The Review Of
DIABETIC
STUDIES OPEN ACCESS

The Association Between Non-Alcoholic Fatty Liver Disease (NAFLD) And Type 2 Diabetes Mellitus In Saudi Arabia: A Systematic Review

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Abstract

Background: Non-alcoholic fatty liver disease (NAFLD) and Type 2 Diabetes Mellitus (T2DM) are closely linked metabolic disorders that share common pathophysiological pathways. The high prevalence of obesity and T2DM in Saudi Arabia creates a significant risk for NAFLD, yet a consolidated understanding of their association within this specific population is needed. This systematic review aims to determine the prevalence and association between NAFLD and T2DM in Saudi Arabia.

Methods: A systematic literature search was conducted using PubMed, Scopus, ScienceDirect, Google Scholar, and the Saudi Digital Library for studies published between January 2000 and June 2025. The review adhered to PRISMA 2020 guidelines. Eligible studies were observational (cross-sectional, cohort, case-control) conducted on Saudi adults with T2DM, investigating NAFLD. Two independent reviewers performed study selection, data extraction, and quality assessment using the Newcastle-Ottawa Scale (NOS).

Results: Six high-quality studies (NOS score ≥7/9), encompassing 1,387 diabetic patients, were included. The prevalence of NAFLD among individuals with T2DM in Saudi Arabia was consistently high, ranging from 47.8% to 80.8%, with a pooled average of 64.2%. Key predictors identified were elevated body mass index (BMI), waist circumference, alanine aminotransferase (ALT) levels, and poor glycemic control. One study using transient elastography (FibroScan) reported a higher prevalence (80.8%) and identified significant liver fibrosis in 8.8% of patients, suggesting that ultrasound may underestimate the true disease burden.

Conclusion: There is a high prevalence of NAFLD among Saudi patients with T2DM, driven largely by shared metabolic risk factors like obesity and insulin resistance. These findings underscore the urgent need for integrated care models that include routine liver screening, utilizing sensitive non-invasive tools like FibroScan, within diabetes management protocols in Saudi Arabia to enable early detection and prevent progression to advanced liver disease.

Keywords: Non-alcoholic Fatty Liver Disease (NAFLD); Type 2 Diabetes Mellitus; Saudi Arabia; Prevalence; Systematic Review; Metabolic Syndrome.

Introduction

Background

Non-alcoholic fatty liver disease (NAFLD) has emerged as one of the most prevalent chronic liver conditions worldwide, representing a growing public health concern. It is characterized by excessive fat accumulation in the liver cells not caused by significant alcohol consumption. The disease spectrum ranges from simple hepatic steatosis to non-alcoholic steatohepatitis (NASH), fibrosis, cirrhosis, and even hepatocellular carcinoma. As lifestyle-related metabolic disorders increase globally, NAFLD has become a major cause of liver-related morbidity and mortality (Wen et al., 2022).

Type 2 diabetes mellitus (T2DM) is another metabolic condition that has reached epidemic proportions. It is characterized by insulin resistance and chronic hyperglycemia, leading to multiple systemic complications. The global rise in obesity and sedentary lifestyles has contributed significantly to the parallel increase in both T2DM and NAFLD. These two conditions share common risk factors, including central obesity, dyslipidemia, and hypertension, suggesting a strong interrelationship between them (Muzica et al., 2020).

In recent years, research has increasingly demonstrated a bidirectional association between NAFLD and T2DM. On one hand, individuals with T2DM are at a higher risk of developing NAFLD due to insulin resistance and altered lipid metabolism. On the other hand, the presence of NAFLD may predispose individuals to developing T2DM by exacerbating hepatic insulin resistance and promoting systemic inflammation. This complex interaction underscores the need to understand their coexistence in specific populations (Padda et al., 2021).

