

(RESEARCH ARTICLE)



## A cross sectional study to assess the prevalence of non-alcoholic fatty liver disease among type 2 diabetes patients

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### Abstract

The objective of this study was to determine the prevalence and factors associated with NAFLD among type 2 diabetes patients ; using a cross sectional study design, a representative sample of T2 DM patients were recruited from A.C.S Medical College And Hospital in Chennai. A detailed medical history as well as laboratory investigation were done NAFLD was diagnosed using abdominal ultrasonography examination. the overall prevalence of NAFLD was 59.3% (89 people) out of 150 T2DM patients. these patients had developed Intermediate fibrosis. In a multivariable regression analysis the risk of NAFLD was significantly higher among male T2DM patients with no alteration in the liver enzymes such as AST and ALT levels. Overall results shows that the most affected age group is between 40-50 years and Individual with BMI range more than 25 (obese) had higher incidence of NAFLD. It was concluded that NAFLD is a common association of T2DM, increasing BMI, poor dietary control are significant factors associated with NAFLD among type 2 DM patients. Health education to improve dietary control and testing for NAFLD among diabetic patients especially those with abnormal BMI are recommended for early detection and prevention of NAFLD.

**Keywords:** NAFLD; T2DM; Ultrasonography Abdomen; Fibrosis; Liver Enzymes; Age Factor; Obese; BMI; Poor Diet

### 1. Introduction

Patients with Type 2 Diabetes Mellitus (T2DM) face a higher risk of developing Non-Alcoholic Fatty Liver Disease (NAFLD) compared to the general population(1). Our research aims to evaluate the severity of NAFLD in Type 2 diabetes patients and to monitor its progression in these individuals. NAFLD, which includes conditions caused by fat accumulation in the liver, is common in overweight or obese individuals and ranges from simple steatosis to non-alcoholic steatohepatitis (NASH)(2). While NAFLD involves fat in the liver without significant inflammation, NASH features liver inflammation similar to alcoholic steatohepatitis and can lead to fibrosis, scarring, and eventually hepatocellular carcinoma (HCC). With the global prevalence of Type 2 DM rising, the International Diabetes Federation (IDF) estimated 537 million adults had diabetes in 2021, projected to increase to 783 million by 2045(3)(4). NAFLD progresses through four stages: simple steatosis, a benign fat build-up; NASH, where the liver becomes inflamed; fibrosis, where scar tissue forms but the liver still functions; and cirrhosis, the severe stage where the liver is permanently damaged, leading to liver failure and cancer(5)(6). Given that fibrosis or cirrhosis can take years to develop, lifestyle changes are essential to prevent the disease from worsening(7).

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## 2. Materials and methods

### 2.1. Study type

The cross sectional study was conducted in the in- patient and out- patient department at A.C.S Medical College and Hospital.

### 2.2. Study population

- **Inclusion criteria:** All male and female in-patients admitted in General medicine and General surgery department ; diabetic patients were included ; patients with age of 30 and above are included irrespective of their genders
- **Exclusion criteria:** Any diabetic patients other than type 2 dm including secondary dm; the average intake of alcohol more than 20 gm/day ; pregnancy ;history of viral hepatitis.

### 2.3. Sample size and population

150 participants were included in the study according to inclusion criteria and duration of the study was 6 months

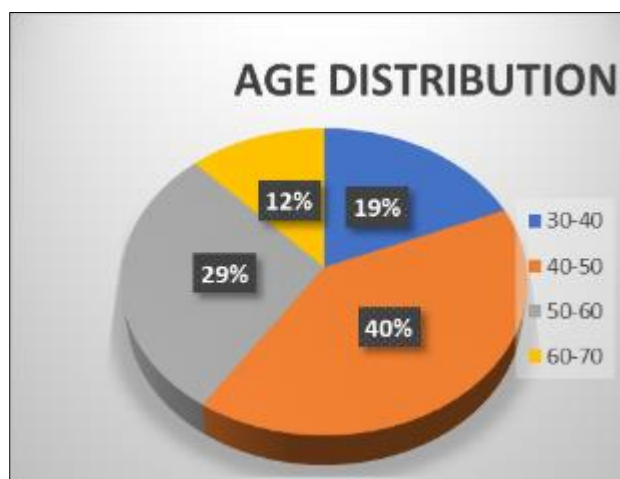
### 2.4. Ethical

The study was approved by the institutional ethical committee, informed consent were obtained from all the participant.

