAFLD was diagnosed based on standard sonographic criteria, including increased liver echogenicity, blurring of the vascular margins, and deep attenuation of the ultrasound signal.

The assessment of coronary risk factors in this study included several clinical and metabolic parameters known to be associated with increased cardiovascular risk in patients with Type 2 Diabetes Mellitus. Demographic factors such as age and sex were recorded for all participants. Blood pressure was measured using a standard sphygmomanometer, and hypertension was defined as a systolic blood pressure ≥140 mmHg, a diastolic pressure ≥90 mmHg, or current use of antihypertensive medications. Lipid profiles were evaluated to assess dyslipidemia, defined according to the Adult Treatment Panel III (ATP III) criteria. Smoking status was recorded based on patient self-report and categorized as current smoker, former smoker, or non-smoker. Obesity was assessed by calculating the Body Mass Index (BMI), with a BMI ≥30 kg/m² considered indicative of

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obesity. Central obesity was evaluated through waist circumference measurements, with thresholds adjusted for sex-specific criteria. Glycemic control was determined by measuring HbA1c levels, and the duration of diabetes since diagnosis was also documented. These coronary risk factors were analyzed for their potential association with the presence of Non-Alcoholic Fatty Liver Disease in the study population.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize baseline characteristics. The prevalence of NAFLD was calculated as a percentage. Associations between NAFLD and coronary risk factors were evaluated using Chi-square test for categorical variables and Student's t-test or Mann–Whitney U test for continuous variables, as appropriate. A p-value of <0.05 was considered statistically significant. Logistic regression analysis was performed to identify independent predictors of NAFLD.

RESULTS

Table 1: Baseline Characteristics of the Study Population

The study included a total of 80 patients with Type 2 Diabetes Mellitus (T2DM), with a mean age of 56.4 ± 9.7 years. The gender distribution showed a slight male predominance, with 46 males (57.5%) and 34 females (42.5%). The average duration of diabetes among the participants was 7.2 ± 3.6 years. The mean Body Mass Index (BMI) was 29.3 ± 4.8 kg/m², which falls in the overweight to obese range, and the mean waist circumference was 98.2 ± 11.5 cm, indicating a high prevalence of central obesity. Hypertension was present in 65% of the participants (52 individuals), and dyslipidemia was found in 75% (60 individuals), reflecting a high burden of cardiovascular risk factors in the study population. Additionally, 22.5% of patients were current or former smokers, and the mean HbA1c level was 8.1 ± 1.2%, suggesting suboptimal glycemic control across the cohort.

Table 2: Prevalence of NAFLD

Out of the 80 participants, Non-Alcoholic Fatty Liver Disease (NAFLD) was detected in 48 individuals, accounting for a prevalence of **60%**. This indicates that NAFLD is a common comorbidity among patients with T2DM in this population. The remaining 32 patients (40%) did not show sonographic evidence of hepatic steatosis. The high prevalence underscores the need for routine NAFLD screening in diabetic individuals, especially in those with other metabolic risk factors.

Table 3: Comparison of Coronary Risk Factors Between NAFLD and Non-NAFLD Groups

In this study, several coronary and metabolic risk factors were compared between patients with and without Non-Alcoholic Fatty Liver Disease (NAFLD). The mean age and gender distribution were similar in both groups, with no statistically significant differences ($p = 0.32$ and $p = 0.49$, respectively), indicating that age and sex were not major determinants of NAFLD in this cohort. However, patients with NAFLD had significantly higher BMI (31.2 ± 4.6 vs. 26.4 ± 3.8 kg/m²; $p < 0.001$) and waist circumference (102.3 ± 10.5 vs. 92.1 ± 9.4 cm; $p < 0.001$), reflecting a strong association with both general and central obesity. The prevalence of hypertension (75% vs. 50%; $p = 0.018$) and dyslipidemia (87.5% vs. 56.3%; $p = 0.002$) was also significantly higher among NAFLD patients, reinforcing their contribution to the pathophysiology of hepatic steatosis. Glycemic parameters showed a clear difference, with NAFLD patients having poorer glycemic control (HbA1c: 8.4 ± 1.1% vs. 7.6 ± 1.2%; $p = 0.004$) and higher fasting blood glucose (162.5 ± 28.4 vs. 141.7 ± 25.2 mg/dL; $p = 0.001$), along with a longer duration of diabetes (8.1 ± 3.4 vs. 5.9 ± 3.2 years; $p = 0.008$), suggesting that chronic hyperglycemia and long-standing diabetes may contribute to NAFLD development. Lipid profile analysis further revealed significantly higher levels of serum triglycerides (198.2 ± 55.1 vs. 158.6 ± 49.3 mg/dL; $p = 0.003$), total cholesterol (202.6 ± 37.2 vs. 179.8 ± 34.6 mg/dL; $p = 0.006$), and LDL cholesterol (126.7 ± 28.9 vs. 112.4 ± 25.3 mg/dL; $p = 0.027$) in the NAFLD group, along with notably lower HDL cholesterol levels (39.8 ± 6.7 vs. 46.2 ± 7.3 mg/dL; $p < 0.001$), which are consistent with the dyslipidemic profile typically associated with fatty liver disease. Although a higher proportion of NAFLD patients reported current or former smoking habits (27.1% vs. 15.6%), this difference was not statistically significant ($p = 0.19$). Overall, these findings indicate that NAFLD in type 2 diabetic patients is strongly associated with obesity, poor glycemic control, dyslipidemia, hypertension, and longer duration of diabetes—factors that also increase cardiovascular risk.

