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Association of Hepatitis B and C with Type 2 Diabetes Mellitus

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Abstract

Hepatitis, a medical condition distinguished by inflammation of the liver, may arise from various etiological factors, including viral infections, chemical exposure, autoimmune disorders, or other specific viral pathogens. For over two decades, diabetes mellitus has been associated with chronic liver diseases, including hepatitis B (HBV) and hepatitis C (HCV). Herein, this study aims to evaluate the association of type 2 diabetes mellitus (type 2DM) in patients suffering from Hepatitis B or C viruses and the susceptible age association with it. The survey data of 330 patients with HBV and HCV (March 2021-March 2022) was collected from one of the teaching hospitals in Pakistan. The analysis shows that 93 (28.18%) patients were HBV-positive, whereas 237 (71.82%) were HCV-positive. Furthermore, Among the HBV patients, 18 (19.3%) were associated with type 2DM. However, in HCV patients, 54 (22.7%) were associated with type 2DM. A higher association of Hepatitis B with diabetes was found in male patients, whereas in the case of the association of type 2DM with Hepatitis C, the ratio of male and female patients

was almost equal. Most of the patients (HBV and HCV) associated with type 2DM were above 40 years of age. Future research should target dual-action treatments for HBV/HCV with Type 2DM and develop targeted screening for at-risk populations, particularly those over 40 years old.

Keywords: Hepatitis B, Hepatitis C, Type 2 Diabetes Mellitus

Introduction

Diabetes and hepatitis are among the most common prevalent diseases in the world; the coexistence of diabetes and hepatitis can result in a life-threatening situation, increasing mortality by around 17% among diabetic patients. Furthermore, hepatitis is an inflammation of the liver caused by a variety of factors, including viral infections such as hepatitis B (HBV) and hepatitis C (HCV), exposure to toxic chemicals that affect the liver, autoimmune illnesses, and less common viral agents. This issue affects not only the liver's function but also has larger implications throughout the body, including its link to metabolic disorders such as diabetes mellitus. Over the last two decades, researchers have increasingly recognized the link between diabetes mellitus and chronic HBV and HCV infections. This correlation is notable because of the reciprocal nature of the relationship; diabetes can worsen the advancement of liver disease, and chronic hepatitis can cause disruptions in glucose metabolism, which can contribute to the onset or deterioration of diabetes **[1-3].**

Multiple studies have demonstrated that HCV infection substantially raises the incidence of DM. While the exact biological mechanisms underlying this remain unknown, it is hypothesized that insulin resistance (IR) significantly contributes to the emergence of diverse complications linked to HCV infection. However, alternative research has demonstrated that there is no statistically significant correlation between HCV infection and the incidence of DM. Diverse findings have been observed across studies investigating the correlation between HBV infection and DM. In addition to the incongruous findings, a significant constraint of these investigations is that they have primarily examined the correlation between lipid metabolism disorder or hepatotropic virus (HBV or HCV) infection and diabetes mellitus (DM). Infrequently have their associations been examined in conjunction with pre-DM or both pre-DM and DM **[4-8]**.

HBV and HCV infections are the primary causes of chronic liver disease globally, affecting 3% of the population and putting 130 million at risk of cirrhosis. According to community-based studies, within 20 years, up to 80% of HCV patients may develop liver fibrosis and cirrhosis. The global prevalence of HBV/HCV co-infections is unknown and may be underestimated due to silent HBV infections. Chronic hepatitis B patients in Asia-Pacific countries like Taiwan have a high HCV prevalence. Hepatocellular carcinoma, liver cirrhosis, and severe hepatic damage are more common in those with concomitant HBV/HCV infections. Chronic hepatitis C (CHC) patients are more likely to acquire Type 2 DM, according to recent studies. Case-control studies show that 12.6% of non-cirrhotic HCV patients have T2DM, compared to 4.9% of HBV patients. Patients with T2DM also have a higher risk of HCV infection **[7, 9-12]**.

Herein, this study investigates the prevalence and age-related susceptibility to Type 2DM in patients with Hepatitis B or C viral infections. Analyzing data from around 330 patients, the study aims to elucidate the association between chronic viral hepatitis infections and the occurrence of Type 2DM, particularly focusing on the age groups most at risk in Pakistan.