## 3. Results

The Present Study Included 150 Participants

### 3.1. SECTION 1 Age distribution

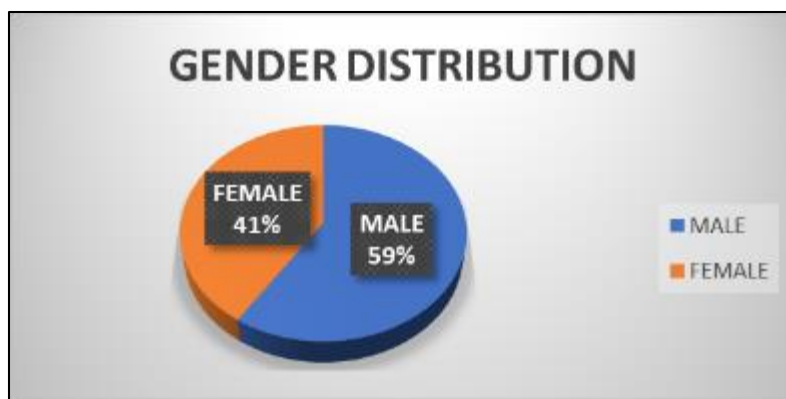


**Figure 1** Total Age distribution

Out of 150 participants comprising both genders ; 12% people were between 60-70 years of age ;29% people between 50-60 years of age; 40 % people were between the age group of 40-50 years of age. and 19% were 30-40 years of age;

### 3.2. SECTION 2 Gender Distribution

Out of the 150 participants 89 are male (59.3 %) and 61 are female (40.7 %).This implies both male and female are involved in the study. The following analysis shows that more male participants in the study than the female participants



**Figure 2** Total Gender Distribution

### 3.3. SECTION 3: Assessment of risk of NAFLD using NAFLD score

#### 3.3.1. Age distribution vs Risk of NAFLD

**Table 1** Age group and Risk of NAFLD

Age group	Intermediate fibrosis	High probability fibrosis	Low probability fibrosis	Total
30-40	11	0	17	28
40-50	37	12	12	61
50-60	25	10	8	43
60-70	16	2	0	18
TOTAL	89	24	37	150

Figure 3.1 shows out of 150 people who underwent ultrasonography abdomen and laboratory tests, by using NAFLD score 37 people between the age of 40-50 shows intermediate fibrosis.

### 3.4. SECTION 4 Gender Distribution vs Risk of NAFLD :

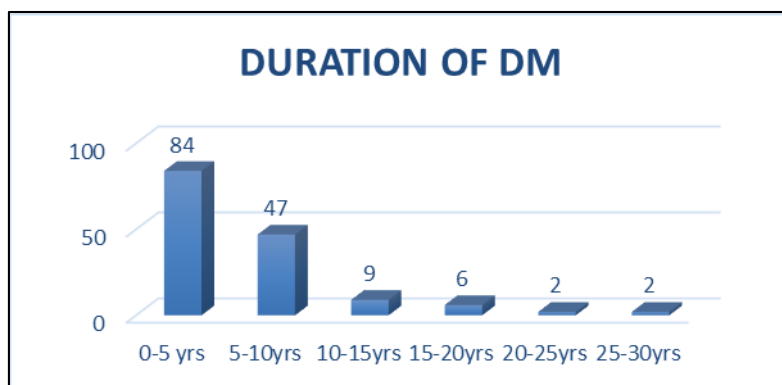
**Table 2** Gender Distribution vs Risk Of NAFLD

Gender	Intermediate fibrosis	High probability fibrosis	Low probability fibrosis	Total
MALE	56	13	20	89
FEMALE	33	11	17	61
TOTAL	89	24	37	150

Figure 3.4 shows out of 150 people who underwent ultrasonography abdomen and laboratory tests, by using NAFLD score 56 male between the age group 40-50 years of age shows Intermediate fibrosis.

### 3.5. Section 5 Duration of diabetic mellitus

Figure 3 shows the number of participants who responded to question; states that 84 people had recently detected diabetes with the minimal diabetic history of 0-5 years, 47 people had diabetic history of 5-10 years, 9 people had diabetic history of 10-15 years, 6 people had diabetic history of 15-20 years, 2 people had diabetic history of 20-25 years, 2 people had diabetic history of 25-30 years. the reason to include this question is to evaluate whether duration of diabetic mellitus has a role in NAFLD Development and progression.