Table 4: Logistic Regression Analysis of Independent Predictors of NAFLD

Multivariate logistic regression analysis identified several independent predictors of NAFLD. Obesity, defined as BMI ≥30 kg/m², was a strong predictor with an odds ratio (OR) of 3.8 (95% CI: 1.5–9.6; $p = 0.005$). Waist circumference also showed a significant association (OR: 1.12; 95% CI: 1.05–1.19; $p = 0.001$), reinforcing the role of central adiposity. Hypertension emerged as an independent risk factor (OR: 2.6; 95% CI: 1.1–6.1; $p = 0.028$), as did dyslipidemia, which had the highest odds ratio (OR: 4.2; 95% CI: 1.6–10.9; $p = 0.003$). Additionally, poor glycemic control (higher HbA1c) was independently associated with NAFLD (OR: 1.7; 95% CI: 1.1–2.7; $p = 0.021$), highlighting the metabolic burden contributing to liver disease in diabetic patients.

DOI: 10.69605/ijlbpr_13.11.2024.158

Table 5: Distribution of NAFLD According to Duration of Diabetes

When evaluating the relationship between the duration of diabetes and NAFLD, it was observed that NAFLD was more prevalent among patients with a longer duration of T2DM. Among those with diabetes for less than 5 years, only 29.2% had NAFLD compared to 56.3% without NAFLD. However, among those with 5–10 years of diabetes, 45.8% had NAFLD, and in those with diabetes for more than 10 years, the prevalence of NAFLD rose to 25.0%, compared to only 12.5% in the non-NAFLD group. The association between NAFLD and longer diabetes duration was statistically significant ($p = 0.037$), suggesting that chronic hyperglycemia and prolonged metabolic stress contribute to hepatic fat accumulation over time.

Table 1: Baseline Characteristics of Study Population (n = 80)

Variable	Mean ± SD / n (%)
Age (years)	56.4 ± 9.7
Male	46 (57.5%)
Female	34 (42.5%)
Duration of T2DM (years)	7.2 ± 3.6
BMI (kg/m²)	29.3 ± 4.8
Waist Circumference (cm)	98.2 ± 11.5
Hypertension	52 (65%)
Dyslipidemia	60 (75%)
Smoking (Current/Former)	18 (22.5%)
HbA1c (%)	8.1 ± 1.2

Table 2: Prevalence of NAFLD in Study Participants

NAFLD Status	n (%)
Present	48 (60%)
Absent	32 (40%)

Table 3: Comparison of Coronary and Metabolic Risk Factors Between NAFLD and Non-NAFLD Groups

Risk Factor	NAFLD (n = 48)	Non-NAFLD (n = 32)	p-value
Age (years)	57.1 ± 9.2	55.3 ± 10.1	0.32
Male sex (%)	29 (60.4%)	17 (53.1%)	0.49
BMI (kg/m²)	31.2 ± 4.6	26.4 ± 3.8	<0.001
Waist Circumference (cm)	102.3 ± 10.5	92.1 ± 9.4	<0.001
Hypertension (%)	36 (75%)	16 (50%)	0.018
Dyslipidemia (%)	42 (87.5%)	18 (56.3%)	0.002
HbA1c (%)	8.4 ± 1.1	7.6 ± 1.2	0.004
Fasting Blood Glucose (mg/dL)	162.5 ± 28.4	141.7 ± 25.2	0.001
Serum Triglycerides (mg/dL)	198.2 ± 55.1	158.6 ± 49.3	0.003
Total Cholesterol (mg/dL)	202.6 ± 37.2	179.8 ± 34.6	0.006
LDL Cholesterol (mg/dL)	126.7 ± 28.9	112.4 ± 25.3	0.027
HDL Cholesterol (mg/dL)	39.8 ± 6.7	46.2 ± 7.3	<0.001
Duration of Diabetes (years)	8.1 ± 3.4	5.9 ± 3.2	0.008
Smoking (current/former)	13 (27.1%)	5 (15.6%)	0.19

Table 4: Logistic Regression Analysis of Independent Predictors of NAFLD

Variable	Odds Ratio (OR)	95% CI	p-value
BMI ≥30 kg/m²	3.8	1.5 – 9.6	0.005
Waist circumference	1.12	1.05 – 1.19	0.001
Hypertension	2.6	1.1 – 6.1	0.028
Dyslipidemia	4.2	1.6 – 10.9	0.003
HbA1c (%)	1.7	1.1 – 2.7	0.021