Materials and Method

The present investigation was conducted at Khyber Teaching Hospital in Peshawar, a prominent medical establishment in the Khyber Pakhtunkhwa province of Pakistan. Data from March 2021 to March 2022 were obtained from the records of Medical Units 'A' and 'B' at Khyber Teaching Hospital. The data-gathering tool utilized was a standardized form, which underwent thorough scrutiny and approval by the hospital authorities. The structure of the study was to collect extensive data, encompassing personal demographic factors such as age, gender, and area of residence, along with specific disease-related information about Diabetes and Hepatitis and their interconnectedness. The pro forma sought to integrate essential facts concerning the correlation between Hepatitis B and C and Type 2DM. The study included a group of 330 persons who were diagnosed with either Hepatitis B or C. These individuals were divided into five age groups: 1-10 years, 11-25 years, 26-40 years, 41-60 years, and over 60 years. The data was subjected to statistical analysis and the results were presented using pie charts, column charts, and bar charts, generated by using Microsoft Excel.

Results

Distribution of Hepatitis 'B' and 'C' among studied individuals

This study comprised a group of 330 individuals, each with a confirmed diagnosis of either HBV or HCV. Out of the total number of patients, 237 individuals, which represents 71.82% of the sample, were found to be infected with HCV. Furthermore, a subset of 93 individuals, which accounts for 28.18% of the total, experienced HBV infection. This indicates the varying prevalence of viral hepatitis infections among the patients (**Figure 1**).

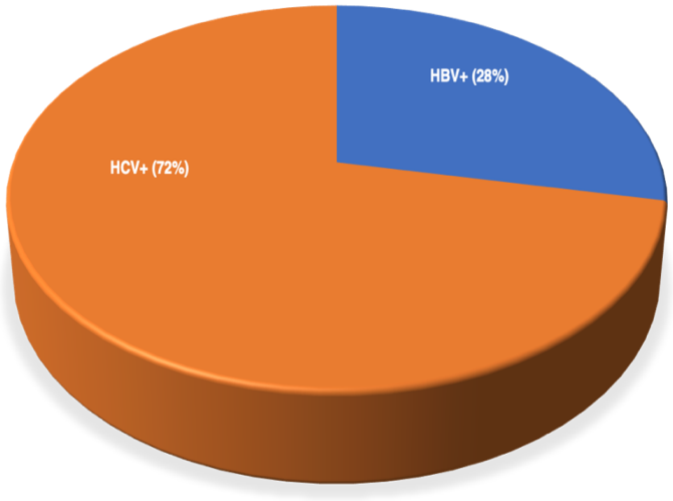


Figure 1. Distribution of Hepatitis B and C among studied individuals

Prevalence of Hepatitis in urban and rural areas

Among the group of patients analyzed for hepatitis infections, the predominant proportion of cases originated from rural areas, accounting for 64% of the whole sample size. This indicates a greater prevalence of hepatitis in less urban areas. In contrast, the remaining 36% of illnesses were detected among individuals residing in urban areas. This distribution emphasizes a possible inequality in healthcare access or risks of disease exposure between rural and urban populations. This calls for targeted public health initiatives and more investigation into the factors that contribute to this difference, to address and reduce it (**Figure 2**).

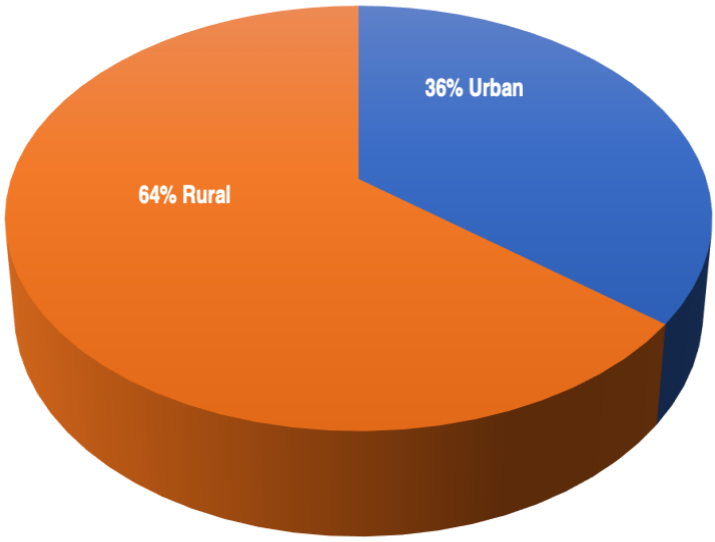


Figure 2. Prevalence of Hepatitis in urban and rural areas

Prevalence of HBV and HCV in both genders

Among the 330 patients, 198 (60%), were male patients, whereas the remaining 132 (40%) were females. It has been noted that 93 patients (28.18%) were HBV positive, in which 63 (67.74%) were males and 30 (32.25%) were females. On the other hand, 237 (71.82%) of the studied cases were HCV-positive, in which 135 (56.96%) were male patients, and 102 (43.03%) were females (**Figure 3**).

