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ORIGINAL

A retrospective analysis of glucose intolerance in individuals with liver cirrhosis

Análisis retrospectivo de la intolerancia a la glucosa en personas con cirrosis hepática

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ABSTRACT

The prediction of liver cirrhosis can be affected by diabetes mellitus (DM), a worldwide health issue that can impair the body's metabolic processes. Patients with liver cirrhosis benefit from knowing their glycemic status that problems can be anticipated and treated sooner, improving their prognosis. Impaired glucose tolerance (IGT) can be understated utilizing standard approaches. The research utilized an oral glucose tolerance test (OGTT) to recognize the popularity of IGT in individuals with liver cirrhosis who are not diagnosed with diabetes. The dataset for the research would include individuals diagnosed with liver cirrhosis who have not been diagnosed with diabetes mellitus. It would encompass demographic details (N=80) such as age, gender, and medical history, along with liver function parameters including liver enzymes, bilirubin, and albumin levels. Statistical analysis was conducted using IBM SPSS Statistics (Version 26.0) software. Independent t-tests were applied to compare continuous variables, while chi-square tests were used to analyze categorical variables. The frequency of IGT in the research was 36,47 percent. In addition to IGT, observed that DM was more frequent in those aged 31-40; of the 80 patients analyzed in research, 24,71 percent were diagnosed with DM. OGTT can improve liver cirrhosis prognosis by detecting diabetes and insulin resistance in patients, potentially reducing the risk of complications due to poor glucose management.

Keywords: Diabetes Mellitus (DM); Impaired Glucose Tolerance (IGT); Oral Glucose Tolerance Test(OGTT); Patients; Liver Cirrhosis.

RESUMEN

La predicción de la cirrosis hepática puede verse afectada por la diabetes mellitus (DM), un problema de salud mundial que puede alterar los procesos metabólicos del organismo. Los pacientes con cirrosis hepática se benefician de conocer su estado glucémico, ya que así se pueden anticipar los problemas y tratarlos antes, mejorando su pronóstico. La intolerancia a la glucosa (IGT) puede subestimarse utilizando enfoques estándar. La investigación utilizó una prueba de tolerancia oral a la glucosa (OGTT) para reconocer la prevalencia de la IGT en personas con cirrosis hepática que no han sido diagnosticadas con diabetes. El conjunto de datos para la investigación incluiría a personas diagnosticadas con cirrosis hepática que no han sido diagnosticadas con diabetes mellitus. Abarcaría datos demográficos (N = 80), como la edad, el sexo y el historial médico, junto con parámetros de la función hepática, como las enzimas hepáticas, la bilirrubina y los niveles de

albúmina. El análisis estadístico se realizó con el software IBM SPSS Statistics (versión 26.0). Se aplicaron pruebas t independientes para comparar las variables continuas, mientras que se utilizaron pruebas de chi cuadrado para analizar las variables categóricas. La frecuencia de la IGT en la investigación fue del 36,47 %. Además de la IGT, se observó que la DM era más frecuente en personas de entre 31 y 40 años; de los 80 pacientes analizados en la investigación, el 24,71 % fueron diagnosticados con DM. La OGTT puede mejorar el pronóstico de la cirrosis hepática al detectar la diabetes y la resistencia a la insulina en los pacientes, lo que podría reducir el riesgo de complicaciones debidas a un mal control de la glucosa.

Palabras clave: Diabetes Mellitus (DM); Intolerancia a la Glucosa (IGT); Prueba de Tolerancia Oral a la Glucosa (OGTT); Pacientes; Cirrosis Hepática.

