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ORIGINAL ARTICLE

Retrospective Analysis of Liver Disease Pattern and Associated Risk Factors among Patients Admitted to a Tertiary Care Hospital in Sana'a City, Yemen

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ABSTRACT

Background: Liver disease is a major global health burden with diverse etiologies and serious complications. Therefore, this study aimed to identify the most common types of liver disease and associated risk factors in Yemen and describe their clinical and laboratory findings.

Methods: A retrospective, cross-sectional study was conducted at the University of Science and Technology Hospital in Sana'a, Yemen, from January 2020 to December 2024, using 1906 patient records. Data on demographics, risk factors, clinical presentations, laboratory, and sonographic findings were collected and analyzed.

Results: Among 1,906 patients with liver disease, autoimmune hepatitis was the most common diagnosis (41.4%), followed by lupus hepatitis (26.7%). A male predominance was observed across all hepatitis types, particularly in hepatitis C (92.9%). The majority aged less than 34 years, especially for hepatitis C (71.4%). Clinically, jaundice was the most frequent symptom (37.3%). Elevated AST and ALT were reported in 59.1% and 49.2% of patients, respectively. Hepatic echogenicity (51.5%) and hepatomegaly (24.2%) were the most common sonographic findings. Type 2 diabetes mellitus was significantly associated with an increased risk of hepatitis B (P=0.006), while khat chewing and autoimmune thyroiditis were significantly associated with increased risks of both lupus hepatitis (P<0.001 and P=0.010) and autoimmune hepatitis (P<0.001 and P=0.021).

Conclusions: Autoimmune and lupus hepatitis are the predominant forms of liver disease in Yemen, significantly associated with khat chewing and autoimmune thyroiditis. These findings highlight the need for early detection and targeted interventions.

Keywords: Liver disease; Risk factors; Autoimmune hepatitis; Lupus hepatitis; Khat chewing.

INTRODUCTION

Liver disease refers to any condition that affects the structure or function of the liver. It can be acute, caused by viruses, toxins, or pharmacological agents, or chronic and potentially leading to cirrhosis and hepatocellular carcinoma (HCC) [1]. It accounts for two million deaths annually,

representing 4% of all deaths (1 out of every 25 deaths worldwide); approximately two-thirds of all liver-related deaths occur in men [2]. Liver disease poses a significant public health burden in developing countries. For instance, the pooled prevalence of nonalcoholic fatty liver disease (NAFLD) among adults in Saudi Arabia was estimated at 16.8% [3]. In Sana'a, Yemen, liver diseases accounted for 30% of gastroenterology admissions in a major hospital [4]. The most common diagnoses included autoimmune hepatitis (27.7%), NAFLD (22.6%), and viral hepatitis (20.6%), while schistosomiasis was identified in 6.5% of cases [4].

Acute liver failure (ALF) is defined as a sudden onset of liver dysfunction accompanied by coagulopathy in previously healthy individuals, most often due to paracetamol overdose, acute viral hepatitis, ischemia, or autoimmune hepatitis [5, 6]. Chronic liver disease (CLD) refers to liver injury persisting for more than six months, often progressing to cirrhosis, and is typically caused by chronic viral hepatitis, alcohol abuse, NAFLD, autoimmune hepatitis, cholestatic disorders, or inherited metabolic diseases such as hemochromatosis and Wilson's disease [6, 7]. Cirrhosis represents the irreversible end stage of CLD, characterized by fibrosis and the formation of regenerative nodules that impair hepatic function [6, 8]. A hepatocellular injury is characterized by a predominant elevation of alanine aminotransferase (ALT) and aspartate aminotransferase (AST), indicating direct damage to hepatocytes, and is commonly caused by viral hepatitis B and C, alcohol-related liver disease, NAFLD, autoimmune hepatitis, drug-induced liver injury (paracetamol toxicity), and ischemic hepatitis [6, 9]. In contrast, a cholestatic lesion is characterized by a marked increase in alkaline phosphatase (ALP) and gamma-glutamyl transferase (GGT), indicating bile flow obstruction, and is often due to gallstones, primary biliary cholangitis (PBC), primary sclerosing cholangitis (PSC), some medications, or infiltrative diseases like sarcoidosis [6, 10]. A mixed hepatocellular-cholestatic lesion, where both enzyme groups are elevated, may result from alcohol-related hepatitis, drug-induced liver injury, or autoimmune hepatitis [6, 11]. Liver diseases in pregnancy include intrahepatic cholestasis of pregnancy, acute fatty liver of pregnancy, and HELLP syndrome [10]. Finally, drug-induced liver injury may present as any type of liver disease pattern, commonly triggered by medications like paracetamol, antibiotics or antiepileptics [9].