**Figure 3 Results**

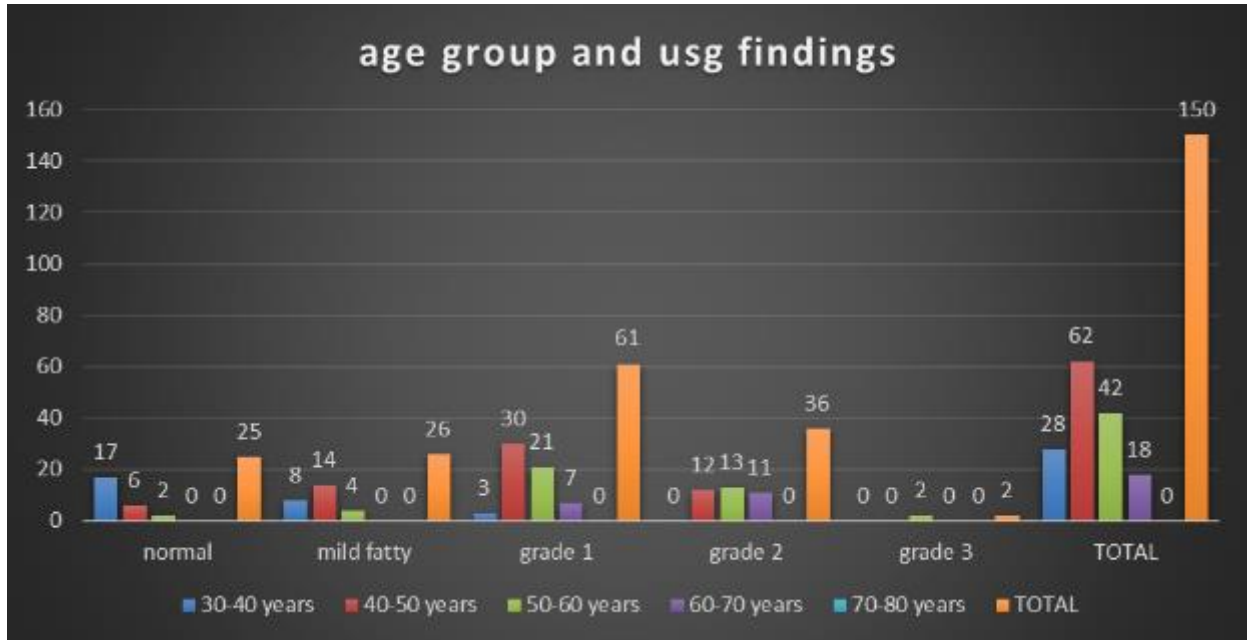
**3.6. SECTION 6 : Assessment of USG abdomen findings in relation to duration of dm and age groups :**

*3.6.1. Duration of diabetes mellitus and USG abdomen findings*

**Table 3** Duration Of Diabetes Mellitus And USG Abdomen Findings

Duration of dm	No abnormality	Mild fatty changes	Grade 1 fatty liver	Grade 2 fatty liver	Grade 3 fatty liver	Total
0-5 YEAR	25	23	33	5	0	86
5-10 YEAR	0	2	25	17	0	44
10-15 YEAR	0	0	3	4	2	9
15-20 YEAR	0	1	1	5	0	7
20-25 YEAR	0	0	0	2	0	2
25-30 YEAR	0	0	0	2	0	2
TOTAL	25	26	62	35	2	150

The given table shows the number of participants of all age groups with the history of diabetes mellitus had undergone the ultrasonography abdomen. The results mentioned above illustrates that people group with history of DM OF 0-5 YEARS shows low risk of developing NAFLD, And people with 5-10 years of diabetic history shows moderate risk of developing NAFLD as these people had grade 1 and grade 2 fatty liver, However the prolong diabetic history can progress the severity of NAFLD. People with diabetic history of 10-15 years and more shows high risk of developing NAFLD and can progress to NASH, These people had upto grade 3 of fatty liver. In whole the above mentioned findings says that NAFLD development and progression is clearly associated with duration of DM. Therefore increase in the time period of DM increases the severity of NAFLD.



