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Siddha-Based Comparative Analysis of Water Quality Using Terminalia chebula and Terminalia bellerica

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ABSTRACT: The purpose of this descriptive observational research was to assess the clinic epidemiological profile and seroprevalence of chronic hepatitis (HBV) and hepatitis C (HCV) in patients at Government Medical College and Memorial Government Hospital in Haldwani, Uttarakhand. and 141 HCV-positive patients (1.97%) during a two-year period. 141 HCV-positive cases (1.97%) and thorough data were used to evaluate the patients. Laboratory testing, imaging investigations, and thorough clinical assessments were used to evaluate the patients; SPSS was used to analyze the data. While HBV patients had substantially higher serum bilirubin (p=0.005) and SGOT levels (p=0.0057), most HCV patients had advanced liver disease, as shown by higher rates of ascites (13.97%), jaundice (11.73%), and increased urea levels (p=0.03). Age, gender, and education did not significantly vary across groups, according to sociodemographic analysis; however, geographic patterns indicated that HBV was more common in Nainital (63.2%) and HCV was more common in Udham Singh Nagar (27.7%) and Bijnor (29.1%). These results highlight the critical need for focused interventions to lower the incidence of viral hepatitis in marginalized communities, such as awareness campaigns, preventative measures, and region-specific healthcare initiatives.

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INTRODUCTION: Millions of individuals worldwide are afflicted by the hepatitis B and hepatitis C viruses, which are serious public health concerns that significantly increase the burden of chronic liver disorders. 1. Over 350 million people globally suffer with chronic HBV, and an estimated 2 billion are exposed to it each year, which results in over 600,000 fatalities. Likewise, chronic HCV affects over 170 million people and causes around 500,000 fatalities annually 2. Both infections have significant rates of morbidity and death because they are linked to serious side effects such cirrhosis and hepatocellular cancer. These concerning figures demonstrate how urgently thorough study into the prevalence, risk factors, and clinical consequences of HBV and HCV is needed. About 30% of the world's hepatitis cases are in the World Health Organization's (WHO) South-East Asia Region (SEAR), with India playing a significant role. It is believed that between 3 and 4% of Indians have chronic HBV.

while around 1% of people are afflicted with HCV. There are many different ways that HBV may spread, but one of the main causes of persistent infections, particularly in young children, is vertical transmission. The frequency of HCV tends to rise with age and is often discovered by chance during unrelated medical examinations. These geographical differences highlight how crucial localized research is to comprehending the clinical impact and epidemiology of these illnesses, especially in environments with limited resources.

Because the symptoms of HBV and HCV might overlap with those of other viral hepatitis, diagnosing them presents special difficulties. Hepatitis B surface antigen (HBsAg) is the main diagnostic marker for HBV, while antibody testing for HCV shows exposure but need further testing to identify current infection. Laboratory testing is essential in this regard. 3. Although accessibility and accuracy have increased due to advancements in diagnostic technologies, such as enzyme immunoassays (EIAs) and molecular tests, there are still large gaps in low-resource areas. These difficulties in diagnosis highlight the need for broadly accessible, reasonably priced, and trustworthy instruments, particularly in areas where illness incidence is high 10.

Chronic HBV infections are now far less common because to preventive efforts, including HBV immunization. India achieved universal coverage of the hepatitis B vaccine by 2011 after including it into its national vaccination program in 2005. However, as there is currently no viable HCV vaccine, prevention through early identification, public awareness, and focused treatment

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approaches is given more importance. There is promise for future disease control as research into new HCV vaccine candidates continues 11.

By assessing the seroprevalence and clinico-epidemiological characteristics of chronic HBV and HCV in the Kumaon area of Uttarakhand, this research seeks to fill in the current information gaps. This study aims to provide region-specific insights into the burden of these illnesses by examining test results, clinical presentations, and demographic trends. In order to lower prevalence and enhance healthcare outcomes for impacted populations, it also seeks to identify high-risk groups, lead the development of focused treatments, and advise public health policy.

