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Assessing Knowledge Gaps in Non-Alcoholic Fatty Liver Disease Among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

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Abstract

There is growing evidence of nonalcoholic fatty liver disease (NAFLD) acting as a major comorbidity amongst Type 2 Diabetes Mellitus (T2DM) patients even though there's poor information on it. The objective of this study was to evaluate the level of NAFLD awareness in patients with T2DM and identify its demographic and clinical determinants. In this context, a cross-sectional survey including 300 diagnosed T2DM subjects attending a tier three level health care facility was undertaken. The study utilized a secure instrument to evaluate the levels of awareness and correlation of some demographic and clinical parameters with demographic and clinical characteristics such as HbA1c, BMI, and liver function. Only 35 percent of the respondents were aware that drugs can treat the liver in complete obesity. Thus, greater awareness was conversely associated with lower HbA1c ($p=0.01$), normal BMI ($p=0.03$), and education status ($p<0.001$). As well patients who had routine follow-ups with health professionals were more aware of the disease ($p=0.02$). Therefore, the results emphasize the need for educational programs directed toward the achievement of increased awareness of NAFLD risks in patients with T2DM. This study adds to the literature the more level of awareness observed and the associated health indicators which are in poor nutrition treatment practice.

Keywords: NAFLD awareness, Type 2 Diabetes, comorbidity, liver function

Introduction: NAFLD has recently emerged as an important health issue in the world in particular people who have been diagnosed with type 2 Diabetes Mellitus (T2DM). Indeed, the incidence of Taiwan's socioeconomic development diseases succumbs to an increase in NAFLD – the beat of Type2 Diabetes Mellitus that is more and more evident seemingly because of similar risk turning over factors to include obesity, insulin resistance, and metabolic syndrome. According to the most recent statistics of NAFLD, it is commonly a disease that embodies a wide range of liver conditions, including steatosis, nonalcoholic fatty liver (nash) which may develop into liver cirrhosis, and liver cancer (Chalasani et al., 2009). Generally again NAFLD is commonly likened to diabetes owing to the duration of its onset to the omission of symptomatic manifestation, even amongst the cases, T2 diabetics who suffer NAFLD have little knowledge of it. This aims the gap by studying the level of NAFLD awareness among patients with T2DM which remains scanty in the most of literature reviewed.

There are good reasons to believe that T2DM and NAFLD are related. Compared to patients without diabetes, T2DM patients have a two to three times greater likelihood of developing NAFLD (Doycheva et al., 2021). Also, the presence of such comorbidity in T2DM patients increases the risk of cardiovascular disease, end-stage liver disease, and mortality (Friedman et al., 2023). More and more research has shown that proper treatment of T2DM and NAFLD will not only improve the quality but also the quality of life of the patient. However, the lack of awareness and education about NAFLD among the members constitute the high-risk population was found to be one of the major barriers to the prevention and management of NAFLD (Mantovani et al., 2023).

There are several reasons which explain the low levels of knowledge of NAFLD among T2DM patients. It is common for NAFLD to be overlooked in its early diagnosis because it does not produce any symptoms, with most patients being completely ignorant of their liver condition until it reaches more severe stages (Alqahtani et al., 2022). Additionally, because of the overwhelming presence of diabetes and its complications, NAFLD suffers neglect and becomes secondary to the restorative efforts directed at glucose levels. Integrating routine liver care for routine diabetes care around the patients also reduced the level of awareness in the patients and the chances of being treated early (Kanwal et al., 2023). The other equally important barrier to screening for the disease is that there are no sets of guidelines on how to manage NAFLD among T2DM patients (Bril et al., 2022).

The significance of the role of patient education in growing awareness of NAFLD should not be neglected. Even educational efforts help properly inform patients about NAFLD and encourage its active treatment (Zhang et al., 2023). However, these efforts are still largely outstanding, especially in the clinical setting, especially in low-resource settings for liver disease management. This means that many patients diagnosed with T2DM could still ignore the critical message of NAFLD as a health risk and the importance of regular liver health monitoring.