The present study retrospectively analyzed the spectrum of liver diseases among patients admitted to a tertiary care hospital in Sana'a City, Yemen, with the aim of identifying the most prevalent liver conditions and their associated risk factors. Understanding these patterns is crucial for informing clinical practice, guiding diagnostic approaches, and developing targeted public health interventions to reduce the burden of liver disease in Yemen and similar resource-limited settings.

METHODS

Study design and setting

A retrospective, cross-sectional study was conducted using the medical records of patients diagnosed with liver disease at the University of Science and Technology Hospital (USTH), a private tertiary care hospital in Sana'a, from January 2020 to December 2024. A total of 1906 records of patients diagnosed with liver diseases were retrieved during the study period. Records with incomplete data were excluded from analyses of clinical presentations and laboratory findings.

Data collection

A pre-designed data collection sheet was used to collect data about demographic characteristics, potential risk factors (including khat chewing, smoking, viral hepatitis, diabetes mellitus (DM), celiac disease, and thyroid disease), clinical presentations (such as jaundice, itching, changes in stool or urine color, and abdominal pain), and laboratory findings (including hemoglobin (Hb), white blood cell (WBC) count, ALT, AST, HbA1c, fasting blood sugar (FBS), antinuclear antibody

(ANA), anti-smooth muscle antibody (ASMA), serum creatinine, thyroid-stimulating hormone (TSH), thyroxine (T4), hepatitis B surface antigen (HBsAg), anti-hepatitis C virus (anti-HCV) antibody, and tissue transglutaminase immunoglobulin A (tTg-IgA), as well as sonographic findings (including increased echogenicity, hepatomegaly and cirrhosis). For this research, ANA was used as a marker of lupus hepatitis in the presence of elevated liver enzymes, while ASMA was as a maker of autoimmune hepatitis, considering the established classifications of autoimmune hepatitis and the potential overlap between lupus and autoimmune hepatitis.

Data analysis

Data was analyzed using IBM SPSS Statistics for Windows, version 24.0 (IBM Corp., Armonk, NY, USA). Continuous variables were described using the mean and standard deviation (SD) for normally distributed data, while categorical variables were presented as frequencies and percentages. The association between independent and dependent variables was tested using Pearson's chi-square test, with reporting odds ratio (OR) and 95% confidence interval (CI). A p-value of < 0.05 was considered significant.

Ethical considerations

This study was ethically approved by the Research Ethics Committee of the Faculty of Medicine and Health Sciences at the University of Science and Technology, Sana'a, Yemen, (ID: 1446/0056/UREC/UST). In addition, permission was obtained from the administration of the USTH. Patient information was handled confidentially and securely by the researchers.

RESULTS

Demographic characteristics of patients

Table 1 shows that most patients were male (67.1%) and aged younger than 34 years (57.4%). The mean age of patients was 33.4 ± 11.4 years, ranging from 8 to 79 years.

Pattern of hepatitis types among patients with liver disease

Table 2 shows that most patients (41.4%) had autoimmune hepatitis (positive ASMA), followed by lupus hepatitis (positive ANA) positivity (26.7%). In contrast, hepatitis B and C infections were rare, with both showing a positive rate of 0.7%.

Distribution of hepatitis types by demographic characteristics

Table 3 shows a male predominance across all hepatitis types, with the highest proportion among hepatitis C (92.9%), followed by hepatitis B (78.6%), autoimmune hepatitis (68.3%), and lupus hepatitis (66.8%). In contrast, females constituted less than one-third of the cases in autoimmune and lupus hepatitis and only 7.1% of hepatitis C cases. Regarding age, younger patients (<34 years) account for most cases across all types, particularly among those with hepatitis C (71.4%).

