

HYPERTENSION, KIDNEY FUNCTION AND NON-ALCOHOLIC FATTY LIVER DISEASE IN TYPE II DIABETES

¹Owamagbe E. M., ²Kiyesi A. L., ³Ogamba M. I.

¹Department of Chemical Pathology, Faculty of Basic Clinical Sciences, Rivers State University, Rivers State Nigeria.

²Department of Chemical Pathology, Faculty of Basic Clinical Sciences, PAMO University of Medical Sciences, Rivers state, Nigeria.

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Abstract: Background: Non-Alcoholic fatty liver disease (NAFLD) is common in type 2 diabetes and can worsen to serious liver damage. The connection between these two conditions highlights the need for combined treatment approaches. This article assesses the relationship between Non-Alcoholic Fatty Liver Disease, and some clinical factors in the context of Type II diabetes.

Method: The study was carried out at the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. The study included 300 participants aged 18 and above, consisting of 150 diabetic patients and 150 age- and sex-matched controls. Participants underwent clinical, biochemical, and anthropometric assessments. Blood samples were collected to analyse liver enzymes, glucose, and lipid profiles according to standard laboratory procedures. Additionally, all subjects received abdominal ultrasound examinations to detect hepatic steatosis, indicative of NAFLD.

Results: There was a 32.7% prevalence of NAFLD among the diabetic patients. Normal kidney function is observed in 53.1% of the NAFLD group and 49.5% of the non-NAFLD group. Mild reduction in kidney function appears in 32.7% of the NAFLD group and 35.6% of the non-NAFLD group. Moderate to severe reductions in kidney function show comparable rates across both groups, and these differences are not statistically significant ($p = 0.939$). Hypertension is more prevalent among those with NAFLD, with 30.6% of these individuals affected compared to 16.8% of those without NAFLD. Although this trend suggests a higher occurrence of hypertension in the NAFLD group, the difference is only marginally significant ($p = 0.053$).

Conclusion: There were no significant differences in the distribution of hypertension and kidney function among persons with NAFLD. However, these findings emphasize the need for a comprehensive approach to management, encompassing strategies to improve glycaemic control, monitor kidney function, manage blood pressure effectively, and promote healthy weight management.

Keywords: NAFLD, Diabetes Mellitus (DM), Glucose control, BMI, Hypertension.

1. INTRODUCTION

Non-Alcoholic Fatty Liver Disease (NAFLD) has emerged as a significant public health concern, particularly among individuals with Type II diabetes. This chronic condition, characterized by the accumulation of fat in the liver unrelated to alcohol consumption, often intertwines with metabolic disorders, leading to a complex web of health issues.^{1,2} One critical yet underexplored aspect of this interplay is the impact of NAFLD on kidney function. As the prevalence of Type II diabetes

continues to rise globally, understanding the interconnections between liver and kidney health becomes paramount. NAFLD is recognized as the hepatic manifestation of metabolic syndrome, a cluster of conditions that includes insulin resistance, hypertension, dyslipidaemia, and central obesity.³⁻⁵ These conditions are prevalent among patients with Type II diabetes, making this population particularly vulnerable to developing NAFLD. The progression of NAFLD can range from simple steatosis, which is relatively benign, to non-alcoholic steatohepatitis (NASH), which can lead to fibrosis, cirrhosis, and even hepatocellular carcinoma.^{6,7}

The liver and kidneys are intricately linked in their roles in metabolic regulation and detoxification. Emerging evidence suggests that the pathophysiological mechanisms of NAFLD can have profound implications for renal health. For instance, insulin resistance and chronic inflammation, common in NAFLD and Type II diabetes, can contribute to the development and progression of chronic kidney disease (CKD).⁸⁻¹⁰ The mechanisms include oxidative stress, activation of the renin-angiotensin-aldosterone system (RAAS), and endothelial dysfunction, all of which can impair renal function.^{11,12}

Clinical studies have shown that patients with NAFLD have a higher prevalence of CKD compared to those without liver disease.¹³⁻¹⁵ The presence of NAFLD in individuals with Type II diabetes has been associated with an increased risk of both microalbuminuria and macroalbuminuria, early markers of kidney damage.^{6,16,17} Furthermore, advanced liver fibrosis in NAFLD patients correlates with a higher likelihood of renal impairment, indicating a dose-response relationship between liver and kidney damage.⁶