Saudi Arabia has witnessed a marked rise in metabolic disorders, largely driven by rapid socioeconomic development, urbanization, and changes in dietary habits. The prevalence of obesity and T2DM in the Saudi population ranks among the highest globally, creating an environment conducive to the widespread occurrence of NAFLD. These trends highlight the urgency of exploring the relationship between NAFLD and T2DM within the Saudi context to guide prevention and management strategies (Ni et al., 2023).

The genetic and environmental characteristics of the Saudi population may further influence the prevalence and severity of NAFLD among individuals with T2DM. Factors such as high-caloric diets, reduced physical activity, and genetic predisposition contribute to the increased metabolic burden. Additionally, cultural and lifestyle practices, including reliance on fast food and limited exercise, have intensified the impact of metabolic diseases in the region (Dharmalingam & Yamasandhi, 2018).

Understanding the association between NAFLD and T2DM is crucial not only for improving clinical outcomes but also for reducing the economic and healthcare burdens linked to chronic liver and metabolic diseases. Early detection and management of NAFLD among diabetic patients can help prevent the progression of liver damage and reduce cardiovascular and metabolic complications. Similarly, recognizing NAFLD as a predictor for T2DM may facilitate targeted interventions in at-risk populations (Targher et al., 2021).

From a clinical perspective, patients with both NAFLD and T2DM often experience more severe disease courses. NAFLD in diabetic patients is frequently associated with advanced fibrosis and an increased risk of cirrhosis and liver cancer. Conversely, the coexistence of T2DM in NAFLD patients accelerates disease progression and worsens metabolic control. This bidirectional aggravation calls for integrated management approaches that address both liver health and glycemic control (Kim et al., 2024).

Recent advancements in diagnostic tools, such as non-invasive imaging and biomarkers, have facilitated better assessment of NAFLD among diabetic patients. Despite these developments, a substantial proportion of cases remain undiagnosed, particularly in primary care settings. This highlights the need for enhanced screening protocols and clinical awareness, especially in countries like Saudi Arabia where both conditions are highly prevalent (Zhao et al., 2022).

Public health policies and preventive programs in Saudi Arabia are increasingly focusing on lifestyle modification, early screening, and health education. However, comprehensive data on the interplay between NAFLD and T2DM within the Saudi population remain limited. A systematic review can help consolidate existing evidence, identify gaps in research, and provide insights into disease patterns specific to the region (Tanase et al., 2020).

Investigating the association between NAFLD and T2DM in Saudi Arabia contributed to a better understanding of their shared pathophysiology and inform national health strategies. By synthesizing available evidence, this research aims to support clinicians and policymakers in developing effective screening, prevention, and treatment frameworks that address both metabolic and hepatic health among Saudi adults (Alfadda et al., 2022).

Methodology

Study Design

This study was conducted as a systematic review to identify, evaluate, and synthesize existing research on the association between non-alcoholic fatty liver disease (NAFLD) and type 2 diabetes mellitus (T2DM) in the Saudi population. The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency, reproducibility, and scientific rigor.

Search Strategy

A comprehensive and systematic literature search was conducted to identify relevant studies published between January 2000 and June 2025. The databases searched included PubMed, Scopus, ScienceDirect, Google Scholar, and the Saudi Digital Library. The following search terms and Boolean operators were used:
(“non-alcoholic fatty liver disease” OR “NAFLD” OR “fatty liver”) AND (“type 2 diabetes mellitus” OR “T2DM” OR “diabetes”) AND (“Saudi Arabia” OR “Saudi population”).

Search filters were applied to include only studies conducted among human participants and published in English. Additionally, the reference lists of selected articles were screened manually to identify any additional studies that met the eligibility criteria.

Eligibility Criteria

Studies were included or excluded based on the following predefined criteria:

- **Inclusion Criteria:**
    - Research conducted in Saudi Arabia.
    - Participants aged 18 years or older.

- Studies investigating the association between NAFLD and T2DM.
- Cross-sectional, cohort, or case-control studies.
- Full-text articles published in peer-reviewed journals between 2000 and 2025.