Clinical, laboratory and sonographic findings among patients with liver disease

Table 4 shows that jaundice (37.3%) was the most common clinical presentation among patients with liver diseases admitted to the USTH in Sana'a, followed by abdominal pain (32.6%) and itching (10.8%). Less common presentations included edema (1.5%) and hepatomegaly on physical examination (1.3%). Laboratory investigations revealed elevated AST and ALT in 59.1% and 49.2% of patients, respectively. Other findings included low hemoglobin levels (<10 g/dL) in 4.1% of patients and leukocytosis (>10,000 WBC/µl) in 8.6%, while elevated FBS and HbA1c were present in 3.6% and 3.2% of patients, respectively. Thyroid dysfunction was relatively rare, with high TSH in 2.0% and low T4 in 0.9% of patients. Sonographic assessment showed that increased hepatic echogenicity was the most common imaging finding (51.5%), followed by hepatomegaly (24.2%), while cirrhosis was identified in 8.3% of patients.

Risk factors for hepatitis B among patients with liver disease

Table 5 shows that type 2 DM was significantly associated with increased risk of hepatitis B among patients with liver disease admitted to the USTH, with diabetic patients showing a higher prevalence of hepatitis B compared to non-diabetics (2.8% vs. 0.5%; OR: 5.6, 95%

CI: 1.85–16.87; P = 0.006). Conversely, no statistically significant association was found between the risk of hepatitis B and gender (P = 0.569), smoking status (P = 1.000), khat chewing (P = 0.159), or autoimmune thyroiditis (P = 0.223).

Risk factors for hepatitis C among patients with liver disease

Table 6 shows that there was statistically significant association between hepatitis C and gender (P = 0.045). However, it was not significantly associated with smoking status (P = 1.000), khat chewing (P = 0.088), DM (P = 0.132), or autoimmune thyroiditis (P = 0.223).

Risk factors for lupus hepatitis among patients with liver disease

Table 7 shows that khat chewing (OR = 1.9, 95% CI: 1.50–2.28; P <0.001) and autoimmune thyroiditis (OR = 2.5, 95% CI: 1.26–4.91; P = 0.010) were significantly associated with increased risk of lupus hepatitis among patients with liver disease admitted to the USTH. In contrast, no statistically significant association was found between the risk of lupus hepatitis and gender (P = 0.912), smoking status (P = 0.061), or DM (P = 0.929).

Risk factors of autoimmune hepatitis among patients with liver disease

Table S1 shows that khat chewing (OR = 1.6, 95% CI: 1.31–1.92; P <0.001) and autoimmune thyroiditis (OR = 2.3, 95% CI: 1.16–4.67; P = 0.021) were significantly associated with increased risk of autoimmune hepatitis among patients with liver disease admitted to the USTH. In contrast, no statistically significant association was found between the risk of autoimmune hepatitis and gender (P = 0.347), smoking status (P = 0.063), or DM (P = 0.077).

Table 1: Demographic Characteristics of Patients with Liver Disease (N = 1906)

Characteristics	N	(%)
Gender	**1278**	**(67.1)**
Male	**628**	**(32.9)**
Female		
Age (years)		
<34	**1094**	**(57.4)**
≥34	**812**	**(42.6)**
Mean (SD)	**33.7 (11.4)**	
Range	**8–79**	

SD, standard deviation.

Table 2: Pattern of hepatitis types among patients with liver disease admitted to USTH in Sana'a City, Yemen (2020–2024) *

Type of hepatitis	Positivity rate	
	n	(%)
Hepatitis B (by HBsAg)	**14**	**(0.7)**
Hepatitis C (by anti-HBC)	**14**	**(0.7)**
Lupus hepatitis (ANA)	**509**	**(26.7)**
Autoimmune hepatitis (ASMA)	**789**	**(41.4)**

*Thetotal number of patients was 1906.

ANA, anti-nuclear antibodies; ASMA, anti-smooth muscle antibodies.