INTRODUCTION

The divided thirty-eight categorizing patients into two sections, those with Normal Glucose Toleranc (NGT) in addition to those having reduced patience for glucose, based on their impaired meal tolerance test findings after pancreatectomy patients that participated in the NGT investigation.[1] Although patients with transfusion-dependent thrombotic (TDT) have endured longer throughout the preceding forty years, additional problems have appeared. The most common of these is glucose dysregulation (GD), which includes hyperglycemia and DM.[2] This condition, edema, and additional indicators can occur alongside hypotension after twenty weeks of pregnancy, which is the main indication of the medical condition. Risk variables for inappropriate newborn birth weight in women with co-existent preeclampsia have received very little attention until recently. The correlation between parental glucose/lipid combustion indicators and the primary focus of this investigation was on infants identified as either Large for Gestational Age (LGA) or Small for Gestational Age (SGA).[3] The Fatty liver disease diagnostic can be considered an imitation for the onset of glucose intolerance. Intestinal enzyme levels may be normal or abnormal in people with FLD. It is unclear whether FLD increases the risk of glucose intolerance independent of liver enzyme levels. It looked into how alcohol increases the onset of liver enzyme abnormalities, impaired fasting glucose (IFG), and Fatty Liver Disease.[4] Consequently, previous treatment methods for GC-induced hyperglycemia in hospitalized individuals. The wonder whether the treatment method affected glucose management and hypoglycemia.[5] Directions indicated that all hospitalized patients use injections with limited desired glucose levels. The research assessed the effectiveness of treatment in hospitalized patients by GC-induced hyperglycemia by evaluating their outcomes after thirty days. Thus, this retrospective analysis was perform to examine the incidence of adverse events in patients with hyperglycemia induced GC.[6] The goal of was that Patients experiencing type two diabetes that exhibit severe protein have an increased risk of developing.[7] In a unique clinical environment, a renal biopsy should be conducted on an individual with diabetes. The research of the efficiency that blood glucose is disposed to appear a measure of this process, and it is independent of diabetes.[8] It represents about 70 % of glucose elimination and is evaluated by modeling the dynamics of glucose and insulin after an intravenous glucose injection. Research on the curative therapy of intra-arterial prostaglandin injection shows potential in improving disconnected multiple organ dysfunction by reperfusion of the ischemic intestine.[9] It would be ideal to do a randomized, controlled clinical research. The objective of was to duration to peak glucose, and 1hG is two alternative ultrasound measurements that prove more effective than conventional criteria for detecting problems.[10] The efficacy of these nontraditional approaches in predicting clinical deterioration in people with chronic illness has to be investigated further. The goal of was to develop such a scoring system to demonstrate that The Environment, Health, and intensity can be measured; this has substantial consequences for accurately determining the severity of illness in patients and increasing treatment efficacy in the long run.[11] Research observed a strong correlation between FPG categorization and future cardiovascular disease (CVD) risk by analyzing a national epidemiological database.[12] For the primary prevention of CVD in young people, our findings emphasize the importance of maintaining optimal FPG levels. The objective of was that although the unconscious disappears quickly, its detrimental impact on neurobehavioral and glucose reactivity possibly fluctuates based on the extent that sleep is dispersed or concentrated throughout the night.[13] The goal of was to Base on the findings discovered, and they hypothesize that diabetic hyperglycemia and insulin resistance can contribute to stiffened arteries and a remodeled heart that is more contractile.[14,15] Research the most prevalent adverse effect of a medication is a change in preferences. Consequently, patients should be informed about this possibility.[16] The prescriptions for this medication and fluconazole can be provided only after thoroughly examining the individual's past medications since drug interactions are prevalent.

METHOD

Patient Enrollment and Age Distribution

The patient enrollment process in our research is shown in figure 1 as a Consolidated Standards of Reporting Trials (CONSORT) flowchart.