Hepatitis C was shown to be most common in children aged 0–10 years, according to the research by Ingle et al.5. Multiple blood transfusions and thalassemia were found to be important risk factors, highlighting the need of early intervention and focused screening in high-risk groups. Dagnew et al.6 emphasized the significance of integrated screening, prevention, and education programs for pregnant women with intermediate seroprevalence rates of HBV (4.6%) and HCV (1.6%). They identified factors like multiple sexual partners, blood transfusions, family history of HBV, and HIV coinfection as significant predictors. With genotypes 3 and 1 predominating, Sharma et al.7 found that the prevalence of HCV in Jammu and Kashmir was 8.33%. This highlights the need for bigger research to map epidemiological patterns and direct focused treatments to lessen the burden of chronic liver disease. Wang et al.8 discovered that Chinese MSM had a high HBV infection rate (26.5%) and a low prevalence of HBV immunization (38.9%). They also found strong correlations between sexual risk factors and HBV infection, highlighting the need for improved vaccination programs, health education, and focused preventive measures within this population.

MATERIAL& METHODOLOGY: From November 2022 to November 2024, this descriptive observational research was carried out at the Government Medical College and the nearby Dr. Susheela Tiwari Memorial Government Hospital in Haldwani, Uttarakhand. Assessing the seroprevalence and clinico-epidemiological characteristics of chronic Hepatitis B (HBV) and Hepatitis C (HCV) patients presenting to this tertiary care facility was the main goal. In order to better understand illness patterns and guide public health initiatives, the goals included reviewing the laboratory and imaging results, identifying important risk factors, and examining the clinical and demographic features of these individuals. Using purposive selection, 179 patients—38 HBV-positive and 141 HCV-positive—were selected among 7,149 screened outpatients for the research. Adults who were 18 years of age or older who had a confirmed molecular or serological diagnosis of chronic HBV or HCV infection met the inclusion criteria. Pregnant women, patients with severe chronic diseases that might affect research results, and patients with co-infections (such as HIV, Hepatitis D, or acute HBV/HCV infections) were not included.

In order to record patient demographics, risk factors (such as blood transfusions, tattoos, and intravenous drug use), and symptoms like exhaustion, jaundice, or stomach discomfort, structured interviews were used for data collection. Physical symptoms such as icterus, splenomegaly, and hepatomegaly were evaluated during a comprehensive clinical examination. The enzyme-linked immunosorbent assay (ELISA) technique was used to collect and analyze blood samples in order to identify HCV antibodies and HBV surface antigen (HBsAg). Complete blood count (CBC), liver function tests, renal function tests, and imaging examinations such as abdominal ultrasonography and FibroScan to assess liver fibrosis and structural abnormalities were among the other investigations.

Inferential tests such as chi-square for categorical variables and t-tests for continuous variables were used in the statistical analysis, which was conducted using SPSS software (version 20) and descriptive statistics such as means, medians, and percentages. Risk factor relationships were evaluated using logistic regression models, with $p < 0.05$ designated as the statistical significance level. A thorough assessment of the seroprevalence and clinical consequences of chronic HBV and HCV in the research population was guaranteed by this thorough technique.

Abdominal ultrasound, non-contrast computed tomography (NCCT), or contrast-enhanced computed tomography (CECT) were used to confirm the imaging results, and upper gastrointestinal endoscopy was carried out as necessary. Liver stiffness tests and diagnostic ascitic fluid analyses were performed on individuals with advanced disease characteristics. Prior to enrollment, all subjects gave their informed permission via IEC Committee approval number 682, and ethical clearance was acquired from the institutional review board. In order to improve prevention, diagnostic, and treatment methods suited to regional healthcare requirements, this methodical approach sought to provide practical insights regarding the burden of HBV and HCV in the Kumaon area.