Table 3: Distribution of Hepatitis Types by Demographic Characteristics

Characteristics	Hepatitis B (N = 14)		Hepatitis C (N = 14)		Lupus hepatitis (N = 509)		Autoimmune hepatitis (N = 789)	
	n	(%)	n	(%)	n	(%)	n	(%)
Gender								
Male	11	(78.6)	13	(92.9)	340	(66.8)	539	(68.3)
Female	3	(21.4)	1	(7.1)	169	(33.2)	250	(31.7)
Age (years)								
<34	8	(57.1)	10	(71.4)	305	(59.9)	463	(58.7)
≥34	6	(42.9)	4	(28.6)	204	(40.1)	326	(41.3)

Table 4: Clinical, Laboratory and Sonographic Findings among Patients with Liver Disease Admitted to USTH in Sana'a City, Yemen (2020–2024) *

Findings	n	(%)
Clinical presentations		
Jaundice	711	(37.3)
Abdominal pain	622	(32.6)
Itching	205	(10.8)
Edema	28	(1.5)
Hepatomegaly	24	(1.3)
Laboratory findings		
Low Hb (<10g/dl)	79	(4.1)
High WBC (>10,000/µl)	163	(8.6)
High ALT	938	(49.2)
High AST	1126	(59.1)
High creatinine	52	(2.7)
High FBS	68	(3.6)
High HbA1c (>6.5%)	61	(3.2)
High TSH	38	(2.0)
Low T4	17	(0.9)
Sonographic findings		
Cirrhosis	159	(8.3)
Increase echogenic pattern	981	(51.5)
Hepatomegaly	461	(24.2)

* The total number of patients was 1906.

Table 5: Risk Factors of Hepatitis B among Patients with Liver Disease Admitted to USTH in Sana'a City, Yemen

Risk factors	N	Hepatitis B			P-value
		n	(%)	OR (95% CI)	
Gender					
Male	1278	11	(0.9)	1.8 (0.50–6.51)	0.569
Female	628	3	(0.5)	Reference	
Smoking status					
Yes	37	0	(0.0)	1.0 (1.00–1.01)	1.000

No	**1869**	**14**	**(0.7)**	**Reference**	
Khat chewing					
Yes	**650**	**2**	**(0.3)**	**0.3 (0.07–1.43)**	**0.159**
No	**1256**	**12**	**(1.0)**	**Reference**	
Type 2 DM					
Yes	**176**	**5**	**(2.8)**	**5.6 (1.85–16.87)**	**0.006***
No	**1730**	**9**	**(0.5)**	**Reference**	
Autoimmune thyroiditis					
Yes	**34**	**1**	**(2.9)**	**4.3 (0.55–34.10)**	**0.223**
No	**1872**	**13**	**(0.7)**	**Reference**	

N, total examined; n, total positive; OR odds ratio; CI, confidence interval; DM, diabetes mellitus.

Table 6: Risk Factors of Hepatitis C among Patients with Liver Disease Admitted to USTH in Sana'a City, Yemen

Risk factors	**N**	**Hepatitis C**			**P-value**
		n	**(%)**	**OR (95% CI)**	
Gender					
Male	1278	13	(1.0)	6.4 (0.84–49.37)	0.045*
Female	628	1	(0.2)	Reference	
Smoking status					
Yes	37	0	(0.0)	1.0 (1.00–1.01)	1.000
No	1869	14	(0.7)	Reference	
Khat chewing					
Yes	650	8	(1.2)	2.6 (0.90–7.51)	0.088
No	1256	6	(0.5)	Reference	
Type 2 DM					
Yes	176	3	(1.7)	2.7 (0.75–9.81)	0.132
No	1730	11	(0.6)	Reference	
Autoimmune thyroiditis					
Yes	34	1	(2.9)	4.3 (0.55–34.10)	0.223
No	1872	13	(0.7)	Reference	

N, total examined; n, total positive; OR, odds ratio; CI, confidence interval; DM, diabetes mellitus.