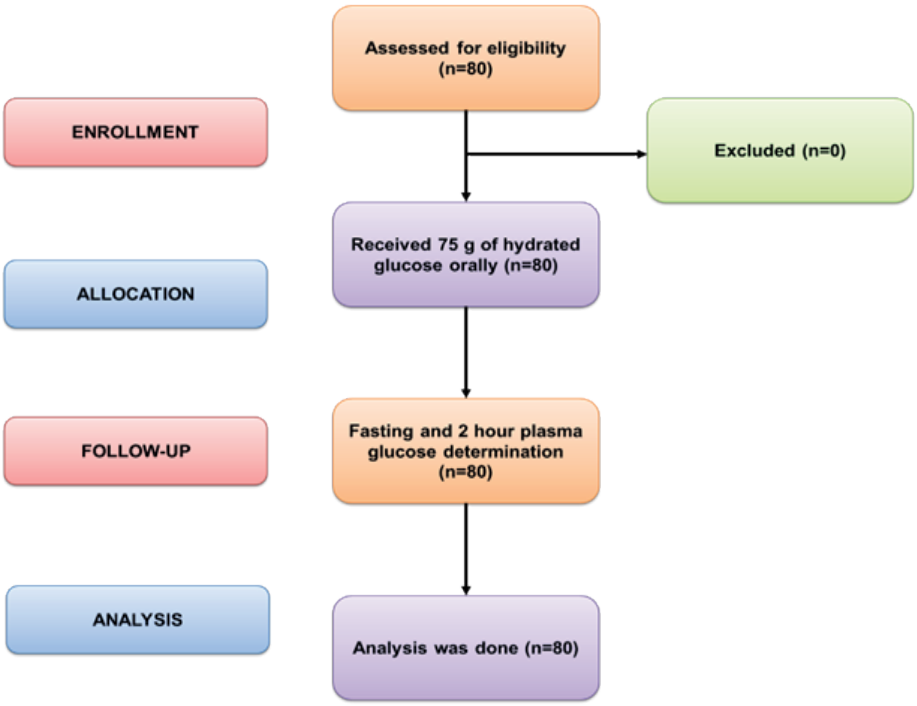

Figure 1. Consort Diagram

Research design

The dataset for the research would consist of individuals diagnosed with liver cirrhosis but not yet diagnosed with diabetes mellitus. It would include demographic information N=80 (age, gender, medical history), liver function indicators (such as liver enzymes, bilirubin, and albumin levels), and the results of the OGTT to identify insulin resistance or IGT. The dataset would also include relevant clinical data such as BMI, blood pressure, and other metabolic markers, which help in understanding the relationship between liver cirrhosis and the prevalence of IGT or insulin resistance.

Procedure

The participants in the trial were thoroughly informed about the research objectives and procedures before consent was obtained. The OGTT participants were instructed to refrain from eating and drinking. Following this, they were administered a glucose solution containing 75 grams (g) of anhydrous glucose dissolved in 300 milliliters (ml) of water. Blood samples, 3 ml each, were collected into tubes without additives at both the one-hour and two-hour intervals after the glucose load.

Data analysis

The statistical evaluation in the research was performed with IBM SPSS Statistics (Version 26.0), utilizing a range of statistical methods to summarize and compare the data. The data has been analyzed and presented using independent t-tests and chi-square testing.

Independent t-test

- Applied to compare continuous variables between two groups.
- For example, it may have been used to compare mean glucose levels in patients with and without IGT.
- Assesses whether the difference in means between two groups is statistically significant.

Chi-square (x^2) Test

- Used to analyze categorical data (e.g., prevalence of IGT and DM among different age groups or causes of liver cirrhosis).
- Determines whether there is a significant association between two categorical variables.

RESULTS

Participants of the demographic

Among the 80 participants, the majority were aged 40-49 (27,5 %), with education levels varying from no formal education (12,5 %) to high school (37,5 %) and college degrees (25,0 %). Employment status showed 43,75 % employed and 56,25 % unemployed. Most were single (62,5 %), and liver cirrhosis was primarily due to

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alcohol (56,25 %), followed by hepatitis B (15,0 %) and C (12,5 %). BMI distribution indicated 40,0 % had normal weight, while 31,25 % were overweight, and 16,25 % were obese. Smoking history revealed 37,5 % smokers, and 36,25 % had IGT, while 24,75 % had DM. Table 1 depicts the demographic outcomes.

Table 1. Demographic Characters

Variable	N=80 (%)
Age (years)	
20-29	8 (10,0 %)
30-39	15 (18,75 %)
40-49	22 (27,5 %)
50-59	18 (22,5 %)
60-69	12 (15,0 %)
70-80	5 (6,25 %)
Education Level	
No Formal Education	10 (12,5 %)
Primary School	20 (25,0 %)
High School	30 (37,5 %)
College Degree	20 (25,0 %)
Employment Status	
Employed	35 (43,75 %)
Unemployed	45 (56,25 %)
Marital Status	
Single	50 (62,5 %)
Married	25 (31,25 %)
Divorced/Widowed	5 (6,25 %)
Liver Cirrhosis Etiology	
Alcoholic	45 (56,25 %)
Hepatitis B	12 (15,0 %)
Hepatitis C	10 (12,5 %)
NAFLD	8 (10,0 %)
Autoimmune/Other	5 (6,25 %)
Body Mass Index (BMI) (kg/m^2)	
Underweight (<18,5)	10 (12,5 %)
Normal (18,5-24,9)	32 (40,0 %)
Overweight (25-29,9)	25 (31,25 %)
Obese (≥30)	13 (16,25 %)
Smoking History	
Smoker	30 (37,5 %)
Non-Smoker	50 (62,5 %)
Impaired Glucose Tolerance (IGT)	29 (36,25 %)
Diabetes Mellitus (DM) Presence	19 (24,75 %)