- **Exclusion Criteria:**
  - Studies involving pediatric or adolescent populations.
  - Reviews, case reports, editorials, commentaries, or conference abstracts.
  - Studies focusing on alcoholic or other secondary causes of liver disease.
  - Non-English publications.

Study Selection Process

All retrieved records from database searches were imported into EndNote reference management software to organize citations and remove duplicates. The study selection process was carried out in three distinct stages:

1. **Title Screening:** The titles of all retrieved studies were reviewed to eliminate those that were clearly irrelevant to the topic.
2. **Abstract Screening:** The abstracts of the remaining studies were examined to assess whether the research addressed the relationship between NAFLD and T2DM in Saudi Arabia.
3. **Full-Text Screening:** The full texts of potentially eligible studies were reviewed in detail to confirm inclusion based on the criteria.

Two reviewers independently conducted the screening process. Disagreements were resolved by discussion or, when necessary, by consulting a third reviewer to reach consensus.

PRISMA Flow

The initial database search identified a total of 312 records. After the removal of 64 duplicate records, 248 unique studies remained for screening. During the title and abstract screening phase, 210 studies were excluded because they did not meet the inclusion criteria, leaving 38 full-text articles for eligibility assessment.

Following a thorough full-text review, 32 articles were excluded for reasons such as being review papers, focusing on non-Saudi populations, lacking relevant data on the NAFLD–T2DM association, or not meeting methodological requirements. Consequently, 6 studies fulfilled all eligibility criteria and were included in the final systematic review.

This process followed the PRISMA 2020 model, ensuring systematic identification, screening, eligibility assessment, and inclusion of studies.

Data Extraction

Data were extracted from each of the six included studies using a standardized extraction form. The following details were collected systematically:

- Author(s) and year of publication
- Study design and location within Saudi Arabia
- Sample size and demographic characteristics

- Diagnostic criteria used for NAFLD and T2DM
- Main findings and statistical measures of association (e.g., prevalence, odds ratios, confidence intervals)
- Reported limitations and quality indicators

Two reviewers independently performed the data extraction to ensure accuracy and reliability, and discrepancies were resolved through discussion.

Quality Assessment

The quality of each included study was evaluated using the Newcastle–Ottawa Scale (NOS), which is designed for assessing observational studies. The scale assessed three key domains:

1. **Selection of participants**,
2. **Comparability of groups**, and
3. **Assessment of outcomes or exposures**.

Each study received a score out of nine possible stars, and studies scoring six or more were considered of moderate to high methodological quality. All six included studies met this quality threshold and were retained for synthesis.

Data Synthesis and Analysis

A **narrative synthesis** was employed due to heterogeneity across study designs, diagnostic tools, and reported outcomes. Quantitative data, including prevalence rates and odds ratios, were tabulated and compared descriptively. Thematic analysis was used to identify recurring patterns and relationships between NAFLD and T2DM among Saudi adults.

Given the differences in methodologies and diagnostic definitions among the included studies, a formal meta-analysis was not conducted. Instead, the synthesis emphasized consistency, strength of association, and the quality of evidence across the reviewed studies.

Ethical Considerations

Since this study relied exclusively on secondary data extracted from previously published research, ethical approval and participant consent were not required. Nonetheless, all included studies had reported obtaining appropriate ethical approval from their respective institutional review boards.

Results

The initial literature search identified 312 records across databases. After duplicate removal and multi-stage screening, 38 full-text articles were assessed for eligibility. Thirty-two were excluded for not meeting inclusion criteria (non-Saudi population, lack of diagnostic confirmation, or non-original data). Six studies published between **2003 and 2023** met all inclusion criteria and were incorporated into the final review.

The included studies represented diverse regions of Saudi Arabia and varied in sample size, study design, and diagnostic method.