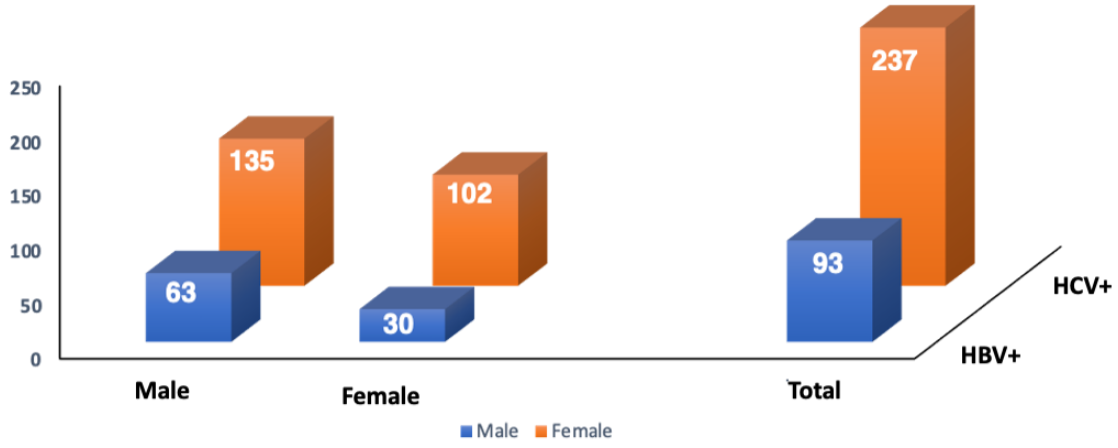
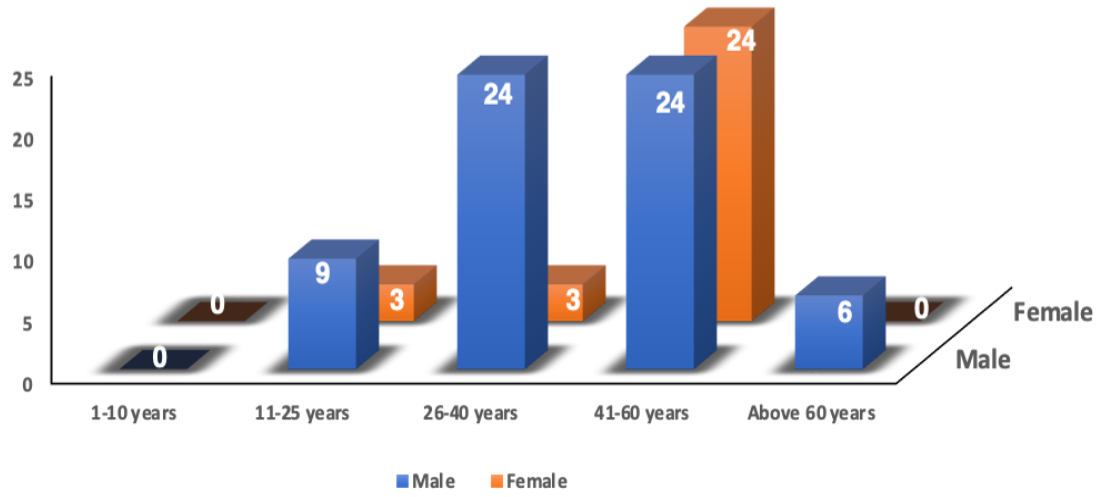