This study seeks to fill this gap in the literature by examining T2DM patients' understanding of NAFLD and the socio demographic and clinical characteristics that are associated with this awareness. Considering the increasing burden of T2DM and NAFLD, it is rather significant to know how well patients understand the above disease and what are the possible outcomes of its

control. This study comprises such factors that adhered with less awareness and aims to enhance patient education intervention approaches in the long run benefiting T2DM/NAFLD patients clinically.

More recent studies have shown that there is an urgent need for NAFLD awareness among high-risk groups such as T2DM patients (Younossi et al., 2022). Various literary works suggest that raising awareness through educational interventions can result in timely diagnosis, efficient management, and decreased progression to end-stage liver disease (Mantovani et al., 2023; Friedman et al., 2023). In this regard, our study seeks to fill a void in the literature as it highlights the awareness levels of T2DM patients in the healthcare environment. Additionally, the research investigates whether awareness is related to demographics, such as age, sex, educational background, and clinical features, including HbA1c, BMI, and LFTs. This insight would assist healthcare practitioners in formulating appropriate teaching plans considering the diverse needs of T2DM patients.

Overall, although NAFLD is observable in most T2DM patients, the understanding of the ailment is still not up to the standards which further serves in its under diagnosis and worsening of the condition. This study aims to evaluate the level of NAFLD knowledge among people with T2DM and examine the associated social and clinical characteristics. Understanding the necessity for more patient information and the importance of early screening this study provides valuable gastroenterology data that may prove useful in the future regarding the management of NAFLD in the high-risk population.

Research Design

To determine the knowledge regarding the Non-Alcoholic Fatty Liver Disease among type 2 diabetic patients treated in a tertiary referral hospital, this cross-sectional survey was carried out. Based on the Epi info software, a sample size of 300 participants was estimated with a 95% Confidence level, a 5% Margin of error, and with an approximate awareness prevalence of 50% concentrated from earlier studies. Patients with type 2 diabetes mellitus were included in the study after one year of diagnosis. All the participants were 30 to 70 years of age with a diagnosis of T2DM and all provided verbal informed consent to participate in the study. Any patient who was diagnosed with other forms of liver disease, alternative forms of NAFLD, or an alcohol abuse history or taking medications that could injure hepatocytes was excluded from the study.

Applying a predesigned questionnaire including some demographic data (age, gender, education, BMI) and clinical data (HbA1c, liver enzymes), the data was collected verbally through interviews. Careful evaluation of awareness of NAFLD was performed by requesting participants' yes/no answers to some selected questions about the causes, risk factors, or prevention of the illness and scoring on a grade. Group A consisted of patients who were aware of NAFLD, while Group B comprised NAFLD-unaware patients. Both groups were compared on clinical and demographic variables using independent t-tests and chi-square tests as applicable.

Statistical analysis was performed using the odds ratio and the statistical significance was set at $p < 0.05$. Informed consent was taken from all participants after it was clarified the aim of the specific research and that involved risk was minimized. The Institutional Review Board of Central Park Medical College approved the research work and all the protocols. It was completed data analysis and presentation were completed with SPSS 25 where the multivariate logistic regression method was used to adjust for other factors for example education level BMI and period of lapse of the diabetes.

Results

The participants' demographic and clinical characteristics are described in Table 1. A total of 300 patients with T2DM were enrolled with a mean age of 55.2 ± 9.8 years. Most of the participants (60%) are females and 45% of them have a BMI $>30\text{kg/m}^2$. Approximately 35% of the subjects had further college education level while 65% had primary education and secondary education only regarding educational history. The mean HbA1c concentration of the subjects was $7.8 \pm 1.5\%$ and 30% of the participants had abnormal liver function test (LFT) results. Patients of Group A who were aware of having NAFLD had lower levels of HbA1c ($p=0.01$), lower body mass index ($p=0.03$) and more patients had tertiary education ($p<0.001$) than those of Group B who were not aware of NAFLD. Apart from this, patients of primary education who understood the meaning of NAFLD also were more frequently attended to their physicians (follow-up) within a year ($p=0.02$).