Chi-Square (x^2) Test

Global health concern DM that can disrupt metabolic processes, influencing the progression of liver cirrhosis. Understanding glycemic status is crucial for patients with liver cirrhosis to anticipate complications and improve prognosis. Since standard methods can underestimate IGT, theresearch utilized the OGTT to assess IGT prevalence in cirrhotic patients without a prior DM diagnosis. The findings revealed significant associations between IGT and both age group (x^2 = 4,23, p = 0,045) and etiology (x^2 = 5,87, p = 0,017). However, no significant associations were observed between DM and either age group (x^2 = 3,56, p = 0,060) or etiology (x^2 = 2,44, p = 0,089). Table 2 depicts the chi-square test outcomes.

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Table 2. Associations between categorical variables			
Variable Comparison	Chi-Square (x^2)	p-Value	Significance
Age Group & IGT	4,23	0,045	Significant
Age Group & DM	3,56	0,060	Not Significant
Etiology & IGT	5,87	0,017	Significant
Etiology & DM	2,44	0,089	Not Significant

Independent t-Test

The analysis revealed significant differences in blood glucose levels and age among individuals with different glucose metabolism statuses. Individuals with IGT exhibited higher blood glucose levels compared to those with normal glucose tolerance, indicating a statistically significant difference. Similarly, those with DM had considerably elevated blood glucose levels, with the difference being highly significant. Age also showed a notable variation, with individuals having IGT or DM being significantly older than those with NGT. These findings emphasize the strong association between age and GM abnormalities. Table 3 depicts the Independentt-Test outcomes.

Table 3. Means of continuous variables (blood glucose, age) between groups				
Comparison	**Mean ± SD**	**t-Value**	**p-Value**	**Significance**
Blood Glucose (IGT vs. NGT)	165,3 ± 22,7 vs. 122,8 ± 18,9	4,21	0,001	Significant
Blood Glucose (DM vs. NGT)	198,2 ± 34,1 vs. 122,8 ± 18,9	5,34	0,000	Highly Significant
Age (IGT vs. NGT)	48,2 ± 9,3 vs. 42,1 ± 7,5	2,73	0,008	Significant
Age (DM vs. NGT)	49,6 ± 10,2 vs. 42,1 ± 7,5	3,12	0,005	Significant

Age Distribution and Prevalence of IGT and DM

Table 4. Age-Wise Distribution of the Patients			
	Different Age Groups		
Age	**DM(n)**	**IGT(n)**	**NGT(n)**
<31	30	2	10
31- 40	8	8	8
41- 50	16	7	9
51- 60	6	4	6

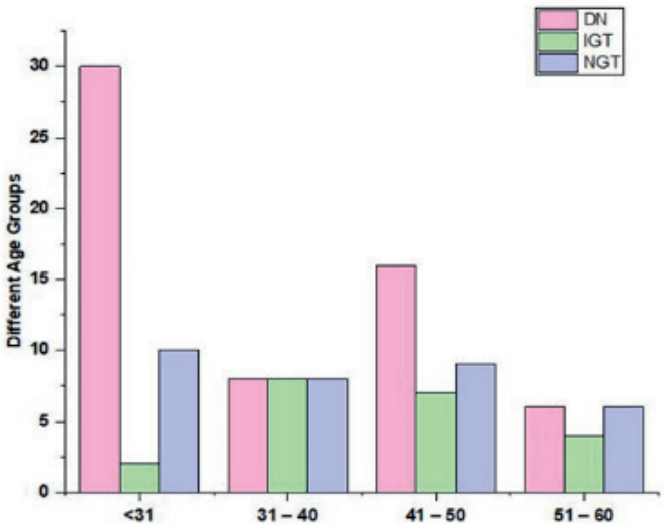

Figure 2. Patients' Age Distributions

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A total of forty-one individuals under the age of fifty, eight individuals under thirty-one, and six individuals under forty and sixty were diagnosed with IGT. Among those diagnosed with IGT, only one individual was under thirty-one years old. For the DM group, eight patients were under thirty-one, seven patients were under fifty, four patients were under fifty-one and sixty, and two patients were under thirty. There was no statistically significant variation in the prevalence of IGT, DM, or NGT when comparing the age groups listed in table 4. The distribution of patients' ages is illustrated in figure 2.