Figure 3. Gender-wise prevalence of HBV and HCV

Age-wise prevalence of HBV and HCV

In a total of ninety-three (93) HBV-positive patients, 9 males, and 3 females were infected with HBV at the age of 11-25 years, 24 males and 3 females were infected at the age of 26- 40 years, 24 males and 24 females had HBV at the age of 41-60 years, and only 6 males had HBV



infection above 60 years of age. So, it has been found that the prevalence of HBV is highest in people ages 41 to 60 while it is less common among people belonging to the age group of 11 to 25 years. However, no prevalence of HBV was observed between the ages of 1- to 10-year-old individuals, in both sexes (**Figure 4a**). Further, within the cohort of 237 HCV-infected patients, both genders in the age group of 11-25 years had three cases each of HCV infection. There were 36 males and 8 females with HCV aged 26-40 years, 69 males and 51 females aged 41-60 years, and 27 males and 30 females over 60 years old. The highest prevalence of HCV infection was observed in the 41-60-year age range for both males and females. In contrast, the 11-25 year age group showed a lower prevalence, mirroring the HBV infection patterns where no cases were found in the 1-10 year age group for either gender (**Figure 4b**).

Figure 4a. Age-wise prevalence of HBV infection

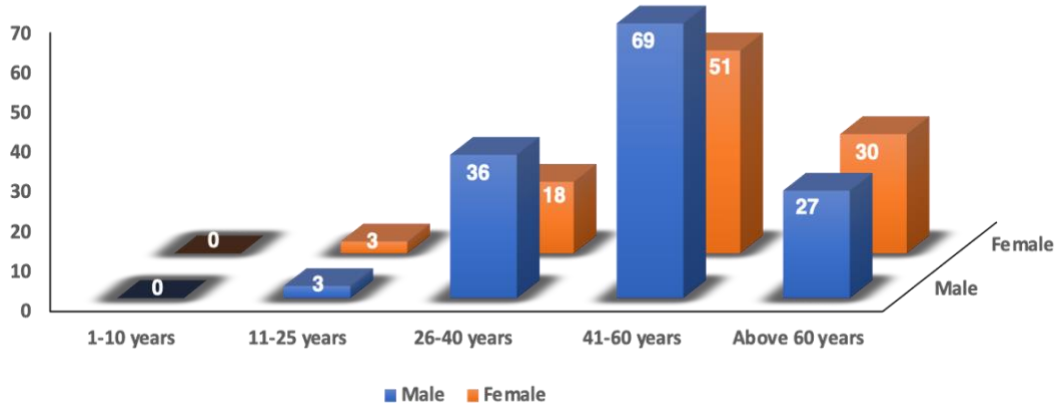


Figure 4b. Age-wise prevalence of HCV infection

Gender-wise association of HBV and HCV with Type 2DM

The study also delved into the gender-specific prevalence of Type 2DM among patients with hepatitis B and C infections. It was found that the patients with HBV infection, 18 were diagnosed with Type 2DM, with males comprising two-thirds of this subset at 12 patients and females constituting the remaining third with 6 patients. In contrast, the cohort with HCV infection presented a larger number of Type 2DM cases at 54 patients, where males accounted for approximately 55.6%, totaling 30, and females made up 44.4% with 24 patients. This data underscores a notable correlation between chronic viral hepatitis infection and the presence of Type 2DM, with gender variations apparent in the distribution among the infected populations (**Figure 5**).