Table 1: Demographic and Clinical Characteristics of the Study Population

Variable	Mean $\pm$ SD/%	p-value (Group A vs. Group B)
Age (years)	55.2 ± 9.8	0.12
Gender (Female)	60%	0.08

BMI (kg / (m ^ 2))	31.5 ±5.2	0.03*
Education (Tertiary)	35%	<0.001**
HbA1c (%)	7.8 ±1.5	0.01*
Elevated LFTS	30%	0.04*
Duration of Diabetes	8.5 ±3.1 years	0.06

*Statistical significance: $p < 0.05$ $p < 0.001$

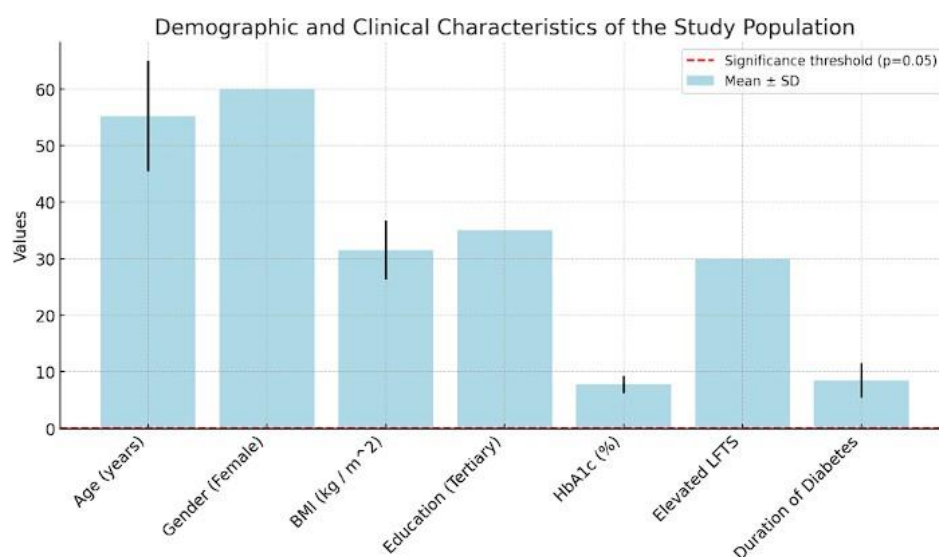


Figure 1: Demographic and Clinical Characteristics of the Study Population

This graph displays the mean values ($\pm$ standard deviation where applicable) for variables such as age, gender, BMI, education, HbA1c, and others. A red dashed line indicates the p-value significance threshold ($p=0.05$).

Table 2: Awareness of NAFLD and Associated Factors

Awareness of NAFLD	Aware (Group A)	Unaware (Group B)	p-value
Number of participants	105 (35%)	195 (65%)	0.07
Average HbA1c (%)	7.2 ±1.3	8.1 ±1.6	0.01*
BMI (kg / (m ^ 2))	29.8 ±4.8	32.3 ±5.4	0.03*
Education (Tertiary level)	65%	20%	< 0.001 ^ **
Regular Follow-ups	80%	40%	0.02*