**Figure 4** Age Group And USG Abdomen Findings

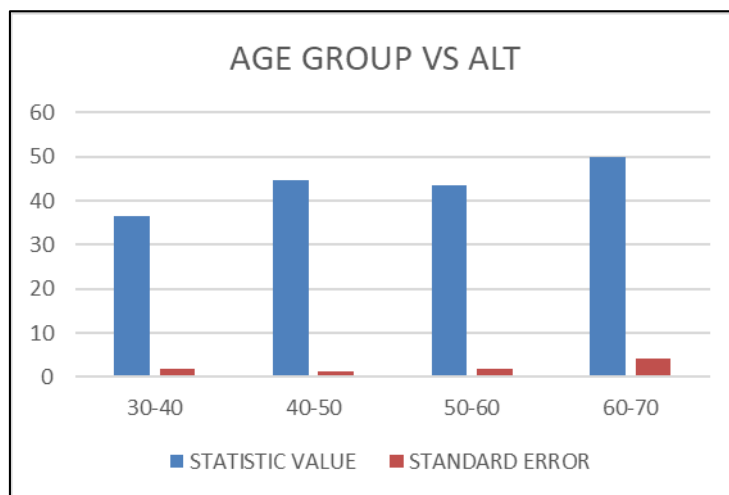
The results mentioned above illustrates that people between the age group of 30-40 years shows mostly no abnormality and possess low risk of NAFLD disease, And people with age group of 40-50 years shows significant grade 2 fatty liver and possess moderate to high risk of developing NAFLD. People with age group of 50 years and above had developed grade 1 to grade 3 fatty liver stating that it has very higher risk of developing NAFLD into NASH. however only few people had developed grade 3 fatty liver among these age group of peoples and it has an association with their duration of DM. This clearly states that age group does not have any association with NAFLD development and progression.

**3.7. Section 7 : assessing the impact of clinical markers including liver enzymes such as ast and alt and lipid profiles in relation to the development and progression of NAFLD**

The given figure below shows the number of participants of all age groups categorised into 4 groups ranges between 30-40 years,40-50 years,50-60 years,60-70 years of age. Stating that there is no clinical increase in the liver enzymes such as AST and ALT. Thus it indicates that no significant relation to liver enzymes and NAFLD. However an increase in the liver enzymes will be noted if the patient had developed NASH.

*3.7.1. Relation of age group and liver enzymes such as alt and ast*

Age group vs alt level



**Figure 5** Age Group vs Alt Level

3.7.2. Age group vs ast level

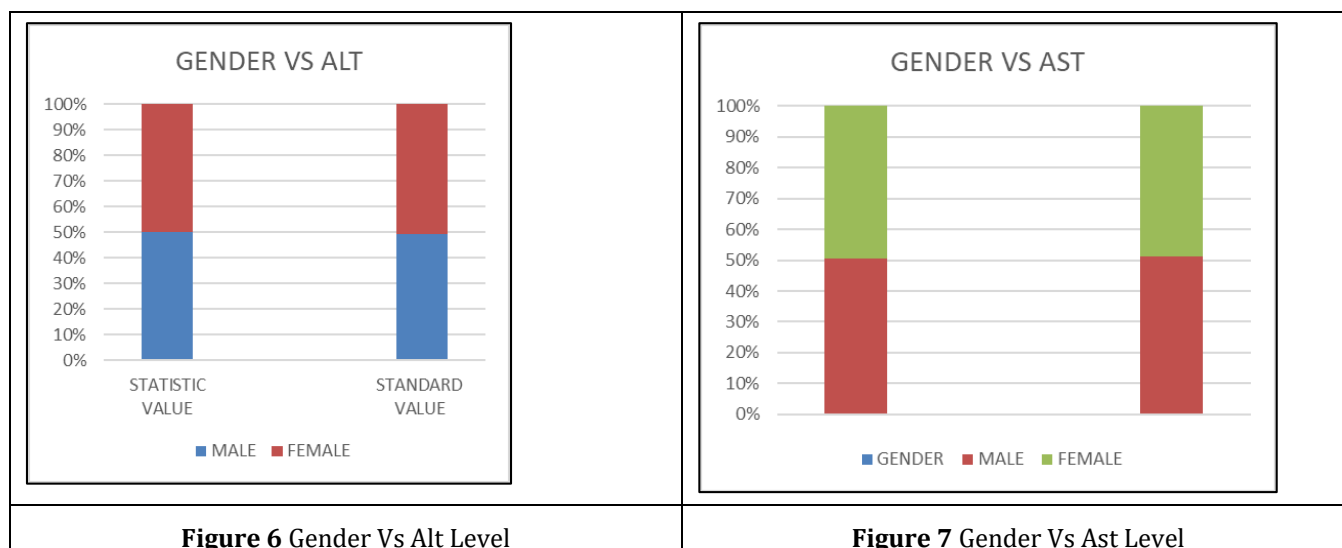
**Table 4** Age Group vs Ast Level

Age	Statistic value	Standard value
30-40	37.46	1.144
40-50	44.38	0.003
50-60	45.02	0.025
60-70	55	0.013