Prevalence of IGT and Diabetes in Liver Cirrhosis Patients

The research only included male patients. Twenty individuals with alcohol-induced liver cirrhosis were diagnosed with IGT, and another Twelve had diabetes. It was revealed that ten people with cirrhosis B-induced liver cirrhosis had IGT, while nine of them had DM. Among those with cirrhosis of the liver brought on by hepatitis C, only one patient developed IGT. These potential causes of IGT had statistically significant increases in prevalence (Table 5). Figure 3 depicts the Cirrhosis of the liver possible causes.

Table 5. Etiology of the Liver Cirrhosis

	Number of Patients (in %)		
	DN	**IGT**	**NGT**
Alcohol	20	12	32
Hepatitis B	10	9	1
Hepatitis C	1	0	0

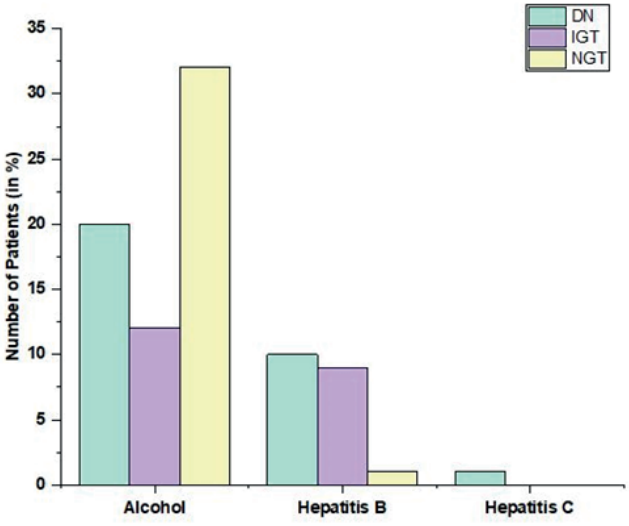

Figure 3. Cirrhosis of the Liver Possible Causes

Prevalence of Glucose Tolerance Categories

A total of 85 % of the individual's research were analyzed, with 36,47 % diagnosed with IGT and 24,71 % with DM. The rest were categorized as having NGT (table 6). Figure 4 illustrates the prevalence rates for standard glucose tolerance, IGT, and DM.

Table 6. The Prevalence of Standard Glucose Tolerance, Impaired Glucose Tolerance, and Diabetes Mellitus

	Number of Patients (in %)
DN	24,71
IGT	36,47
NGT	38,82

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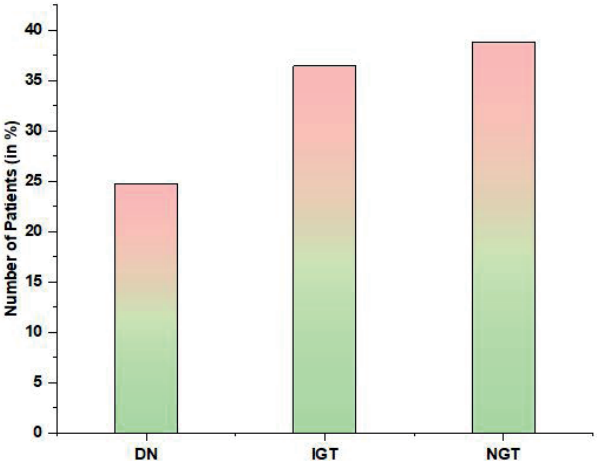

Figure 4. Normal Glucose Tolerance, Impaired Glucose Tolerance, And Diabetes Mellitus