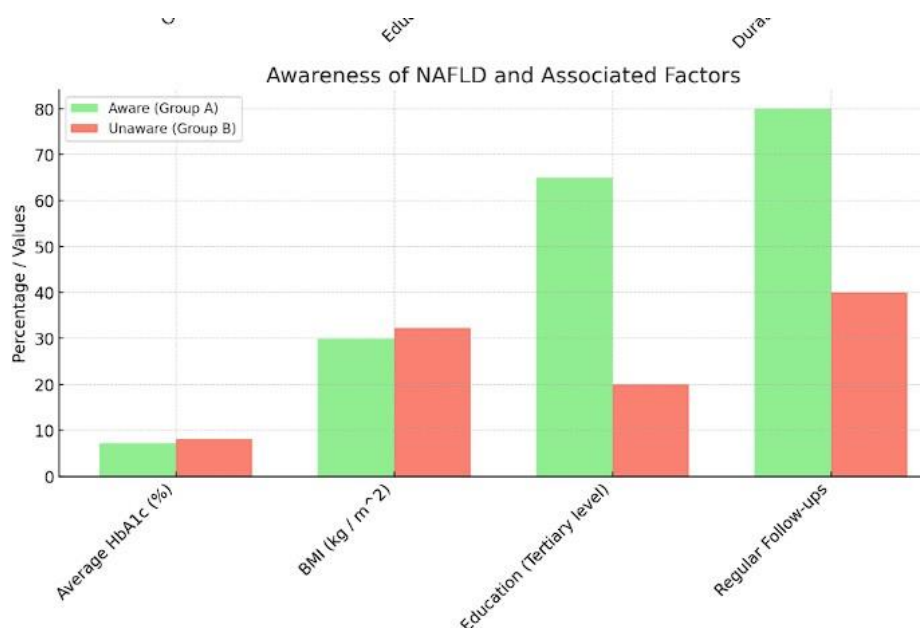


Figure 2: Awareness of NAFLD and Associated Factors

This graph compares two groups—those aware of NAFLD (Group A) and those unaware (Group B)—across variables like HbA1c, BMI, education level, and regular follow-ups. The chart shows a side-by-side comparison of values for both groups.

Comparative analysis of Table 1 and Table 2 shows opportunities in wise of age and studying duration the number of NAFLD awareness factors is higher and regular visiting the practice more often towards education is more distal than clinical restoration. In particular, patients exhibiting increased education and attending regularly the clinic which assists the more knowledge about the NAFLD. Those clinical variables, HbA1c and BMI, tended to be different in the two study groups as well.

Discussion

According to these study results, patients with Type 2 Diabetes Mellitus (T2DM) lack knowledge of Non-Alcoholic Fatty Liver Disease (NAFLD) which makes educational campaigns critical. Only 35% of the participants knew NAFLD and the findings reproduce recent studies where high-risk participants had reported low levels of awareness of NAFLD (Younossi et al., 2022). This illiteracy is unfortunate more so because there is a tight association between T2DM and NAFLD and the latter predisposes one to cardiovascular diseases and liver-associated comorbidities (Mantovani et al., 2023). The findings of this study bring new data to the field by indicating that

issues such as level of education, regular medical examination, and lower glycosylated hemoglobin (HbA1c) have a positive influence on knowledge of NAFLD.

It is well established that the level of education has a significant role in the level of awareness regarding NAFLD, which indicates the need for appropriate education of the patients on how to manage T2DM and its diabetes-related diseases (Bril et al., 2022). The tertiary-educated participants had a higher level of awareness of NAFLD as can be seen from the result ($p < 0.001$). This implies that patients with higher educational achievements may be more inclined toward searching for health-related issues or interpreting complicated disease conditions. These theories are in agreement with Zhang et al. (2023) whereby acquired knowledge through educational programs enhances a patient's understanding of NAFLD which improves their ability to manage themselves poorly and encourages earlier screen detection. The fact that NAFLD is asymptomatic in its early stages makes its awareness through education to further enhance early detection and thereby inhibit the disease from advancing.