Table 7: Risk Factors of Lupus Hepatitis among Patients with Liver Disease Admitted to USTH in Sana'a City, Yemen

Risk factors	**N**	**Lupus hepatitis**			**P-value**
		n	**(%)**	**OR (95% CI)**	
Gender					
Male	**1278**	**340**	**(26.6)**	**0.9 (0.79–1.22)**	**0.912**
Female	**628**	**169**	**(26.9)**	**Reference**	
Smoking status					
Yes	**37**	**15**	**(40.5)**	**1.9 (0.98–3.69)**	**0.061**
No	**1869**	**494**	**(26.4)**	**Reference**	
Khat chewing					

Yes	**650**	**227**	**(34.9)**	**1.9 (1.50–2.28)**	**<0.001***
No	**1256**	**282**	**(22.5)**	**Reference**	
Type 2 DM					
Yes	**176**	**46**	**(26.1)**	**1.0 (0.68–1.38)**	**0.929**
No	**1730**	**463**	**(26.8)**	**Reference**	
Autoimmune thyroiditis					
Yes	**34**	**16**	**(47.1)**	**2.5 (1.26–4.91)**	**0.010***
No	**1872**	**493**	**(26.3)**	**Reference**	

N, total examined; n, total positive; OR odds ratio; CI, confidence interval; DM, diabetes mellitus.

DISCUSSION

This study provides a comprehensive overview of the epidemiological and clinical patterns of liver disease among patients attending a private tertiary care hospital in Sana'a, Yemen. It revealed that approximately two-thirds of patients admitted with liver disease were males (67%), aligning with findings from a previous study conducted in a public tertiary hospital in the same city [4].

The male predominance may reflect gender-related differences in health-seeking behavior, exposure to environmental risk factors, or underlying biological susceptibilities to certain liver conditions. The underlying mechanisms for these sex differences involve sex hormones, sex chromosomes, and genetic factors influencing gene expression, immune response, and xenobiotic metabolism [12].

Several studies have reported higher rates of hepatitis B virus infection, alcoholic liver disease, and HCC in men compared to women [13, 14]. This gender disparity is particularly pronounced during reproductive years, suggesting a potential protective role of estrogen [13]. However, unlike that study, which reported a predominance of cases among individuals in their fifth and sixth decades [4], the majority of patients in the current study were under 34 years of age.

In line with the present study, recent studies have indicated a concerning trend of increasing liver disease among younger populations elsewhere in the world [15, 16]. This trend suggests a growing burden of chronic liver disease among younger populations, emphasizing the need for preventive strategies and early interventions to address this public health concern.

Autoimmune hepatitis (41%) and lupus hepatitis (26.7%) emerged as the most common types of hepatitis identified in our study, with around two-thirds of these cases occurring in male patients. In contrast, hepatitis B and C were uncommon, each identified in only 0.7% of patients. Comparatively, a previous study conducted at a public tertiary care hospital in the same city reported autoimmune hepatitis in 27.7% of patients admitted with liver diseases, while hepatitis B and C accounted for 20.6% of cases [4]. However, this substantial discrepancy between this study and previous ones in the reported percentages of hepatitis B and C could not be attributed to improvements in medical services or health policies. Instead, it may reflect the characteristics and limitations of the hospital's record system where the study was conducted. Autoimmune hepatitis and lupus hepatitis can present similar clinical and laboratory features, making differentiation challenging [17].

Both conditions can coexist with other autoimmune disorders, such as systemic lupus erythematosus (SLE), and may respond to immunosuppressive therapy [18]. Therefore, the distinction between viral-induced autoimmunity and genuine autoimmune hepatitis is crucial for appropriate diagnosis and treatment [19]. This study also revealed a male predominance across all types of hepatitis, particularly in autoimmune hepatitis (68%) and lupus hepatitis (66.7%). This observation warrants further investigation, and a possible explanation is that the markedly higher

prevalence of khat chewing among Yemeni men may be closely linked to the observed male predominance in autoimmune and lupus hepatitis. However, the association between khat chewing and autoimmune hepatitis was not investigated in this study. Additionally, there was a slight predominance of patients under the age of 34 across all hepatitis types, with the highest proportion observed in autoimmune hepatitis cases.

This study highlights jaundice as the most frequent clinical manifestation, affecting more than a third of patients. This finding aligns with the well-established pathophysiology of liver dysfunction, where impaired bilirubin metabolism and excretion commonly lead to jaundice as an early and visible sign of hepatic impairment [20]. Abdominal pain in nearly one-third of patients may reflect hepatomegaly, hepatic inflammation, or biliary tract involvement. Itching, observed in 10.8% of patients, is likely attributable to cholestasis and the accumulation of bile salts in the skin, a recognized symptom in various hepatobiliary disorders [21, 22]. The relatively low prevalence of edema and hepatomegaly in our study suggests that most cases were either detected at an earlier stage or reflected milder forms of hepatic dysfunction.