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RESULTS & DISCUSSION: In this study, the seroprevalence and clinico-epidemiological characteristics of 179 patients with chronic Hepatitis B (HBV) and Hepatitis C (HCV) in a tertiary care hospital in Uttarakhand were evaluated. Among 7,149 screened outpatients, the seroprevalence of HBV was 0.53% (n=38) and HCV was 1.97% (n=141), suggesting that HCV rates were higher in this group. This is in line with global trends that show that unsafe medical practices are the reason why HCV is more prevalent in underdeveloped places.
Geographically, each area had a very different occurrence. HBV cases were mostly from Nainital (63.2%), but HCV infections were widely distributed, with the highest percentages in Bijnor (29.1%), Udham Singh Nagar (27.7%), and Nainital (28.4%). These findings imply that HCV is more regionally dispersed, maybe as a consequence of regional risk factors such inappropriate injection techniques and blood transfusions. This has been shown using Table 1. The p-value of 0.002 in the table indicates a statistically significant correlation between the patients' geographic distribution and their hepatitis status (HCV or HBV). This suggests that the prevalence of HBV and HCV varies significantly across districts. The chi-square value of 29.66 further supports the strength of this association.

TABLE 1: GEOGRAPHIC DISTRIBUTION OF HBV AND HCV PATIENTS

District	Hep B	Hep C	Total
Almora	1	2	3
Bageshwar	1	0	1
Bareilly	2	6	8
bijnor	2	41	43
Haridwar	1	0	1
Moradabad	0	5	5
Nanital	24	40	64
Pilbhit	1	2	3
Pithorgarh	1	4	5
Rampur	0	1	1
Sitapur	0	1	1
Udham Singh Nagar	5	39	44
Total	38	141	179

Chi-Sq Value= 29.66, P-Value= 0.002 (Significant)

The average age of HBV patients was 44.89 ± 14.48 years, whereas HCV patients were somewhat younger at 41.7 ± 14.89 years. There was a male majority in both groups, with 63.8% of HCV cases and 65.8% of HBV patients being male. Men are more exposed to risk factors such cultural norms and occupational hazards, which contributes to this gender disparity. The majority of patients belonged to the lower medium (38.55%) and upper lower (28.49%) socioeconomic categories, according to socioeconomic studies, suggesting a connection between low income and limited access to healthcare. The patients' educational attainment also showed significant variability, with 36.31% of them being illiterate, particularly among female patients. Low literacy might lead to delayed diagnosis and a lack of awareness about prevention measures. Risk factor analysis revealed distinct patterns between HBV and HCV. Tattooing (10.63%), dangerous injections (30.17%), and prior blood transfusions (29.05%) were significant variables in HCV patients, which is consistent with the parenteral transmission pathway of HCV.
In contrast, barber shaving, a culturally common practice in rural areas, was cited by 13.91% of HBV patients as a significant risk factor. These findings underline how important it is to educate the public about safe medical and cosmetic procedures as well as infection prevention techniques.

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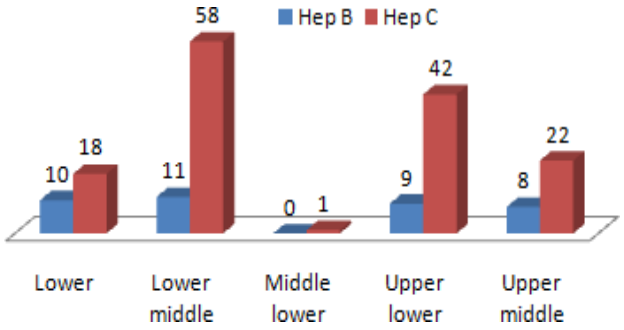