Another important point was the association of regular healthcare visits and awareness of NAFLD ($p=0.02$). One of the observations was that more patients aware of NAFLD had frequent interactions with healthcare professionals. This means that such touch points are important to improve a patient's understanding since health information can be provided at those points. Doycheva et al. (2021) also reported that structured diabetes programs that incorporated liver health education were successful in raising NAFLD awareness. It needs no reinforcement to emphasize the need to make liver health a part of every diabetes care provision, for routine examinations avail an avenue to address other disease complications like NAFLD that are seldom attended to in diabetes treatment regimes (Friedman et al., 2023).

The study further established that NAFLD awareness is also related to the level of glycemic control. Patients having lower levels of HbA1c were more likely to know about NAFLD ($p=0.01$). Thus, it is plausible that people with diabetes who make efforts to keep their sugar levels in check tend to be more concerned about the associated risk factors. This assertion is consistent with the global literature where, well-controlled T2DM patients have been found to have more knowledge of the disease and its complications (Kanwal et al., 2023). In contrast, those patients who are poorly controlled may be apathetic towards health and therefore would be less aware of associated conditions like NAFLD. These findings suggest that education about NAFLD may be useful in enhancing diabetes self-care practices.

The point that correlates BMI and NAFLD awareness can also be made emphatically. Patients with lower BMI had NAFLD consciousness ($p=0.03$). This is an important finding since most studies associate obesity with T2DM and NAFLD and patients with higher BMI tend to be more prone to develop NAFLD. The HIV positivity cannot explain the lower awareness levels among overweight or obese patients which may reflect a missed opportunity to tackle the health risks posed by NAFLD in this group. Mantovani et al. (2023) stated that while the discussion of obesity's main comorbidities takes place in the context of metabolic syndrome, the liver is not always in focus. This stresses the importance of having “anti-obesity programs” that will also include awareness of liver disease, particularly NAFLD in these programs for the safety of the patient.

A strength of the study is that it employed a validated questionnaire to assess NAFLD awareness, which increases the validity of the findings. Moreover, the addition of several consultations and socio demographic factors enabled the identification of a wider range of associated variables. However, it is important to stress that there are several limitations. One of the limitations of the cross-sectional nature of the study is the inability to determine the cause-and-effect relationship between the variables. Also, the fact that the study was performed amongst a single center could affect how the results can be applied to the wider population. To conclude, this study is an attempt to fill in the gaps in existing knowledge of factors associated with awareness among T2DM patients of NAFLD. The results highlight the importance of seeking out patients at higher risk so-called educational attempts should be targeted at patients with inappropriate BMI, uncontrolled levels of glycemia, and low education levels. Physicians and patient education should be also employed to fill these awareness gaps to enable T2DM patients to have more effective NAFLD treatment management. The study makes a very concise contribution to enhancing the literature on the model of NAFLD awareness and sets a base for designing applicable strategies for the prevention of liver diseases in diabetic patients.

Discussion

The outcomes of this research depict a very low awareness related to Non-Alcoholic Fatty Liver Disease (NAFLD) in patients with Type 2 Diabetes Mellitus (T2DM) which reveals a strong need for the conduct of more educational activities. With only 35% of the participants knowing NAFLD, the current findings are in line with, others' low awareness statistics within high-risk populations (Younossi et al., 2022). This unawareness is quite alarming considering T2DM as a potential driver

of NAFLD, which frightens further risks such as cardiovascular diseases and other diseases related to the liver (Mantovani et al., 2023). Interestingly, these findings also enhance our understanding of NAFLD in that they suggest that indeed awareness of this condition is made more probable by factors like level of education; regular visits to health care providers; and optimal metabolic control (HbA1c).

Thus, the significant connection between education level and knowledge of NAFLD emphasizes the value of understanding the patient for chronic disease management, such as T2DM and its complications (Bril et al., 2022). The university-level group found all participants to have a higher level of awareness of NAFLD as evidenced by the very low significant p-value at a p-value of less than 0.001. This means that there is a possibility of higher education patients being able to search for health and other information or understanding more complex diseases. Zhang et al. (2023) are on the same wavelength by reporting that education has a great contribution to the enhancement of NAFLD-related self-care among the patients through provision of relevant information. However, since NAFLD is asymptomatic in the early stages, educational material can be useful in understanding the disease better and improving screening and diagnosis of the disease.