Table 1: Characteristics of Included Studies

Author (Year)	Design	Setting	Sample Size	% Male	Mean Age	Diagnostic Method	NAFLD Prevalence (%)	Main Findings

					(Years)			
Akbar et al. (2003)	Cross-sectional	Hospital-based	116	28.0	54 ± 12.8	Ultrasound	55.0	Moderate NAFLD prevalence among diabetic adults; correlated with obesity and higher fasting glucose.
Fallatah et al. (2010)	Cohort	Hospital-based	72	41.7	58.5	Ultrasound	55.6	High prevalence among T2DM; severity correlated with BMI and elevated ALT.
Elmakki et al. (2015)	Cross-sectional	Hospital-based	207	54.1	–	Ultrasound	47.8	NAFLD present in nearly half of diabetic patients; older age and obesity were significant factors.
Alsabaani et al. (2018)	Cross-sectional	Community-based	245	66.1	57.1 ± 13.5	Ultrasound	72.8	Highest NAFLD prevalence; linked to obesity, male gender, and poor glycemic control.
Alfadda et al. (2022)	Cohort (CORDIAL)	Multicenter hospital-based	490	53.5	49.9 ± 7.5	Transient elastography (FibroScan)	80.8	396/490 had hepatic steatosis; 8.8% had fibrosis. Steatosis

								correlated with BMI, ALT, SBP, and waist circumference.
Al Humayed et al. (2020)	Cross-sectional	PHC-based (Abha)	237	66.2	56.5 ± 10.4	Ultrasound	73.4	ALT was best biochemical predictor of NAFLD (AUC = 0.701); BMI and duration of DM were weak predictors.

Aggregate Findings

Across all six studies, sample sizes ranged from 72 to 490 participants, with a combined total of 1,387 diabetic individuals.

The prevalence of NAFLD among T2DM patients in Saudi Arabia ranged from 47.8% to 80.8%, demonstrating a consistently high burden across both hospital and community settings.

When pooled using descriptive synthesis, the average prevalence was 64.2%. This reflects a notably higher rate than global estimates for diabetic populations, indicating a significant national public health issue.

Diagnostic Methods

Five studies relied on abdominal ultrasonography to identify fatty liver, while one (Alfadda et al.) utilized transient elastography with controlled attenuation parameter (CAP) via FibroScan®.

Ultrasound-based studies tended to report prevalence in the 50–73% range, whereas FibroScan, a more sensitive tool, identified hepatic steatosis in over 80% of participants. This difference suggests that ultrasound may underestimate NAFLD prevalence in Saudi diabetic populations.

Quality Assessment

All six studies were assessed using the Newcastle–Ottawa Scale (NOS). Each achieved a score of 7–8 out of 9, classifying them as high-quality observational studies.

Table 2: Quality Assessment

Study	Selection (4)	Comparability (2)	Outcome/Exposure (3)	Total (9)	Quality Tier
Akbar et al. (2003)	3	2	2	7	High
Fallatah et al. (2010)	4	2	2	8	High

Elmakki et al. (2015)	3	2	2	7	High
Alsabaani et al. (2018)	4	2	2	8	High
Alfadda et al. (2022)	4	2	3	9	High
Al Humayed et al. (2020)	4	2	3	9	High

Patterns and Significant Findings

1. **High Prevalence Across Regions:** All studies confirmed NAFLD as highly prevalent among Saudi adults with T2DM, exceeding 60% in most samples.
2. **Key Predictors:** Elevated BMI, waist circumference, and ALT consistently correlated with NAFLD presence. In the CORDIAL study, SBP, ALT, and HDL levels were independent predictors, while in Al Humayed et al., ALT was the best single discriminator (AUC = 0.701).
3. **Fibrosis and Advanced Disease:** The FibroScan-based CORDIAL study revealed that 8.8% of diabetic patients already had significant fibrosis (LSM ≥ 7.9 kPa), highlighting progression risks.
4. **Gender and Obesity Influence:** Men exhibited higher NAFLD prevalence in several studies (e.g., Alsabaani et al.), although obesity's influence was consistent in both sexes.
5. **Heterogeneity:** The earlier meta-analysis (Albeshry et al.) reported $I^2 = 91\%$, indicating substantial heterogeneity due to methodological and diagnostic variability among included studies.

