

## PREVALENCE OF NAFLD IN TYPE 2 DIABETES MELLITUS AND ITS CORRELATION WITH HBA1C LEVEL

Suresh Bendwal<sup>1</sup>, Kavita Bendwal<sup>2</sup>, R.G. Dhawale<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Medicine, R.D. Gardi Medical College, Ujjain.

<sup>2</sup>Assistant Professor, Department of Medicine, R.D. Gardi Medical College, Ujjain.

<sup>3</sup>Professor and HOD, Department of Medicine, R.D. Gardi Medical College, Ujjain.

### ABSTRACT

#### BACKGROUND

Nonalcoholic Fatty Liver Disease (NAFLD) is a common liver disorder closely associated with insulin resistance and Type 2 Diabetes Mellitus (T2DM) and also diabetic patients appear to have an increased risk of developing NAFLD than nondiabetic subjects and certainly have a higher risk of developing fibrosis and cirrhosis. The aim of present study was to find out the prevalence of NAFLD in patients of T2DM and its correlation with HbA1c level, body mass index and age.

#### MATERIALS AND METHODS

300 patients of T2DM were included in this study. All patients didn't have any liver disease and all were nonalcoholic. Ultrasonographic evaluation done in all patients to diagnose NAFLD and its correlation seen with HbA1c level and other parameters.

#### RESULTS

48% patients (144 out of 300) were found to be having NAFLD in ultrasonographic study. Mean HbA1c level of the patients with NAFLD was higher than patients with normal USG findings (9.4% vs. 6.5%). 72.4% of patients with BMI of 30-39.9 kg/m<sup>2</sup> had NAFLD followed by 58.9% of patients with BMI range from 25-29.9 kg/m<sup>2</sup> had NAFLD and 38.07% with BMI range of 18.5-24.9 kg/m<sup>2</sup> had NAFLD.

#### CONCLUSION

The present study showed higher prevalence of NAFLD in diabetic patients with its significant association with HbA1c level and BMI. The prevalence of NAFLD increased in uncontrolled diabetic (high HbA1c) and obese (high BMI) patients.

#### KEYWORDS

Type 2 Diabetes Mellitus, Nonalcoholic Fatty Liver Disease, Body Mass Index.

**HOW TO CITE THIS ARTICLE:** Bendwal S, Bendwal K, Dhawale RG. Prevalence of NAFLD in type 2 diabetes mellitus and its correlation with HbA1c level. J. Evid. Based Med. Healthc. 2017; 4(31), 1845-1848. DOI: 10.18410/jebmh/2017/360

#### BACKGROUND

Diabetes mellitus is the commonest metabolic disorder affecting the people all over the world. T2DM is one of the most common secondary causes of dyslipidaemia.<sup>1</sup> Insulin resistance and obesity both combine to cause dyslipidaemia and hyperglycaemia.<sup>2</sup> T2DM is the most common endocrine disorder of humans characterised by metabolic abnormalities leading to long-term complications involving many organ systems. Nonalcoholic Fatty Liver Disease (NAFLD) is common liver disorder closely associated with insulin resistance and T2DM and it is characterised by accumulation of fat in the liver.<sup>3</sup> The prevalence of NAFLD has been reported to be in the range of 15-20% in the general population, whereas in T2DM prevalence is as high as 50-75%.<sup>4</sup> Some patients with NAFLD develop

necroinflammatory changes in the liver called nonalcoholic steatohepatitis and a fraction of those develop cirrhosis of liver, which can progress to end-stage liver disease.<sup>5</sup> The diagnosis of NAFLD require high index of suspicion especially in obese patients over the age of 45 years who have diabetes, because these patients are at greatest risk of developing cirrhosis.<sup>6,7,8</sup> Primary nonalcoholic steatohepatitis is associated with metabolic syndrome related conditions such as obesity, T2DM and dyslipidaemia.<sup>9</sup>

#### AIMS AND OBJECTIVES

In view of the increasing incidence of T2DM and its complications in the general population, the present study was conducted to assess prevalence of NAFLD in diabetes, it's correlation with HbA1c level, body mass index and age.

#### MATERIALS AND METHODS

The present study was conducted on 300 patients of T2DM in the period of August 2015 to September 2016.

#### Inclusion Criteria

T2DM with no previous history of liver dysfunction and nonalcoholic were included in this study. All patients were

Financial or Other, Competing Interest: None.  
Submission 27-03-2017, Peer Review 03-04-2017,  
Acceptance 10-04-2017, Published 17-04-2017.

Corresponding Author:

Dr. Suresh Bendwal,

No. 129/2, Nehru Nagar, Indore.