The given table shows the number of participants of all age groups categorised into 4 groups ranges between 30-40 years,40-50 years,50-60 years,60-70 years of age. Stating that there is no clinical increase in the liver enzymes such as AST and ALT. Thus it indicates that no significant relation to liver enzymes and NAFLD. However an increase in the liver enzymes will be noted if the patient had developed NASH.

3.7.3. Relation of gender and liver enzymes such as ALT and AST

The given table shows that there is no alteration in liver enzymes irrespective of their genders



**3.8. SECTION 8 relation of lipid levels and gender**

**Table 5** Lipid Levels And Gender relation

Lipid profile	Gender	Statistic value	Standard value
TRIGLYCERIDES	MALE	162.955	2.1821
TRIGLYCERIDES	FEMALE	162.623	2.5253
TOTAL CHOLESTROL	MALE	227.596	3.85
TOTAL CHOLESTROL	FEMALE	230.262	4.1653
HDL	MALE	40.202	0.7015
HDL	FEMALE	41.639	0.8192
LDL	MALE	127.831	2.5651
LDL	FEMALE	131.41	3.0152

The above table Results showing that blood lipid levels changes noted in the both gender does not have any findings related to fat accumulation in liver ; people with dyslipidemia developed grade 1 to 2 fatty liver. However people with normal lipid levels too developed grade 2 fatty liver. Clearly stating that no significant relation to lipid and NAFLD.

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#### 4. Discussion

The current study was conducted to explore the prevalence of NAFLD among type 2 Diabetic mellitus patients by assessing, evaluating the severity and correlating the affected individuals. people who had history of diabetes for minimum 5-10 years are more likely to develop NAFLD (8). Persons who compromise the Metabolic Syndrome criteria are three times more likely to develop NAFLD. This study comprises of 150 individuals with history of diabetic mellitus are diagnosed with NAFLD by assessments with clinical biochemical markers such as LFT and Lipid Profile Test, ultrasonography abdomen and potential factors such as BMI, Physical Activity etc. These 150 individuals have been participated with their own interest. Out of these participants, 89 are male (59.3%) and 61 are female (40.7 %). We assessed that most affected gender is Male. The participants ages who had diabetic history and found with NAFLD, have been differentiated into certain range of groups like between 30-40 years are 18.7 % (28), 40-50 years are 40.7 % (61)(9), 50-60 years are 28.7 % (43), 60-70 years are 12% (18). This results that the most affected range of age group is between 40-50 years. Prevalence of NAFLD in T2DM patients are of 89 people (59.3%) had intermediate fibrosis (NAFLD), 24 People (16%) had high probability of NAFLD And 37 People (24.7%) had low risk of NAFLD (10). And the prevalence is higher in Males 59.3% compared to females 40.7%.

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#### 5. Conclusions

The purpose of the current study is to assess the relationship between the NAFLD and Type 2 diabetes mellitus patients. The clinical impact becomes more severe as the prevalence increases. The results from this study have established a prevalence pattern of NAFLD in T2DM population. Beside this, the study has brought to light that no prevalent aminotransferase levels in T2DM population. In our consecutively inducted sample, more males [60%] were affected by disease and prevalence was found highest in 40-50 year age group. Also in our study we demonstrated risk for NAFLD with associated elements of Metabolic syndrome, age groups and gender, dietary habits and physical activity. Our study demonstrates that NAFLD may exist without elevation of liver enzymes. However liver enzymes may also increase with severity so there is important need for frequent evaluation of liver enzymes such as AST and ALT in type 2 DM patients, as even mild elevation of these liver enzymes may be a sign of unanticipated hepatic disorder. We sincerely wish this study will be an important step in understanding prevalence of NAFLD in T2DM patients and designing preventive strategies as well as future studies on this condition.

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#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

##### *Statement of ethical approval*

The study is approved by the Institutional Ethical Committee of ACS medical college and Hospital dated on 17/10/2023 with reference no. 966/2023/IEC/ACSMCH/Dt. 17/11/2023.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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