Fatty liver disease can contribute to high blood pressure through several mechanisms. Inflammation in the liver, a hallmark of NAFLD, can trigger the release of substances that constrict blood vessels and raise blood pressure.^{1,2} Additionally, insulin resistance, a common feature in both conditions, can further impair the kidneys' ability to regulate blood pressure.^{4,5} Also, chronically high blood pressure can also worsen NAFLD. The constant pressure on blood vessels can damage the liver and hinder its ability to process fats effectively, leading to increased fat accumulation in the liver.^{9,10} Furthermore, some medications used to treat hypertension can have side effects that contribute to fat accumulation in the liver.^{11,18} The intersection of Non-Alcoholic Fatty Liver Disease and kidney function in Type II diabetes represents a critical area of study with significant clinical implications. As our understanding of the pathophysiological links between these conditions deepens, it becomes increasingly clear that integrated management approaches are essential. This article assesses the relationship between Non-Alcoholic Fatty Liver Disease, and some clinical factors in the context of Type II diabetes.

2. METHODS

2.1 Study Population

The study was carried out at the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. The study included 150 diabetic patients receiving care at UPTH. Diabetic patients were screened to exclude those positive for hepatitis B surface antigen, hepatitis C virus antibody, and those with significant alcohol history.

2.2 Sample Collection and Assessment

Participants underwent clinical, biochemical, and anthropometric assessments. Blood samples were collected to analyse liver enzymes, glucose, and lipid profiles according to standard laboratory procedures.¹⁹ Additionally, all subjects received abdominal ultrasound examinations to detect hepatic steatosis, indicative of NAFLD.

2.3 Data Collection

Data were gathered through structured questionnaires and medical examinations. The questionnaire covered socio-demographic information and medical history. Physical examinations recorded anthropometric measurements, while laboratory tests provided biochemical data.

2.4 Data Analysis

The collected data were analysed using statistical software. Descriptive statistics summarized the socio-demographic and clinical characteristics of participants. Comparative analyses were performed to examine differences between diabetic patients with and without NAFLD, and logistic regression identified predictors of NAFLD within the diabetic cohort. All analyses were done with the Statistical Package for Social Sciences (v26) IBM, USA at a 95% confidence interval and a p-value less than 0.05 was considered statistically significant.

2.5 Ethical Considerations

Ethical approval was obtained from the UPTH Ethics Committee. Informed consent was secured from all participants after explaining the study's purpose, procedures, and potential risks. Confidentiality was maintained throughout the study.

3. RESULTS

Table 1 shows the demographic distribution of the study participants. The table presents the demographic characteristics of a sample population of 150 individuals, broken down by age group, sex, education, and marital status. In terms of age distribution, the largest proportion of the sample, 36.7%, falls within the 50 to 59-year age range, followed by 24.7% aged 40 to 49 years, and 23.3% aged 60 to 69 years. The youngest group, aged 30 to 39 years, makes up 12.7% of the sample, while the oldest group, aged 70 to 79 years, comprises just 2.7%. Regarding sex, most of the sample is female, accounting for 80.7%, while males represent 19.3%. Educational attainment is varied, with the majority of individuals, 58.7%, having tertiary education. Those with secondary education make up 27.3% of the sample, and those with primary education account for 14%. Marital status reveals that a significant majority, 82.7%, are married. Widowed individuals constitute 12.7%, while those who are single make up 4.7% of the sample.

Table 1: Sociodemographic distribution of Subjects

Demography	Frequency (n=150)	Percent (%)
Age group		
30 - 39 years	19	12.7
40 - 49 years	37	24.7
50 - 59 years	55	36.7
60 - 69 years	35	23.3
70 - 79 years	4	2.7
Sex		
Male	29	19.3
Female	121	80.7
Education		
Primary	21	14
Secondary	41	27.3
Tertiary	88	58.7
Marital status		
Married	124	82.7
Single	7	4.7
Widowed	19	12.7

Table 2 shows the distribution of clinical and metabolic factors among Type II DM patients participating in the study.

Table 2: Distribution of Clinical and Metabolic Factors in Patients

Clinical factors	Frequency (n=150)	Percent (%)
Glycated Haemoglobin		
Uncontrolled (>7%)	34	22.67
Controlled (<7%)	116	77.33
Chronic Kidney Disease class		
Normal	76	50.67
Mild Reduction	52	34.67
Moderate reduction	12	8.00
Moderate - Severe	3	2.00

Severe	5	3.33
Kidney failure	2	1.33
Hypertension		
Yes	32	21.33
No	111	74.00
Body Mass Index		
Normal	48	32.00
Overweight	62	41.33
Obese	40	26.67

Figure 1 shows that 32.7% of the patients had NAFLD.