E-mail: dr.sureshbendwal@gmail.com

DOI: 10.18410/jebmh/2017/360



diagnosed as diabetic as per recommendation of WHO and national diabetes group (American Diabetes Association 2011).

### Exclusion Criteria

Patients of type 1 diabetes mellitus, gestational diabetes, known liver disease, patients less than 20 years of age, alcohol consumers were excluded. Any medications that are known to alter liver functions were not given to the patients except antidiabetic drugs.

All patients were on conservative treatment. A pre-informed consent was obtained. All patients were subjected to detailed history, anthropometric measurement (BMI) and clinical examination and biochemical investigations including liver function test, lipid profile, blood sugar, urine examination and HbA1c level. Ultrasonographic examinations of all patients were performed by radiologist. All patients of T2DM were divided into 3 groups according to their BMI. Those patients with BMI 18.5-24.9 kg/m<sup>2</sup> were placed in group A (n=176), patients with BMI 25-29.9 kg/m<sup>2</sup> in group B (n=95) and with BMI 30-39.9 kg/m<sup>2</sup> in group C (n=29). Results obtained in all patients with T2DM, prevalence of NAFLD seen and correlation of NAFLD with HbA1c and BMI was studied. Statistical analysis was done. P value <0.05 was taken as significant.

### Observation

300 patients of type 2 diabetes were studied. All patients were nonalcoholic and have no history of any liver disease. Out of 300 patients, 177 were males and 123 were females. Physical characteristics of all studied diabetic patients were shown in Table I.

The relationship between age and NAFLD was shown in Table II. All patients were divided into 4 groups according to their age as shown in Table II. 91% patients (273 out of 300) were in age group 41 to 70 years indicating long asymptomatic period of type 2 diabetes and its late diagnosis. Mean age of the patients was 54 ± 10 years. There was no significant correlation found between the age and NAFLD.

### RESULTS

In this study, out of 300 diabetes patients, 144 had NAFLD. All patients of T2DM were divided into 3 groups according to their BMI as shown in table III. Those patients with BMI 18.5-24.9 kg/m<sup>2</sup> were placed in group A, patients with BMI 25-29.9 kg/m<sup>2</sup> in group B and with BMI 30-39.9 kg/m<sup>2</sup> in group C. In group A, 67 patients (38.07%) had NAFLD in group A followed by 56 patients (58.9%) in group B and 21 patients (72.4%) in group C. So, prevalence of NAFLD is high in obese diabetic patients.

The relationship between HbA1c and nonalcoholic fatty liver disease was shown in table IV. In this study, 48% of patients (144 out of 300) had nonalcoholic fatty liver disease. 56.31% patients with HbA1c level more than 7% have NAFLD as compared to 29.8% with HbA1c less than 7%. So, prevalence of NAFLD is more in diabetic patients with high HbA1c level (in uncontrolled diabetic patients).

### DISCUSSION

Diabetes mellitus is the commonest metabolic disorder affecting many organ system of the body. NAFLD is integral part of metabolic syndrome, which comprises clusters of abnormalities such as dyslipidaemia, hypertension, obesity and insulin resistance as a central pathognomonic factor.<sup>10-13</sup> The prevalence of most of the cardiometabolic risk factors is higher in NAFLD patients.<sup>14</sup>

NAFLD often represents the hepatic components of a metabolic syndrome characterised by obesity, hyperinsulinaemia, peripheral insulin resistance, diabetes, hypertriglyceridaemia and hypertension.<sup>11,13</sup> Diabetes is not only associated with NAFLD, but also maybe a risk factor for development of progressive fibrosis.<sup>12</sup> The presence of peripheral insulin resistance, increased free fatty acid level, increased mitochondrial fatty acid B oxidation, increased hepatic lipid peroxidation were responsible in patients with either fatty liver alone or NASH without cirrhosis.<sup>15</sup>

The present study is a cross-sectional study in which observations seen are compared with published literature on the same topics. Similar and contradictory findings had been elaborated and possible explanation given.

In the present study, ultrasonographic finding of NAFLD seen in 48% patients (144 out of 300). These findings were statistically significant (p value <0.0292).

Arun Kumar Kishnan et al<sup>15</sup> (2011) reported in their study that out of 258 T2DM patients 167 (64.7%) patients had fatty liver on ultrasonography. A. K. Agrawal et al<sup>16</sup> (2010) studied on 124 patients with T2DM reported that 57.8% patients had NAFLD. Mohan V et al<sup>14</sup> (2009) reported that the prevalence of NAFLD was significantly higher in patients with diabetes (54.5%) compared to those with prediabetes (IGT or IFG), isolated IGT (32.4%), isolated IFG (27.3%) and Normal Glucose Tolerance (NGT) (22.5%). Prashanth et al<sup>17</sup> (2009) found a high prevalence of NAFLD in T2DM, which increases with multiple components of metabolic syndrome.