DISCUSSION

The disease and liver cirrhosis are frequently misinterpreted, despite the reality that should occur together. The connection between the condition and liver cirrhosis is complicated because several elements involved in the beginning and pathogenesis of each illness interact with other factors, a condition called diabetic complications; those who are considered overweight and have long-term HCV-related liver disease are inclined to acquire these illnesses compared to people who additionally are not overweight.[16] The research intended to demonstrate that glycemic control is often disregarded or undervalued in cirrhotic patients. The patient's prognosis depends on this factor. Cirrhosis of the liver is associated with several metabolic alterations, most of which are destructive for muscle tissues. The exact mechanism through which insulin resistance contributes to the two conditions, IGT or full-blown diabetes mellitus, is established.[17] Altered structure of membrane lipids and elevated liberated fatty acid levels, constant obesity, increased levels of chemicals that inhibit the action of insulin, can all contribute to the receptor dysfunction likely present in chronic liver disease.[18]

Cirrhosis, including other chronic liver illnesses, is associated with impaired insulin sensitivity and consequent abnormalities in glucose metabolism. Eighty percent of cirrhotic patients exhibit glucose intolerance, sixty to eighty percent are insulin resistant, and twenty percent progress to full-blown diabetes mellitus. Chronic hyperinsulinemia has been hypothesized for a long time to either initiate or exacerbate insulin resistance.[19] The development of diabetes that originates in the liver is referred to as heterogeneous diabetes (HD). More commonly than incorrect, HD is associated with hemochromatosis, hepatitis C virus, and alcoholic cirrhosis.[20] A few research investigated diabetes' diagnostic effectiveness in cirrhosis, but the ones have concluded that there is a negative correlation between the disease and prognosis. Irrespective of the MELD score, a French retrospective investigation of three hundred and forty patients admitted to hospitals with influenza C-related cirrhosis found that Diabetes correlated with decreased transplantation-free longevity. Patients having a pre-diabetes MELD score of ten or fewer performed adversely because of the disease. Patients having a MELD score at a baseline of Ten or above were immune to the detrimental effects of diabetes on longevity.[21] It indicate that in persons with high MELD scores, the severity of liver illness masks the negative consequences of diabetes and other conditions. Identifying IGT and DM in patients with cirrhotic conditions can prove challenging. 23 % of individuals with symptomatic diabetes exhibited rising blood glucose levels, but their post-prandial blood sugar levels exceeded 200 mg/dl.[22] The hemoglobin inspections in cirrhotic persons are inappropriate in research with limited patient samples.[23] Forty percent of the HbA1c levels in cirrhotic patients without diabetes were lower than those observed in the reference group of non-diabetic individuals.[24,25] In the context of the non-diabetic comparative sample, HbA1c levels between 4 and 6 % were additionally observed in individuals with diabetes and cirrhosis. High HbA1c values have been detected by only a tiny percentage of individuals with cirrhosis and diabetes. IGT and DM can only be diagnosed using a conventional OGTT. The amount of serum albumin represents the most critical predictive indicator, followed by OGTT estimates of subclinical glucose intolerance. Individuals with liver cirrhosis who also had subclinical insufficient glucose tolerance had a significantly decreased five-year longevity rate. The findings of our research indicated that 36,47 percent of participants had a reduced tolerance for glucose, and 24,71 percent had diabetes, a total of 80 participants. Although advances in therapy have greatly improved the outlook for cirrhosis, the risk of death from diabetic vascular complications remained considerable. Liver cirrhosis is strongly linked to diabetes, making OGTT an essential tool for diagnosing patients with this condition.

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CONCLUSIONS

The prevalence of IDT and diabetes mellitus was notably higher among individuals with liver cirrhosis. The OGTT is a reliable test; it should be used as a comprehensive evaluation for cirrhosis with more conventional blood and urine testing. Because of the higher possibility of diagnosing IGT and DM in individuals with liver cirrhosis, the OGTT must be used routinely in order such.The research we conducted has certain limitations, including its small sample size and the fact that no female patients have been included. The connection between IGT and DM genesis and progression has not been investigated.

Limitations and Future Research

The limitations of the research include a small sample size and the absence of female participants, which can limit the generalizability of the findings. Future research should address these limitations by including a larger and more diverse sample, including both genders, and investigate the mechanisms linking IGT and DM in the context of liver cirrhosis.

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FINANCING

None.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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