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FIG. 1: SOCIODEMOGRAPHIC PROFILE OF HBV AND HCV PATIENTS

TABLE 2: RELEVANT PAST HISTORY IN BOTH GROUPS OF PATIENTS

Past history	Hep B(N=41)	Hep C(N=141)	P value
Past history of blood transfusion	14(7.82%)	52(29.05%)	0.99
Past history of surgery Present	3(1.68%)	15(8.38%)	0.62
Past unsafe injection	13(7.26%)	54(30.17%)	0.64
High risk behavior	6(3.35%)	31(17.32%)	0.40
HIV Positive	1(0.56%)	5(2.79%)	0.78
Hemodialysis present	1(0.56%)	7(3.91%)	0.54
IV Drug User	1(0.56%)	6(3.35%)	0.64
Tatoo making	11(6.15%)	30(16.76%)	0.32
Body piercing	13(7.26%)	51(28.49%)	0.82
History of shaving by barber	25(13.91%)	89(49.72%)	0.76

There are significant differences in the clinical presentations of patients with Hepatitis B (HBV) and Hepatitis C (HCV), particularly with regard to ascites and jaundice. Ascites was more prevalent in HCV patients (13.97%) compared to HBV patients (7.82%), with a statistically significant p-value of 0.01, indicating a higher likelihood that HCV may progress to decompensated liver disease. Jaundice was considerably more common in HCV patients (11.73%) than in HBV cases (7.82%), with a very significant p-value of 0.002, suggesting that HCV patients had greater liver impairment. Although hematemesis, malena, chronic liver disease, pedal edema, anorexia, and malaise were more common in HCV patients, the differences were not statistically significant, according to P-values ranging from 0.20 to 0.58. Although the clinical signs of HBV and HCV are similar, these findings highlight the need of early detection and treatment to prevent complications in HCV patients. Presentations of advanced liver disease are more closely associated with HCV.

TABLE 3: CLINICAL PARAMETER OF STUDY SUBJECTS WITH HEP B AND HEP C

	HEP B	HEP C	P value
Ascites	14(7.82%)	25(13.97%)	0.01
Jaundice	14(7.82%)	21(11.73%)	0.002
Hematemesis	4(2.23%)	7(3.91%)	0.21
Malena	5(2.79%)	13(7.26%)	0.46
Chronic liver disease	19(10.61%)	47(26.26)	0.058
Pedal edema	23(12.85%)	55(30.73%)	0.38
Anorexia	24(13.41%)	104(58.1%)	0.20
Malaise	28(15.64%)	97(54.19%)	0.56

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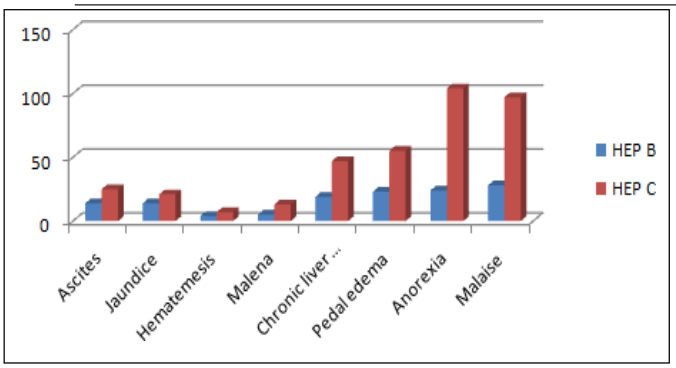

FIG. 2: CLINICAL PARAMETER OF STUDY SUBJECTS WITH HEP B AND HEP C

The laboratory results show that individuals with Hepatitis B (HBV) and Hepatitis C (HCV) have significant disparities in liver function and damage indicators. Serum bilirubin levels were substantially greater in HBV patients (2.53 ± 3.12 mg/dL) than in HCV patients (1.71 ± 1.71 mg/dL, p = 0.03), suggesting that HBV cases had more severe liver inflammation or cholestasis. Similarly, SGOT values, which indicate acute hepatic damage, were significantly higher in HBV patients (147.74 ± 217.32 U/L) than in HCV patients (84.37 ± 83.19 U/L, p = 0.005). Furthermore, compared to HCV patients (3.54 ± 0.68 g/dL, p = 0.006), HBV patients had substantially lower total albumin levels (3.21 ± 0.62 g/dL), indicating a larger impairment in liver synthetic function. However, there were no statistically significant changes between the two groups in terms of platelet count, INR, SGPT, LDH, or total protein levels (p >0.05). These results highlight the need for specialized diagnosis and treatment strategies for HBV and HCV infections, since individuals with HBV are more likely to show signs of acute liver inflammation and decreased synthetic function, whereas those with HCV have a comparatively milder hepatic profile.