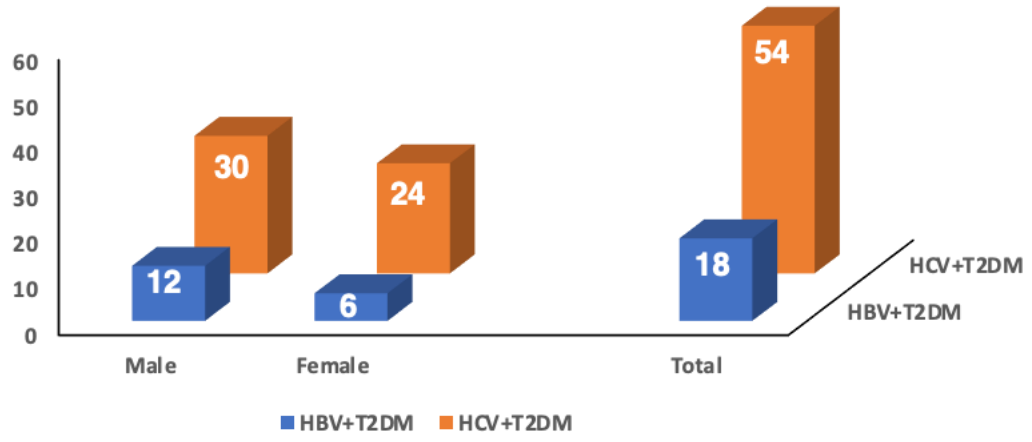
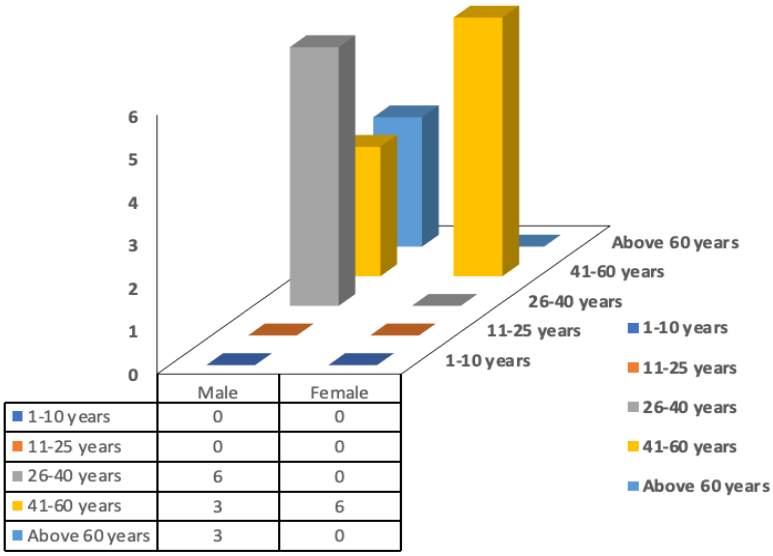


Figure 5. Gender-wise association of HBV and HCV with Type 2DM

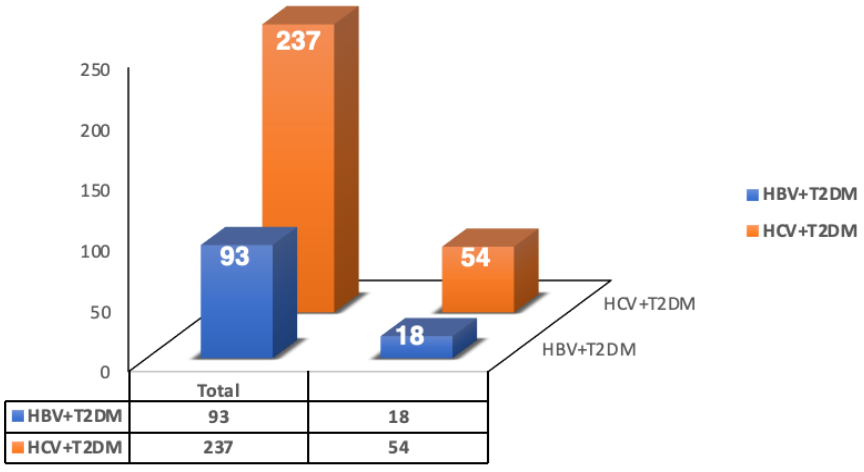
Age-wise and overall association of HBV and HCV with Type 2DM

The research found that there was a clear incidence of 19.3% of Type 2DM in patients with HBV infection. Out of these, 6 male patients aged 26 to 40 were diagnosed with Type 2DM. The age range of 41 to 60 years showed a stronger correlation, with 3 males and 6 females being diagnosed with Type 2DM. In addition, 3 individuals above the age of 60 were observed to develop Type 2DM in conjunction with HBV. It is worth mentioning that there were no persons under the age of 25 who tested positive for HBV and were linked to Type 2DM. The data shows that the age group between 41 and 60 years had the highest occurrence of comorbidity between HBV and Type 2DM. In addition, a consistent pattern was noted in which male patients exhibited a stronger correlation with Type 2DM in comparison to their female counterparts in all age groups that were examined (**Figure 6a**). Furthermore, the overall association was calculated in which Type 2DM was found in 19.3% of patients with HBV infection while 22.7% were found to have HCV infections (**Figure 6b**).