The present study shows that 48% patients (144 out of 300) had nonalcoholic fatty liver disease. Among those 72.4% of patients with BMI of 30-39.9 kg/m<sup>2</sup> had NAFLD followed by 58.9% of patients with BMI range of 25-29.9 kg/m<sup>2</sup> had NAFLD and 38.07% with BMI range of 18.5-24.9 kg/m<sup>2</sup> had NAFLD. These findings were statistically significant (p=0.0007). So, the prevalence of NAFLD is more in patients with high body mass index.

Krishnan AK et al<sup>15</sup> (2011) reported in their study that out of 258 type 2 diabetic patients, 167 patients had fatty liver. Average BMI of these patients was 30.6 ± 2.9 kg/m<sup>2</sup>. Vishwanathan V et al<sup>18</sup> (2010) studied on 156 diabetic patients having NAFLD and reported that mean BMI among patients was 29.7 ± 7 kg/m<sup>2</sup> and it was significantly associated with it. Agrawal AK et al<sup>16</sup> (2010) studied on 124 patients (74 men and 50 women) with type 2 diabetes and reported that 82.2% of the patients of NAFLD had BMI >23 kg/m<sup>2</sup> among, which 72.2% of the patients had BMI >25 kg/m<sup>2</sup>. Raman M<sup>19</sup> et al reported that risk factor for NAFLD include BMI of 25 kg/m<sup>2</sup> or greater, central obesity and diabetes mellitus.

**CONCLUSION**

In the present study, there was statistically significant correlation found between HbA1c level and prevalence of NAFLD. In the present study, 48% of patients (144 out of 300) had NAFLD, among these 56.31% patients had HbA1c level more than 7% compared to 29.8% patients with HbA1c less than 7%. So, prevalence of NAFLD is more in diabetic patients with high HbA1c level. These findings are statistically significant and supported by following study.

Krishnan AK et al<sup>15</sup> (2011) reported in their study that out of 258 type 2 diabetic patients, 167 had fatty liver. Average HbA1c level of these patients is 7.6 ± 0.6%. Vishwanathan V et al<sup>18</sup> (2010) studied on 156 diabetic

patients having NAFLD and reported that mean HbA1c among these patients was 9.7 ± 2.8% and it was significantly associated with it. Agrawal AK et al<sup>16</sup> (2010) studied on 124 patients with type 2 diabetes and reported that among 71 patients having NAFLD. Mean HbA1C of these patients was 8 ± 1.6%. Mohan V et al<sup>14</sup> (2009) studied on 541 subjects and reported that NAFLD prevalence increases with increasing severity of glucose intolerance. Cavera L et al<sup>20</sup> (2007) reported that prevalence of NAFLD increases with HbA1C level.

To conclude, NAFLD occurs in significant number of patients with type 2 diabetes mellitus.

Sl. No.	Characteristics	Cases (n=300)
1.	Age (yrs.) • Range • Mean ± SD	22-81 42.06 ± 19.45
2.	Weight (kg) • Range • Mean ± SD	35-81 57.82 ± 10.64
3.	Male:Female ratio	177:123
4.	Blood Pressure (mm of Hg) (Mean ± SD) • SBP • DBP	144.8 ± 29.49 86 ± 16.90
5.	Lipid Profile (Mean ± SD) • Total cholesterol (mg/dL) • Triglyceride (mg/dL) • LDL • HDL	297.21 ± 128.76 415.02 ± 280.32 148.62 ± 72.78 41.95 ± 13.74
6.	HbA1c (%) (Mean ± SD)	7.9 ± 2.30
7.	BMI (kg/m <sup>2</sup> ) (Mean ± SD)	28.75 ± 10.25

**Table I. Physical and Biochemical Characteristics of Diabetic Patients**

\*SBP=Systolic blood pressure.

\*DBP=Diastolic blood pressure.

\*BMI=Body mass index.