TABLE 4: VARIOUS LABORATORY PARAMETER OF PATIENTS DIAGNOSED WITH HEPATITIS B AND HEPATITIS C

	Hep B	Hep C	P value
Platelet	23501.06±42204.65	45866.9±159138	0.39
International Normalized Ratio (INR)	1.63+-0.64	1.56+-0.97	0.67
Serum bilirubin levels	2.53+-3.12	1.71+-1.71	0.03
SGOT	147.74+-217.32	84.37+-83.19	0.005
SGPT	124.08+-199.91	89.1+-88.91	0.11
LDH	186.76+-93.04	191.22+-100.42	0.80
Total Protein	6+-1.06	6.14+-0.88	0.41
Total Albumin	3.21+-0.62	3.54+-0.68	0.006

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Although there is no statistically significant correlation, the Child-Turcotte-Pugh (CTP) score analysis reveals variations in the severity of liver disease between Hepatitis B (HBV) and Hepatitis C (HCV) patients. HCV infections were more common (7.27%) than HBV instances among patients with Child A scores (5 and 6), which indicate compensated liver disease.

instances (3.36%), indicating a somewhat higher incidence of HCV early-stage illness. HCV patients were more common in the Child B group (scores 7–9), which denotes mild liver damage, with significant frequencies at scores of 7 (3.91%) and 8 (4.47%), but HBV patients made up a smaller portion of this category.

TABLE 5: CHILD-TURCOTTE-PUGH (CTP) SCORES AMONG PATIENTS IN BOTH GROUPS Higher percentages of HCV patients were found in the Child C group (scores 10–13), which denotes severe liver dysfunction. This is especially true for scores of 10 (2.79%) and 11 (3.91%), which indicate the advanced disease progression often linked to HCV. However, a significant percentage of

Child CTP	Diagnosis			p-value
	Hep B	Hep C	Total	
Child A ctp 5	3	3	6	0.1092
	1.68%	1.68%	3.35%	
Child A ctp 6	3	10	13	
	1.68%	5.59%	7.26%	
Child b ctp 7	0	7	7	
	0%	3.91%	3.91%	
Child b ctp 8	2	8	10	
	1.12%	4.47%	5.59%	
Child b ctp 9	3	4	7	
	1.68%	2.23%	3.91%	
Child c ctp 11	3	7	10	
	1.68%	3.91%	5.59%	
Child c ctp 13	2	2	4	
	1.12%	1.12%	2.23%	
Child c ctp10	1	5	6	
	0.56%	2.79%	3.35%	
Child c ctp12	2	1	3	
	1.12%	0.56%	1.68%	
NA	19	94	113	
	10.61%	52.51%	63.13%	

patients—10.61% of HBV cases and 52.51% of HCV cases—were categorized as not available (NA), which restricts a thorough assessment. These results highlight how HCV is more likely than HBV to cause liver dysfunction to develop to more severe stages.