Table 3: Summary Table: Pooled Findings Across All Studies

Parameter	Range / Summary	Interpretation
Publication period	2003 – 2023	Two decades of research reflect persistent high NAFLD rates.
Total participants	1,387	Adults with confirmed T2DM.
Mean NAFLD prevalence	64.2% (range 47.8 – 80.8%)	Indicates widespread hepatic involvement in diabetics.
Diagnostic approach	Ultrasound (5 studies); FibroScan (1 study)	Imaging choice influences detection sensitivity.
Common risk factors	BMI, waist circumference, SBP, ALT, low HDL	Metabolic risk factors consistently implicated.
Mean NOS score	8 / 9	Strong methodological quality.

Discussion

The findings of this systematic review demonstrated that non-alcoholic fatty liver disease (NAFLD) is highly prevalent among individuals with type 2 diabetes mellitus (T2DM) in Saudi Arabia, with a pooled prevalence of 64.2% across six studies. This result aligns with the global recognition of NAFLD as a major

metabolic liver disorder strongly associated with diabetes. The prevalence rates observed across the included studies ranged from 47.8% to 80.8%, indicating that the coexistence of T2DM and NAFLD represents a significant health concern in Saudi adults (Akbar et al., 2003; Fallatah et al., 2010; Elmakki et al., 2015; Alsabaani et al., 2018; Al Humayed et al., 2020; Alfadda et al., 2022).

The strong association between T2DM and NAFLD observed in this review can be explained by shared pathophysiological mechanisms, particularly insulin resistance and obesity. Insulin resistance promotes hepatic fat accumulation through increased free fatty acid flux to the liver and de novo lipogenesis. All studies in this review consistently showed that higher body mass index (BMI) and central obesity were major determinants of NAFLD among diabetic patients (Alsabaani et al., 2018; Alfadda et al., 2022). Similarly, elevated alanine aminotransferase (ALT) levels and waist circumference emerged as independent predictors, reinforcing the role of metabolic dysregulation in hepatic steatosis (Al Humayed et al., 2020).

The variability in NAFLD prevalence across studies may stem from differences in diagnostic methods, sampling settings, and regional factors. For instance, studies using ultrasonography (Akbar et al., 2003; Elmakki et al., 2015) reported lower prevalence estimates (47.8–55%) compared to those employing transient elastography, such as the CORDIAL cohort, which revealed an 80.8% prevalence among diabetic patients (Alfadda et al., 2022). This difference reflects the higher sensitivity of FibroScan in detecting hepatic steatosis and mild fibrosis. Consequently, traditional ultrasound may underestimate disease burden in diabetic populations, emphasizing the need for non-invasive, standardized diagnostic protocols in Saudi healthcare facilities.

Several studies in this review also highlighted the coexistence of hepatic fibrosis among diabetic patients with NAFLD. In the CORDIAL study, 8.8% of participants had significant fibrosis (LSM $\geq$ 7.9 kPa), suggesting progression beyond simple steatosis (Alfadda et al., 2022). This finding is clinically important because the coexistence of T2DM not only increases the risk of developing NAFLD but also accelerates progression to non-alcoholic steatohepatitis (NASH) and cirrhosis. Thus, early identification and risk stratification are essential to prevent end-stage liver disease.

Regional and lifestyle factors may further explain the high NAFLD prevalence observed among Saudi diabetic patients. The Saudi population is characterized by sedentary behaviors, high-caloric diets rich in saturated fats, and limited physical activity, all of which contribute to obesity and insulin resistance (Alsabaani et al., 2018). Urbanization and socioeconomic transitions have also played a key role in modifying dietary habits, particularly among middle-aged adults, who represented the largest subgroup in the included studies (Elmakki et al., 2015; Alfadda et al., 2022).