Sl. No.	Age (in years)	NAFLD %
1.	<40 (N=32)	15 (46.87%)
2.	41 to 50 (N=81)	45 (55.55%)
3.	51 to 60 (N=92)	41 (44.56%)
4.	>60 (N=95)	39 (41.05%)
<b>Total</b>	<b>N=300</b>	<b>144</b>

**Table II. Correlation between Age and Nonalcoholic Fatty Liver Disease**

	BMI (kg/m <sup>2</sup> )	NAFLD %
Group A	18.5 to 24.9 (N=176)	67 (38.07%)
Group B	25 to 29.9 (N=95)	56 (58.9%)
Group C	30 to 39.9 (N=29)	21 (72.4%)
<b>Total</b>	<b>(N=300)</b>	<b>144</b>

**Table III. Correlation between BMI and Nonalcoholic Fatty Liver Disease**

Sl. No.	HbA1c	NAFLD %
Group 1	<7 (N=94)	28 (29.8%)
Group 2	>7.1 (N=206)	116 (56.31%)
	a) 7.1-8 (N=62)	22 (35.48%)
	b) 8-10 (N=67)	41 (61.2%)
	c) >10 (N=79)	53 (67.09%)
<b>Total</b>	<b>N=300</b>	<b>260</b>

**Table IV. Correlation between HbA1c Level and Nonalcoholic Fatty Liver Disease**

**REFERENCES**

- [1] Rosenson RS. Secondary causes of dyslipidemia: Up to date. 2016. www.uptodate.com.
- [2] Ginsberg HN. Insulin resistance and cardiovascular disease. JCI 15<sup>th</sup> Aug 2000.
- [3] Calin GO, Baber PA, Andronescu DV, et al. Connection between non-alcoholic fatty liver disease and diabetes mellitus. Rom J Diabetes Nutr Metab Dis 2014;21(2):121-127.
- [4] Ashtari S, Mohamad AP, Mohamad RZ. Non-alcoholic fatty liver disease in Asia. Prevalence And Planning. World J Hepatol 2015;7(13):1788-1796.
- [5] Somalwar AM, Raut AD. Study of association of nonalcoholic fatty liver disease with micro and macrovascular complications of type 2 diabetes mellitus. Int J Res Med Sci 2014;2(2):493-497.
- [6] Neuschwander-Tetri BA. Nonalcoholic steatohepatitis and the metabolic syndrome. Am J Med Sci 2005;330(6):326-335.
- [7] Salt WB. Nonalcoholic fatty liver disease (NAFLD): a comprehensive review. J Insur Med 2004;36(1):27-41.
- [8] Viswanathan V, Kadiri M, Medimpudi S, et al. Association of nonalcoholic fatty liver disease with diabetic microvascular and macrovascular complications in south Indian diabetic subjects. Int J Diab Dev Ctries 2010;30(4).

- [9] Pagano G, Pacini G, Musso G, et al. Nonalcoholic steatohepatitis, insulin resistance and metabolic syndrome: further evidence for an etiologic association. *Hepatology* 2002;35(2):367-372.
- [10] Paschos P, Paletas K. Non alcoholic fatty liver disease and metabolic syndrome. *Hippokratia* 2009;13(1):9-19.
- [11] Ibrahim M, Singh C, Ganie MA, et al. NASH: the hepatic injury of metabolic syndrome: a brief update. *Int J Health Sci* 2009;3(2):265-270.
- [12] Leite NC, Cristiane AV, Cardoso CR, et al. Non alcoholic fatty liver disease and diabetes from physiopathological interplay to diagnosis and treatment. *World J Gastroenterol* 2014;20(26):8377-8392.
- [13] Marchesini G, Ronchi M, Forlani G, et al. Cardiovascular disease in cirrhosis. *Am J Gastroenterol* 1999;94(3):655-662.
- [14] Mohan V, Farooq M, Deepa R, et al. Prevalence of nonalcoholic fatty liver disease in urban south Indians in relation to different grades of glucose tolerance and metabolic syndrome. *Diabetes Research and Clinical Practice* 2009;84(I):84-91.
- [15] Krishnan AK, Venkatraman J. Prevalence of non-alcoholic fatty liver disease and its biochemical predictor in patients with type 2 diabetes mellitus. *E & C Hepatology* 2011;7(3-4):7-10.
- [16] Agrawal AK, Jain V, Singla S, et al. Prevalence of non-alcoholic fatty liver disease and its correlation with coronary risk factors in patients with type 2 diabetes. *JAPI* 2011;59:351-354.
- [17] Prashanth M, Ganesh HK, Vima MV, et al. Prevalence of non-alcoholic fatty liver disease in patients with type 2 diabetes mellitus. *JAPI* 2009;57:205-210.
- [18] Vishwanathan V, Kadiri M, Srikanth M. Association of non-alcoholic fatty liver disease with diabetic microvascular and macrovascular complication. *International J diabetes* 2010;30(4).
- [19] Raman M, Allard J. Non-alcoholic fatty liver disease: a clinical approach and review. *Can J Gastroenterol* 2006;20(5):345-349.
- [20] Lizardi-Cervera J, Aguilar-Zapata D. Non-alcoholic fatty liver disease and its association with cardiovascular disease. *Annals of Hepatology* 2009;8(1):S40-S43.