Biochemical investigations showed elevated aminotransferases in a substantial proportion of patients, with AST and ALT elevated in 59% and 49% of patients, respectively. This enzyme pattern is consistent with hepatocellular injury and is a hallmark of both acute and chronic liver conditions [23], including autoimmune hepatitis, viral hepatitis, and nonalcoholic liver disease. Other laboratory abnormalities were relatively infrequent in the present study. The low prevalence of hyperglycemia and thyroid dysfunction indicates that metabolic and endocrine comorbidities were not prominent among patients in the present study. Overall, these findings underscore the need for early clinical recognition of liver disease, with jaundice and elevated transaminases serving as primary indicators.

Sonographic findings provided further insight into liver pathology, and sonography is often the first imaging procedure performed in the evaluation of individuals with suspected liver disease [24]. For instance, increased hepatic echogenicity, seen in around half of patients, is a nonspecific but common sign of chronic liver disease, often associated with fatty infiltration or fibrosis [24, 25]. While ultrasound can detect liver abnormalities with good sensitivity, its specificity is limited [26, 27]. Despite its limitations, ultrasonography remains a useful initial imaging tool for evaluating suspected liver disease, capable of detecting hepatomegaly, fatty infiltration, and signs of cirrhosis [24]. Hepatomegaly, 24.2% of patients may reflect inflammation or congestion. Notably, cirrhosis was identified in only 8.3% of patients, suggesting that the majority may have presented before progressing to end-stage liver disease, or that cirrhosis remains underdiagnosed without histological confirmation. The integration of imaging assessments remains crucial for staging and etiological determination, particularly in resource-limited settings such as Yemen.

Our study revealed a significant association between type 2 DM and hepatitis B infection among patients with liver disease despite the low prevalence of hepatitis B infection in our study. Likewise, Chinese patients with type 2 DM wed a significantly higher HBsAg seroprevalence than non-diabetics [28]. Chronic HBV infection may contribute to insulin resistance and type 2 DM development [29], and type 2 DM in chronic hepatitis B) patients is linked to increased risks of liver fibrosis, cirrhosis, and HCC [29, 30]. These findings highlight the importance of monitoring glucose levels in high-risk chronic hepatitis B patients and managing modifiable risk factors to improve outcomes.

Our study did not identify any statistically significant association between hepatitis B infection and other commonly proposed risk factors such as gender, smoking status, khat chewing, or autoimmune thyroiditis. In line with this study, gender was not found to be

significantly associated with hepatitis B in sickle cell anemic patients in Hodeidah governorate [31]. In contrast, khat chewing was found to be significantly associated with higher hepatitis B viral load in chronic infection among patients attending hepatology clinics in Sana'a [32]. Although our study did not find a significant association between smoking and hepatitis B, earlier research identified smoking as a factor impairing the development of protective anti-HBs antibodies, both naturally and after vaccination [33]. On the other hand, the association between hepatitis B and autoimmune thyroid disease remains unclear [34]. However, a study found a significantly higher prevalence of thyroiditis in Down syndrome American patients with hepatitis B compared to those without [35].

In the present study, hepatitis C infection did not show a statistically significant association with any of the assessed demographic or clinical risk factors, including gender, smoking status, khat chewing, type 2 DM, and autoimmune thyroiditis. Similarly, a previous study did not find a significant association between gender and anti-HCV seropositivity in Yemen [36]. Although smoking was not identified as a risk factor for hepatitis C, it is important to note that both smoking and HCV have been independently implicated in the pathogenesis of HCC among Yemeni patients [37], indicating their potential synergistic role in liver disease progression. Likewise, although khat chewing was not significantly associated with hepatitis C in the present study, a case-control study revealed a strong, dose-dependent association between khat chewing and the risk of developing chronic liver disease in men [38], suggesting that khat may contribute to liver pathology through mechanisms other than HCV infection.