Gender differences were also observed across some studies. Alsabaani et al. (2018) and Alfadda et al. (2022) noted slightly higher NAFLD prevalence among males compared to females, a trend potentially attributed to differential fat distribution and lifestyle factors such as physical inactivity and dietary patterns. However, other studies did not find significant gender-based differences (Fallatah et al., 2010; Elmakki et al., 2015). This inconsistency suggests that gender effects may be mediated by obesity and metabolic control rather than sex alone.

The role of biochemical markers in predicting NAFLD among diabetic patients was investigated in several studies. ALT was identified as a reliable biochemical indicator, showing a strong association with ultrasonographically confirmed NAFLD (Al Humayed et al., 2020). Elevated liver enzymes often reflect hepatic inflammation or injury secondary to fat accumulation. Nevertheless, other markers, such as aspartate aminotransferase (AST), cholesterol, triglycerides, and HbA1c, were less discriminatory in identifying NAFLD, highlighting the limited utility of routine biochemical tests as sole screening tools.

From a clinical perspective, the high prevalence of NAFLD among diabetic patients underscores the need for routine liver assessment in diabetes management protocols. Despite the widespread availability of ultrasound in Saudi Arabia, its limited sensitivity and operator dependence suggest that FibroScan or other

non-invasive imaging modalities should be integrated into tertiary and secondary care screening pathways (Alfadda et al., 2022). Early identification of steatosis and fibrosis would enable clinicians to implement targeted interventions, including weight reduction, glycemic optimization, and lipid control.

Interestingly, earlier studies, such as those by Akbar et al. (2003) and Fallatah et al. (2010), already demonstrated high NAFLD prevalence in diabetic populations two decades ago, suggesting that the problem has persisted over time despite growing awareness and diagnostic advancements. This indicates that preventive strategies at the population level have been insufficient to curb the metabolic risk factors fueling both diabetes and NAFLD in Saudi Arabia. Public health efforts should therefore focus not only on treatment but also on early prevention through community education and lifestyle modification programs.

The findings of this review also reflect a transition in the diagnostic approach to NAFLD over the years. Earlier studies relied exclusively on ultrasonography, while more recent research incorporated transient elastography and biochemical scoring models. This evolution signifies progress toward more accurate and non-invasive methods that allow early detection of hepatic changes even in asymptomatic diabetic individuals (Alfadda et al., 2022). Establishing standardized diagnostic thresholds and national screening guidelines would enhance the comparability of data and improve disease monitoring.

The burden of NAFLD among T2DM patients also poses substantial implications for healthcare resource allocation. Given the high prevalence of both conditions, their coexistence could lead to escalating demands for hepatology services, imaging, and long-term monitoring. Integrating hepatometabolic care within diabetes clinics could optimize resource use and facilitate multidisciplinary management. This approach aligns with current trends in comprehensive chronic disease models that emphasize preventive and patient-centered care.

It is noteworthy that despite regional variations in diagnostic practices, all studies demonstrated a consistent positive relationship between NAFLD and poor metabolic control. This suggests that NAFLD can be both a marker and a mediator of metabolic dysfunction. Chronic hepatic fat accumulation contributes to systemic inflammation and exacerbates insulin resistance, creating a vicious cycle that worsens glycemic regulation (Al Humayed et al., 2020; Alfadda et al., 2022). Therefore, addressing NAFLD may concurrently improve diabetic control and reduce cardiovascular risk.

Although the included studies were all rated high in methodological quality, heterogeneity was notable (I^2 = 91% in Albeshry et al., 2023). Such heterogeneity likely arises from differences in study populations, diagnostic accuracy, and sampling designs. Future research should aim to standardize diagnostic criteria and employ longitudinal designs to better understand the causal relationship between T2DM and NAFLD progression. Moreover, the inclusion of genetic and lifestyle variables could provide further insight into population-specific risk factors.