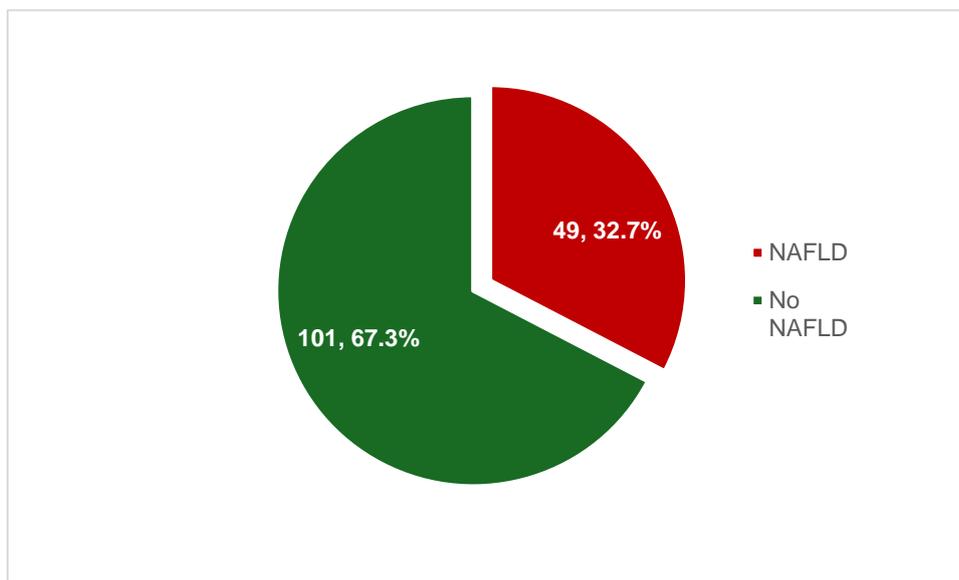


Figure 1: Proportion of DM patients with NAFLD

Table 3 shows the association between NAFLD and clinical factors among the patients. The data reveal a significant link between NAFLD and poor glycaemic control. A striking 49% of individuals with NAFLD have uncontrolled glycated haemoglobin levels (>7%), compared to just 9.9% in the non-NAFLD group. Conversely, 90.1% of those without NAFLD maintain controlled glycated haemoglobin levels (<7%), whereas only 51% of the NAFLD group achieve this target. This association is highly significant, with a p-value of less than 0.0001.

When looking at chronic kidney disease (CKD) stages, the distribution is relatively similar between the two groups. Normal kidney function is observed in 53.1% of the NAFLD group and 49.5% of the non-NAFLD group. Mild reduction in kidney function appears in 32.7% of the NAFLD group and 35.6% of the non-NAFLD group. Moderate to severe reductions in kidney function show comparable rates across both groups, and these differences are not statistically significant (p = 0.939).

Hypertension is more prevalent among those with NAFLD, with 30.6% of these individuals affected compared to 16.8% of those without NAFLD. Although this trend suggests a higher occurrence of hypertension in the NAFLD group, the difference is only marginally significant (p = 0.053).

Regarding body mass index (BMI), normal BMI is more common in the non-NAFLD group (35.6%) compared to the NAFLD group (24.5%). However, a higher percentage of individuals with NAFLD are overweight (44.9%) and obese (30.6%) compared to those without NAFLD, who are overweight (39.6%) and obese (24.8%). Despite these trends, the differences in BMI between the two groups are not statistically significant (p = 0.381).

Table 3: Association of NAFLD with clinical and metabolic factors

Metabolic and Clinical factors	NAFLD n=49 (%)	No NAFLD n=101, (%)	Chi-square (p-value)
Glycated Haemoglobin			
Uncontrolled (>7%)	24(49.0)	10(9.9)	28.7 (<0.0001)*
Controlled (<7%)	25(51.0)	91(90.1)	
Chronic Kidney Disease class			
Normal	26(53.1)	50(49.5)	1.26 (0.939)
Mild Reduction	16(32.7)	36(35.6)	
Moderate reduction	4(8.2)	8(7.9)	
Moderate - Severe	1(2.0)	2(2.0)	
Severe	2(4.1)	3(3.0)	
Kidney failure	0(0.0)	2(2.0)	
Hypertension			
Yes	15(30.6)	17(16.8)	3.73 (0.053)
No	34(69.4)	84(83.2)	
Body Mass Index			
Normal	12(24.5)	36(35.6)	1.93 (0.381)
Overweight	22(44.9)	40(39.6)	
Obese	15(30.6)	25(24.8)	