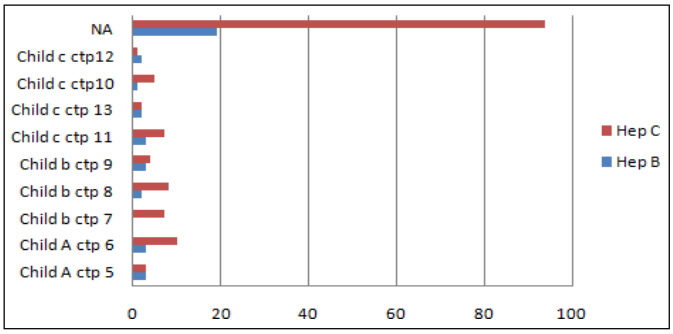

FIG. 3: CHILD-TURCOTTE-PUGH (CTP) SCORES AMONG PATIENTS IN BOTH GROUPS

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These results demonstrate how socioeconomic, regional, and cultural variables all play a role in the multifactorial nature of HBV and HCV in the Kumaon area. Given its greater incidence and more severe state of illness, HCV is likely still underdiagnosed and underreported, especially in high-risk groups like those getting dangerous injections or blood transfusions. It is essential to implement public health initiatives that emphasize early identification, HBV immunization, and awareness-raising campaigns for high-risk populations. Addressing the burden of chronic viral hepatitis and its sequelae requires improved diagnostic capabilities as well as preventative measures tailored to a given location.

DISCUSSION: The seroprevalence and clinico-epidemiological characteristics of chronic Hepatitis B (HBV) and Hepatitis C (HCV) in the Kumaon area of Uttarakhand are highlighted in this research in a number of important ways. Compared to HBV (0.53%), the seroprevalence of HCV (1.97%) was much greater, which is consistent with worldwide data that highlight HCV's predominance in areas with little resources. With HBV infections mostly recorded in Nainital (63.2%) and HCV cases more broadly dispersed, especially in Bijnor (29.1%) and Udham Singh Nagar (27.7%), regional differences were apparent. This emphasizes how healthcare methods and geographical risk factors affect the spread of illness.
Both HBV and HCV mostly impacted men and those from lower socioeconomic groups, according to sociodemographic research. These populations are more likely to experience cultural and occupational risk factors, such as traditional barbering and hazardous medical practices, which have been linked to a high risk of HBV transmission. On the other hand, improper injection practices and blood transfusions were strongly associated with HCV infections, highlighting weaknesses in infection control protocols. Clinically, HBV patients showed signs of acute hepatic inflammation, such as increased SGOT and serum bilirubin levels, but HCV patients showed signs of advanced liver disease, such as jaundice and ascites. The examination of the Child-Turcotte-Pugh (CTP) score also showed that patients with HCV had a higher chance of developing decompensated liver disease, which suggests a delayed diagnosis and treatment. These results highlight important knowledge gaps,

preventative actions and early detection. They draw attention to the need of focused public health initiatives to address risk factors unique to a given area and enhance access to medical treatment, particularly for high-risk groups. To lessen the prevalence of chronic hepatitis in the Kumaon area, improved diagnostic facilities and educational initiatives emphasizing safe medical and cultural practices are crucial.

CONCLUSION: The seroprevalence and clinico-epidemiological characteristics of chronic Hepatitis B (HBV) and Hepatitis C (HCV) in the Kumaon area of Uttarakhand vary significantly, according to this research. With clear geographical differences, such as a greater concentration of HCV cases in Udham Singh Nagar, Bijnor, and Nainital, HCV was more common than HBV. Disparities in healthcare access and knowledge were highlighted by the demographic profile, which showed a male preponderance in both groups and a larger frequency among those from lower socioeconomic strata.
While HBV patients had more acute liver inflammation with markedly raised blood bilirubin and SGOT levels, HCV patients were more likely to arrive with advanced liver disease, as shown by greater rates of ascites, jaundice, and advanced Child-Turcotte-Pugh (CTP) scores9. Risk factor analysis showed that whereas cultural activities like barber shaves were more linked to HBV, dangerous medical procedures such uncontrolled blood transfusions and injections were major drivers to HCV transmission. These results highlight the need of focused public health initiatives, such as HBV vaccine campaigns, more stringent infection control protocols, and instruction on safe cosmetic and medical procedures. To lessen the burden of chronic viral hepatitis and stop the development of severe liver disease, improved diagnostic and treatment facilities are crucial, as are awareness campaigns in areas with a high incidence. Future studies must to concentrate on determining more regional risk variables and assessing the long-term efficacy of preventative strategies.

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