Another critical gap revealed by this review is the scarcity of community-based studies utilizing advanced imaging modalities. Most Saudi research remains hospital-based, which may overrepresent patients with more severe metabolic disorders. Community screening programs employing FibroScan or biochemical risk algorithms would provide a clearer picture of NAFLD burden across different population strata and facilitate early intervention among asymptomatic diabetics (Alsabaani et al., 2018).

Overall, the high prevalence of NAFLD in Saudi diabetics reflects the combined impact of obesity, dietary habits, and sedentary lifestyles that characterize much of the Saudi population. Integrating lifestyle interventions such as physical activity promotion, nutritional counseling, and weight management within diabetes care pathways may significantly mitigate NAFLD progression and reduce related morbidity. Public awareness campaigns and primary care training should be prioritized to ensure early recognition and management of hepatic steatosis.

Conclusion

This systematic review revealed a consistently high prevalence of non-alcoholic fatty liver disease among Saudi patients with type 2 diabetes mellitus, ranging from 47.8% to 80.8% across six high-quality studies. The strong association between NAFLD and diabetes is largely driven by obesity, insulin resistance, and poor metabolic control. Elevated ALT, increased BMI, and central obesity were the most reliable predictors of NAFLD. The findings emphasize the urgent need for nationwide screening protocols, adoption of non-invasive diagnostic tools such as FibroScan, and integrated management strategies that address both metabolic and hepatic health to reduce future liver-related morbidity and mortality in Saudi Arabia.

References

1. Wen, X., Zhou, X., Chen, D., Cheng, J., & Ji, L. (2022). Association between non-alcoholic fatty liver disease and diabetes-related microvascular complications: A retrospective cross-sectional study of hospitalized patients. Endocrine Practice, 28(3), 304–309. https://doi.org/10.1016/j.eprac.2021.02.004
2. Muzica, C. M., Sfarti, C., Trifan, A., Zenovia, S., Cuciureanu, T., Nastasa, R., Huiban, L., Cojocariu, C., Singeap, A. M., Girleanu, I., Chiriac, S., & Stanciu, C. (2020). Nonalcoholic fatty liver disease and type 2 diabetes mellitus: A bidirectional relationship. Canadian Journal of Gastroenterology & Hepatology, 2020, 6638306. https://doi.org/10.1155/2020/6638306
3. Padda, J., Khalid, K., Khedr, A., Tasnim, F., Al-Ewaidat, O. A., Cooper, A. C., & Jean-Charles, G. (2021). Non-alcoholic fatty liver disease and its association with diabetes mellitus. Cureus, 13(8), e17321. https://doi.org/10.7759/cureus.17321
4. Ni, X., Tong, C., Halengbieke, A., Cao, T., Tang, J., Tao, L., Zheng, D., Han, Y., Li, Q., & Yang, X. (2023). Association between nonalcoholic fatty liver disease and type 2 diabetes: A bidirectional two-sample Mendelian randomization study. Diabetes Research and Clinical Practice, 206, 110993. https://doi.org/10.1016/j.diabres.2023.110993
5. Dharmalingam, M., & Yamasandhi, P. G. (2018). Nonalcoholic fatty liver disease and type 2 diabetes mellitus. Indian Journal of Endocrinology and Metabolism, 22(3), 421–428. https://doi.org/10.4103/ijem.IJEM_585_17
6. Targher, G., Corey, K. E., Byrne, C. D., & Roden, M. (2021). The complex link between NAFLD and type 2 diabetes mellitus—mechanisms and treatments. Nature Reviews Gastroenterology & Hepatology, 18(9), 599–612. https://doi.org/10.1038/s41575-021-00448-y
7. Kim, K. S., Hong, S., Han, K., & Park, C. Y. (2024). Association of non-alcoholic fatty liver disease with cardiovascular disease and all-cause death in patients with type 2 diabetes mellitus: Nationwide population-based study. BMJ, 384, e076388. https://doi.org/10.1136/bmj-2023-076388
8. Zhao, P., Yan, J., Pan, B., Liu, J., Fu, S., Cheng, J., Wang, L., Jing, G., & Li, Q. (2022). Association between the risk of non-alcoholic fatty liver disease in patients with type 2 diabetes and chronic kidney disease. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 15, 1141–1151. https://doi.org/10.2147/DMSO.S356497
9. Tanase, D. M., Gosav, E. M., Costea, C. F., Ciocoiu, M., Lacatusu, C. M., Maranduca, M. A., Ouatu, A., & Floria, M. (2020). The intricate relationship between type 2 diabetes mellitus (T2DM), insulin resistance (IR), and nonalcoholic fatty liver disease (NAFLD). Journal of Diabetes Research, 2020, 3920196. https://doi.org/10.1155/2020/3920196
10. Albeshry, A. M., Abdulrahman Alasmari, M., Alshahrani, J. A., Alshahrani, A. M., Saad Almusma, A., Alfaya, M. A., Alfaifi, A. J., Alshahrani, M. A., Alharbi, H. K. D., Ali Etwdi, A. S., Aldawsari, E., Zakir Hiyat Moazam, S. M., Alshaiban, M., & Al-Harthi, S. N. (2023). Prevalence of Non-alcoholic Fatty Liver Disease (NAFLD) Among Diabetic Mellitus Patients in Saudi Arabia: Systematic Review and Meta-Analysis. Cureus, 15(12), e51092. https://doi.org/10.7759/cureus.51092
11. Akbar, D. H., & Kawther, A. H. (2003). Nonalcoholic fatty liver disease in Saudi type 2 diabetic subjects attending a medical outpatient clinic: Prevalence and general characteristics. Diabetes Care, 26(12), 3351–3352. https://doi.org/10.2337/diacare.26.12.3351-a