Regarding metabolic comorbidities, the lack of a significant association between HCV and type 2 DM in our findings contrasts with several studies that have identified chronic HCV infection as a risk factor for insulin resistance and the development of DM [39-41]. The association between HCV infection and autoimmune thyroiditis remains controversial. Our study did not find a significant association, but existing literature presents conflicting evidence. While some studies found no significant link between hepatitis C and thyroid autoimmunity [42], others reported a higher prevalence of thyroid autoantibodies and autoimmune thyroiditis in hepatitis C patients [43, 44]. These inconsistencies highlight the need for further large-scale, prospective studies to clarify the complex interplay between HCV and autoimmune processes in different populations.

In our study, khat chewing and autoimmune thyroiditis were significantly associated with an elevated risk of lupus hepatitis and autoimmune hepatitis among patients with liver disease. The observed association between khat use and autoimmune hepatitis supports the hypothesis that khat, which is a commonly used stimulant in Yemen and parts of East Africa, may act as a triggering factor in genetically predisposed individuals [45]. However, another study in Ethiopia did not find a significant association between khat use and autoantibodies typical of autoimmune liver disease [46]. The latter study revealed high seroprevalence of ASMA in the Ethiopian population, regardless of khat use [46]. Autoimmune thyroiditis and autoimmune hepatitis can co-occur, suggesting a potential link between these conditions [47-49]. Overall, these findings emphasize that targeted screening for autoimmune thyroid disorders and detailed assessment of khat use may be beneficial in the early identification and management of patients at risk for lupus hepatitis or autoimmune hepatitis.

This study has several limitations that should be considered. First, the retrospective design depended on the accuracy and completeness of medical records, making the data prone to missing or incomplete information, including platelet counts for thrombocytopenia in autoimmune hepatitis patients or the complicated and decompensated chronic liver diseases. Second. it was conducted at a single tertiary care hospital, which may limit the

generalizability of the findings to other healthcare settings or to the wider population.

CONCLUSION

Autoimmune hepatitis and lupus hepatitis emerge as the most common forms of hepatitis among patients, reflecting a shift in the pattern of liver diseases in Yemen, with a significant association with khat chewing and autoimmune thyroiditis. However, viral hepatitis remains uncommon, with an association between type 2 DM and hepatitis B. A male predominance and younger age distribution characterize all forms of hepatitis. Clinically, jaundice is the most common presenting symptom, and elevated liver enzymes frequently indicate hepatocellular injury. Sonographic evaluation most commonly reveals increased hepatic echogenicity, followed by hepatomegaly and cirrhosis. Therefore, there is a need for early detection, autoimmune screening, and targeted interventions to address modifiable risk factors associated with hepatitis.

Author Contribution: ASH, EAS and AMA designed the study; AYK, KWY, TAF, AFA, AASA, and AMA contributed to patient interview and data collection; ASH, AYK and KWY contributed to data analysis and interpretation of results. ASH, AYK and KWY drafted and revised the manuscript. All authors read and approved of the final manuscript.

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Supplementary files: Table S1

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Supplementary files:

Table S1: Risk Factors of Autoimmune Hepatitis among Patients with Liver Disease Admitted to USTH in Sana'a City, Yemen

Risk factors	N	Autoimmune hepatitis			P-value
		n	(%)	OR (95% CI)	
Gender					
Male	1278	539	(42.2)	1.1 (0.91–1.34)	0.347
Female	628	250	(39.8)	Reference	
Smoking status					
Yes	37	21	(56.8)	1.9 (0.98–3.63)	0.063
No	1869	768	(41.1)	Reference	
Khat chewing					
Yes	650	317	(48.8)	1.6 (1.31–1.92)	<0.001*
No	1256	472	(37.6)	Reference	
Type 2 DM					
Yes	176	84	(47.7)	1.3 (0.97–1.81)	0.077
No	1730	705	(40.8)	Reference	
Autoimmune thyroiditis					
Yes	34	21	(61.8)	2.3 (1.16–4.67)	0.021*
No	1872	768	(41.0)	Reference	

N, total examined; n, total positive; OR odds ratio; CI, confidence interval; DM, diabetes mellitus.

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