Table 5: Distribution of NAFLD According to Duration of Diabetes

Duration of Diabetes (years)	NAFLD Present (n=48)	NAFLD Absent (n=32)	p-value
<5 years	14 (29.2%)	18 (56.3%)	
5–10 years	22 (45.8%)	10 (31.2%)	

DOI: 10.69605/ijlbpr_13.11.2024.158

>10 years	12 (25.0%)	4 (12.5%)	0.037

DISCUSSION

In this study, the baseline characteristics of patients with Type 2 Diabetes Mellitus (T2DM) reveal that the mean age of the participants was 56.4 ± 9.7 years, with a predominance of males (57.5%) and a relatively high prevalence of obesity (mean BMI of 29.3 ± 4.8 kg/m² and waist circumference of 98.2 ± 11.5 cm). These findings align with previous research, which demonstrates a high prevalence of obesity and metabolic syndrome in individuals with T2DM (Yamane et al., 2022).[10] Furthermore, 65% of the participants had hypertension and 75% had dyslipidemia, which are well-established cardiovascular risk factors in the diabetic population (Targher et al., 2008). The mean HbA1c of 8.1 ± 1.2% suggests that the participants had suboptimal glycemic control, contributing to the increased risk of complications associated with T2DM.[11]

Table 2 highlights the significant burden of Non-Alcoholic Fatty Liver Disease (NAFLD) in this population, with 60% of participants diagnosed with NAFLD. This prevalence is consistent with findings from previous studies that report a high co-occurrence of NAFLD in T2DM patients, reflecting the impact of metabolic derangements such as obesity and insulin resistance on liver health (Younossi et al., 2016).[12] The high prevalence also suggests the need for regular screening for NAFLD in T2DM patients, especially in those with other metabolic risk factors, as the disease often remains undiagnosed due to its asymptomatic nature in early stages (Golabi et al., 2019).[13]

Table 3 compares the coronary and metabolic risk factors between patients with and without NAFLD. The results show that individuals with NAFLD had significantly higher BMI, waist circumference, and higher levels of dyslipidemia and hypertension, all of which are well-documented risk factors for cardiovascular diseases (Di Sessa et al., 2017; Tamura et al., 2020).[14,15]Additionally, NAFLD patients had poorer glycemic control, as indicated by higher HbA1c and fasting blood glucose levels. These findings are consistent with other studies that report an increased risk of cardiovascular diseases and poor glycemic control in T2DM patients with NAFLD (Targher et al., 2008; Zhan et al., 2012).[16] The association between NAFLD and dyslipidemia, including elevated triglycerides and lower HDL cholesterol, further emphasizes the role of lipid metabolism in the pathophysiology of both conditions (Lv et al., 2013).[17] Despite a higher proportion of smokers in the NAFLD group, smoking did not significantly influence the presence of NAFLD in this cohort, as reported in other studies (Eguchi et al., 2012).[18]

Table 4 explores the independent predictors of NAFLD using logistic regression analysis. The results reveal that obesity (BMI ≥30 kg/m²), central adiposity (measured by waist circumference), hypertension, dyslipidemia, and poor glycemic control (higher HbA1c) are all significant independent predictors of NAFLD. These findings align with prior research highlighting the central role of obesity and metabolic dysregulation in the development of NAFLD (Yamane et al., 2022; Kim et al., 2014).[10,19]The odds ratio for dyslipidemia was particularly high, reinforcing the strong association between lipid abnormalities and liver fat accumulation (Zhan et al., 2012). This underscores the importance of managing these risk factors to prevent the progression of NAFLD in T2DM patients.[16]

Table 5 examines the relationship between the duration of T2DM and the prevalence of NAFLD. The results indicate that NAFLD becomes more prevalent with longer durations of diabetes, with 56.3% of patients having NAFLD after 5–10 years of diabetes, and 25.0% in those with diabetes for more than 10 years. This significant association between longer diabetes duration and NAFLD suggests that chronic hyperglycemia and prolonged metabolic stress contribute to liver fat accumulation over time, as reported in previous studies (Yamane et al., 2022).[10] Early intervention and better glycemic control may help prevent or delay the onset of NAFLD in these patients (Golabi et al., 2019).[13]

CONCLUSION

In conclusion, this study highlights a high prevalence of Non-Alcoholic Fatty Liver Disease (NAFLD) among patients with Type 2 Diabetes Mellitus (T2DM), strongly associated with obesity, hypertension, dyslipidemia, and poor glycemic control. NAFLD was more common in patients with longer diabetes duration and significantly linked to increased cardiovascular and metabolic risks. These findings underscore the need for early screening and integrated management strategies targeting metabolic health and liver function in T2DM patients to prevent complications and improve outcomes.

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