12. Fallatah, H. I., & Akbar, H. O. (2010). Lack of correlation between serum alanine aminotransferase and abdominal ultrasound in the diagnosis of nonalcoholic fatty liver disease in type 2 diabetes. International Journal of Diabetes and Metabolism, 18, 120–123.
13. Elmakki, E., Aqeely, H., Bani, I., et al. (2015). Nonalcoholic fatty liver disease (NAFLD) in Saudi patients with T2DM in Jazan region: Prevalence and associated factors. Journal of Advances in Medical and Medical Research, 10, 872–879. https://journaljammr.com/index.php/JAMMR/article/view/1307
14. Alsabaani, A. A., Mahfouz, A. A., Awadalla, N. J., Musa, M. J., & Al Humayed, S. M. (2018). Non-alcoholic fatty liver disease among type 2 diabetes mellitus patients in Abha City, south western Saudi Arabia. International Journal of Environmental Research and Public Health, 15(11), 2521. https://doi.org/10.3390/ijerph15112521
15. Alfadda, A. A., Sherbeeni, S. M., Alqutub, A. N., Aldosary, A. S., Aldaghri, N. M., Taylor-Robinson, S. D., Alqahtani, S. A., Gul, R., & Almaghamsi, A. M. (2022). Transient elastography for the prevalence of non-alcoholic fatty liver disease in patients with type 2 diabetes: Evidence from the CORDIAL cohort study. Saudi Journal of Gastroenterology, 28(6), 426–433. https://doi.org/10.4103/sjg.sjg_73_22
16. Al Humayed, S. M., Al Sabaani, A. A., Mahfouz, A. A., Awadalla, N. J., Musa, M. J., & Patel, A. (2020). Clinical and biochemical predictors of nonalcoholic fatty liver disease among type 2 diabetes mellitus patients at primary health care level in south western Saudi Arabia. Diagnostics, 10(10), 809. https://doi.org/10.3390/diagnostics10100809