	Male	Female
1-10 years	0	0
11-25 years	0	0
26-40 years	6	0
41-60 years	3	6
Above 60 years	3	0

Figure 6a. Age-wise association of HBV with Type 2DM



	Total	
HBV+T2DM	93	18
HCV+T2DM	237	54

Figure 6b. Overall association of HBV and HCV with Type 2DM

DISCUSSION

Researchers from various backgrounds, including people, organizations, and government agencies, have examined the correlation between Type 2DM and Hepatitis B and C in various contexts, including public health organizations and hospitals. The link between type 2 diabetes and hepatitis B and C is the focus of this investigation. The majority of the 330 patients included

in the study were from rural areas, constituting 64% of the total. There was a total of 237 people detected with HCV, with 135 men and 102 females; 93 patients tested positive for HBV, with 63 men and 30 females making up the total. Researchers found that 19.3% of patients with HBV and 22.7% of patients with HCV also had Type 2 diabetes. Based on these results, it appears that the probability of acquiring Type 2DM is somewhat higher when HCV is present in comparison to HBV. In a study conducted by a group in 2014, the researchers investigated the relationship between Hepatitis and Diabetes Mellitus using a survey-based approach **[13]**. It was found that 27.9% of the subjects studied had type 2DM. Among these instances, 73.3% were infected with HCV, while only 25.5% were infected with HBV. This study found a significant correlation of 21.8% between type 2DM and both HBV and HCV. A discrepancy of 6.1% can be detected in the overall number of patients with HBV and HCV who are linked to type 2DM when comparing these findings to those of the published work **[13]**. Similarly, another group reported the same study and they analyzed the prevalence of type 2DM in 400 patients of HBV and HCV. Based on his statement, the prevalence of type 2DM was 24.5% among patients who tested positive for HCV and 19.4% among patients who tested positive for HBV. The results of this study closely align with the findings of the published research work, indicating nearly the same occurrence of diabetes in patients who are positive for both HBV and HCV. This could be attributed to the comparable prevalence of hepatitis B and C viruses within our community **[14]**. Furthermore, another study was conducted on the association of type 2DM with chronic HCV infection, where diabetes was identified in 24% of HCV-positive patients and 13% in HBV-positive patients **[15]**. Among individuals under the age of 40, 12% of those with HBV and 8% of those with HCV were found to have an association with type 2DM. A study revealed that 12% of patients infected with HBV and 26% of individuals infected with HCV were shown to have a correlation with type 2DM, and their age range was between 40 and 60 years. A group of researchers discovered that 25% of individuals infected with HBV also had type 2DM, while 31% of patients with HCV were found to have type 2DM. Based on this research, it was found that 6.45% of patients who tested positive for HBV and 6.32% of persons infected with HCV under the age of 40 have a connection to type 2DM **[15]**. Among patients who test positive for HBV, 5.37% are also diagnosed with type 2DM between the ages of 40 and 60. Similarly, among patients who test positive for HCV, 11.39% are also diagnosed with type 2DM in the same age range. The prevalence of individuals positive for HBV and HCV in connection to Type 2 DM among

individuals above the age of 60 is 3.22% and 5% respectively **[15]**. The number of patients employed by the research group was nearly twice as large as the present study. Upon comparing the two findings, it is evident that the proportion of HBV patients associated with type 2DM is nearly identical, however, the proportion of HCV-infected persons is higher than in this study among those under the age of 40 years. The present study, for those aged 40 to 60 years, shows a slightly reduced prevalence of both HBV and HCV compared to the findings reported by the researcher group **[15]**.

CONCLUSION

The study supported earlier research by confirming the association between diabetes mellitus and chronic liver diseases, specifically HBV and HCV. It also confirmed that patients who test positive for HCV have a higher risk of developing diabetes mellitus than those who test positive for HBV. Notably, compared to younger age groups, patients with HBV or HCV over 40 years old were found to have a higher risk of acquiring Type 2DM. Diabetes's genetic component, which may be impacted by Pakistan's high rate of marriage between close relatives, may also play a role in the disease's spread and needs to be further investigated using detailed data from a wider range of demographics. In conjunction with Type 2DM, future research should concentrate on developing therapeutic alternatives that target the pathogenic pathways of HBV and HCV. Improving our knowledge of how these disorders interact could lead to the creation of integrated treatment plans. Improved screening techniques are essential for identifying those who are at risk, especially those over 40, to facilitate timely interventions and improve patient outcomes.

Author Contributions

Tufail Ahmad: data collection, writing original draft. **Rashid Ahmad:** data analysis. **Zakir Ullah**: formal analysis. **Shahab Alam**: Reviewing the draft. **Tooba Wajid**: draft modification. **Abrar Khan**: Reviewing the draft. **Shahin Shah Khan**: Conceptualization, supervision, and reviewing draft.

Conflict of Interest: Authors have no conflict of interests.

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