*Statistically significant ($p < 0.05$)

4. DISCUSSION

There was a 32.7% prevalence of NAFLD among the subjects in the current study. This is similar to the findings of Chukwurah et al which reported a 38.2% prevalence among subjects in Nnewi South-East, Nigeria.²⁰ Similarly, Wenjie et al in a meta-analysis reported a NAFLD prevalence between 29.6% to 87.1% among subjects with type 2 diabetes mellitus.²¹ However, the findings of the current study is in contrast with the reports of Olusanya et al which reported a lower 16.7% prevalence of NAFLD in patients with T2DM in south-west Nigeria.²² This study paints a concerning picture of the interconnected health challenges faced by individuals with type 2 diabetes.

A significant portion (22.67%) have uncontrolled blood glucose, highlighting the urgent need for targeted interventions. These interventions should be multifaceted, potentially including medication adjustments, lifestyle modifications, and educational programs to empower patients with the knowledge and tools to improve glycaemic control.^{23,24} The high percentage (49%) of uncontrolled HbA1c (>7%) in the NAFLD group mirrors findings from previous studies. The significant chi-square value (p -value < 0.0001) strongly reinforces the established link between poor blood glucose control and increased risk of NAFLD. This is consistent with the findings of similar studies which reported an 8 – 17 times increased likelihood of poor glycaemic control associated with the occurrence of NAFLD among diabetics.^{25–28} Poor glycaemic control is a common occurring phenomena in diabetes, while NAFLD has been seen to be associated with an elevated increase in blood glucose levels when compared to non-NAFLD diabetic subjects.^{29,30} This underscores the importance of prioritizing interventions like medication adjustments, lifestyle changes, and educational programs to achieve optimal glycaemic control in diabetic patients.¹⁴

Furthermore, the study reveals a worrying prevalence of chronic kidney disease (CKD) in nearly half the patient population. While nearly half (49%) of the NAFLD group showed no signs of chronic kidney disease (CKD), the remaining half presented with varying degrees of CKD severity. This finding aligns with emerging research suggesting a potential link between NAFLD and impaired kidney function.^{13–15} While the study doesn't show a statistically significant difference in mild CKD stages between NAFLD and non-NAFLD groups, the presence of more severe CKD cases in the NAFLD group warrants further investigation. This necessitates a heightened focus on kidney health. Early detection of kidney impairment through enhanced monitoring is crucial. Once identified, interventions to slow disease progression become paramount.

Optimizing blood pressure control and effectively managing diabetes are key strategies in this fight to preserve kidney function.^{16,17}

Hypertension, another significant finding affecting over 21% of patients, demands immediate attention. The study identifies a higher prevalence of hypertension (30.6%) in the NAFLD group compared to the non-NAFLD group (16.8%), with a marginally significant chi-square value (p-value = 0.053). This aligns with existing research suggesting a bidirectional relationship between NAFLD and hypertension. Effectively managing blood pressure becomes crucial in this population to prevent further kidney damage and cardiovascular complications.

The study underscores the importance of addressing overweight and obesity. Excess weight is a major contributor to metabolic syndrome, a cluster of conditions including high blood glucose, high blood pressure, and unhealthy cholesterol levels. The study doesn't show a statistically significant difference in BMI categories between NAFLD and non-NAFLD groups. However, the trend of a higher proportion of overweight and obese individuals in the NAFLD group is consistent with existing research highlighting the association between excess weight and an increased risk of NAFLD development.^{6,24,31} These findings paint a complex picture, emphasizing the need for a multifaceted approach to managing type 2 diabetes. Prioritizing interventions to improve glycaemic control, implementing strategies for early detection and management of CKD and hypertension, and addressing weight management through lifestyle modifications are all crucial aspects of this comprehensive approach. Further research is necessary to solidify the links between NAFLD and other health complications in type 2 diabetes, paving the way for the development of more targeted preventive and therapeutic strategies for this growing population.

5. CONCLUSION

The findings emphasize the need for a comprehensive approach to management, encompassing strategies to improve glycaemic control, monitor kidney function, manage blood pressure effectively, and promote healthy weight management. Further research is needed to explore the causal relationships and underlying mechanisms to develop more targeted preventive and therapeutic strategies for this growing population.

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