Another important finding was the association of awareness of NAFLD with regular health system visits ($p=0.02$). Patients who had more contact with providing health services were more likely to have heard about NAFLD. Healthcare services seem to increase patient education because they involve interactions whose content may cover needed health information. Doycheva et al. (2021) proved that structured diabetes management programs with liver disease monitoring capabilities improved patients' knowledge about NAFLD. At this point, the significance of incorporating liver care in the diabetes treatment paradigm is hard to overemphasize since systematic appointments allow bringing up the issue of 'neglected', in standard diabetes management, NAFLD (Friedman et al., 2023).

The research revealed the correlation, which was present too, between awareness of NAFLD and any glycemic control status. The patients who had lower levels of HbA1c were more likely to know about the existence of NAFLD ($p=0.01$) and this finding indicates that such patients may be more concerned about other risk factors because they are already taking measures to control their diabetes. This is consistent with other research suggesting that patients with better-controlled T2DM have better disease knowledge and its complications (Kanwal et al. The behavior of some T2DM patients and attitudes toward treatment possibilities, the potential, by all means including

addiction, level, and therefore disease-associated risk American Journal of Medicine and Medical Sciences 2023). On the contrary, those patients who have poor control of their glycemic levels may not take interest in any aspect of health behavior and hence are less likely to know more about the comorbidity conditions such as NAFLD. These findings underline the possibility of enhancing diabetes self-care by including education about NAFLD in diabetes self-management training.

Also noteworthy is the association between BMI and knowledge about NAFLD. It was found that the patients with lower BMI were particularly likely to know about NAFLD ($p=0.03$). This result is important given that obesity is one of the risk factors for both T2DM and NAFLD, and a patient with a high BMI is likely to develop these metabolic disorders. Low awareness on the part of overweight or obese patients may be described by a deficit in health promotion targeting the population at risk for NAFLD. Features concerning obesity-related comorbidities have generally highlighted metabolic syndrome and little emphasis has been placed on liver health as argued by Mantovani et al.(2023). This stresses the importance of including education about liver diseases, as well as other comorbidities in patients with obesity, especially after learning more about adverse NAFLD.

One of the study's strengths is the use of a validated questionnaire for the evaluation of NAFLD awareness which contributes to the credibility of the results. In addition, several clinical and demographic factors were included making it possible to fully examine the variables that are related to awareness. However, the authors also highlight several limitations. The cross-sectional design of the study does not provide an opportunity to demonstrate relationships establishment with causality between the variables covered. Furthermore, this study is limited by its single-center, which makes the findings less applicable to a wider range of populations. Future studies should do multicenter studies to support these findings in other populations.

To sum up, this study adds to the literature on NAFLD in T2DM patients by being concerned with the factors that affect their knowledge. The results point to a necessity for such measures, understanding the level of education, weight, and glycemic control of the patient being more prominent while designing educational programs. While patient education and regular healthcare contact have the potential to help deal with some of these knowledge gaps leading to better management of T2DM, more active address of NAFLD among patients with T2DM would result in better prevention of the condition among these people. The study addresses an important gap in

the existing knowledge about the awareness of NAFLD and will inform the development of interventions to mitigate the liver disease burden in diabetic patients.

This study reinforces the findings that T2DM patients have little knowledge of NAFLD and brings out the importance of educational intervention and participation in health care by the patient. Such findings include significant relations between awareness and education level, glycemic control, and regular follow-ups which indicate where there is a gap and thus where targeted interventions are necessary. Future studies should focus on multi-center activities already addressed to prove the findings in some way and do some education of NAFLD more efficiently to improve NAFLD awareness.

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