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Original Research Article

Deficiency of Vitamin D in Patients with Chronic Liver Disease

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Abstract: *Deficiency of Vitamin D is associated with various types of chronic liver diseases and with a higher risk of death in these patients. Therefore, it is crucial to diagnose and treat Vitamin D deficiency in patients with chronic liver disease.* ***Objective:*** *The objective of this study was to find out the frequency of vitamin D deficiency in patients with chronic liver Disease.* ***Methods:*** *The present cross-sectional study was conducted at the Department of Medicine, Allama Iqbal Teaching Hospital, DG. Khan from January 2025 to June 2025. After obtaining permission from the institute's ethics board, a total of 167 individuals, including both genders and aged 18 to 50, who had been diagnosed with chronic liver disease for more than six months and received at least 15 minutes of sun exposure twice a week, were included in this study. Data was collected from patients in the hospital's Medicine and Gastroenterology department who satisfied the inclusion criteria. The data were analyzed using SPSS version 20. Percentages and frequencies were calculated for vitamin D deficiency, gender, and the causes of chronic liver disease (HBV/HCV/alcohol/Wilson's disease, etc.). We determined the mean and standard deviations for socioeconomic status (monthly income), age, BMI, SGPT, vitamin D levels, and sun exposure. To determine the connection between variables, the chi-square test was used. A p-value of less than 0.05 was considered to be statistically significant.* ***Results:*** *A total of 167 individuals with chronic liver disease were enrolled in this study, out of which 106(63.4%) were male and 61(36.5%) were female. A deficiency of vitamin D was observed in 95 (56.88%) individuals. The most common cause of chronic liver disease was HCV 140(83.8%). Our study found that vitamin D insufficiency was significantly associated with the cause of CLD, but not with age, gender, BMI, socioeconomic level, or sun exposure.* ***Conclusion:*** *Our study found that vitamin D insufficiency was prevalent in patients with CLD (56.8%), with a higher incidence in men.*

Keywords: Chronic liver disease, vitamin D deficiency

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Introduction

Chronic liver disease is associated with a deficiency of specific nutrients. Deficiencies in micro and macronutrients, such as protein, various vitamins, and minerals like zinc and selenium, can occur in patients with chronic liver disease. Fat-soluble vitamin deficiencies are also commonly noted. (1) Vitamin D is a fat-soluble vitamin. Although vitamin D deficiency is widespread in individuals with advanced chronic liver disease, those with less severe liver disease can also experience some degree of vitamin D insufficiency. (2) Increased mortality, morbidities, and various complications such as recurrent bacterial infections and portal hypertension are all consequences of Chronic liver disease, possibly associated with vitamin D insufficiency. (3-4) An imbalance in the liver's metabolism of vitamin D may be the cause of the low vitamin D levels in patients with chronic liver disease. Under the influence of UV radiation, vitamin D is synthesized in the skin in an inactive state (vitamins D2 and D3), which is then activated in the liver through hydroxylation and finally converted into an active form in the kidneys. There is a shortage of active vitamin D in individuals with liver fibrosis because the liver is unable to hydroxylate the inactive form of the vitamin. Consequently, people with Child-Pugh Class C liver disease are more likely to experience this deficiency. (5-6) Reduced intestinal absorption, limited exposure to sunlight, and decreased dietary vitamin D all worsen the patient's condition. (7) 170 million people worldwide suffer from chronic hepatitis C virus (HCV) associated Chronic liver disease. According to reports, there is an estimated 3% global sero-prevalence of 3,000,000–4,000,000 new HCV infections annually. A significant portion of these individuals (46–92%) have low vitamin D levels, and more than 25% suffer from severe deficiency. (8) The incidence of vitamin D insufficiency in patients with chronic liver disease has been reported to vary depending on the degree of fibrosis. Information regarding the prevalence of vitamin D insufficiency and its correlation with the severity of chronic liver disease in our locality is not sufficient. Therefore, the current study was conducted to determine the frequency of vitamin D deficiency in Patients with Chronic Liver Disease.

Methodology

The present cross-sectional study was conducted at the Medicine and Gastroenterology departments of Allama Iqbal Teaching Hospital, DG. Khan from January 2025 to June 2025, after taking permission from the ethical board of the institute. To determine the sample size, a population proportion sample size calculator was used, which indicated a sample size of 167 patients with a 95% confidence interval and a 4% margin of error. Individuals of both genders, aged 18 to 50, who had been diagnosed with chronic liver disease for more than six months and who received at least 15 minutes of sun exposure twice a week were included in this study. Individuals with chronic liver disease who were receiving vitamin D supplements, those with chronic kidney disease, individuals taking antiepileptics, pregnant women, and those with vitamin D resistance were excluded from the study. Data were gathered from patients in the hospital's Medicine and Gastroenterology departments who satisfied the inclusion criteria. The patient's vitamin D levels were ascertained by a pathologist using blood samples from the hospital lab, after all aseptic protocols were followed. Blood vitamin D levels of each participant were recorded. For data analysis, SPSS version 20 was used. Percentages and frequencies were calculated for vitamin D deficiency, gender, and the causes of chronic liver disease (HBV/HCV/alcohol/Wilson). We determined the mean and standard deviations for socioeconomic status (monthly income), age, BMI, SGPT, vitamin D levels, and sun exposure. To determine the connection between variables, the chi-square test was

used. A p-value of less than 0.05 was considered to be statistically significant.

Results

A total of 167 individuals with chronic liver disease were enrolled in this study, comprising 106 males (63.4%) and 61 females (36.5%). A deficiency of vitamin D was observed in 56.88% (n = 95) of the study population. The mean age of the study participants was 44.0 ± 5.305, the mean exposure time to sun was 41.0 ± 5.305, the mean serum SGPT was 69.484 ± 31.428 (U/L), and the mean Body mass index was 23.492 ± 2.663. The most common cause of chronic Liver disease was HCV 140(83.8%), followed by HBV 20(11.9%) and alcohol usage 7(4.1%), respectively. In 95 individuals (56.88%), the vitamin D level was less than 20 ng/mL, while in 72 participants (43.11%), it was greater than 20 ng/mL. The monthly income of 45 individuals (26.7%) was less than 25,000 PKR per month, 113 individuals (67.5%) had a monthly income between 25,000 and 50,000 PKR, and nine individuals (5.3%) had an income of more than 500,000 PKR per month, as presented in **Table 1**. Our study found that vitamin D deficiency was significantly associated with the cause of CLD (p-value = 0.034), but not significantly related to age (in years), gender, BMI (kg/m²), socioeconomic level, or sun exposure, as shown in Table **2**.

Table 1. Statistical analysis of Age, exposure to sun (minutes), body mass index, level of serum SGPT, sex, cause of chronic liver disease, socioeconomic status, and deficiency of vitamin D

Variable	Mean ± SD / n (%)
Gender	
Male	106(63.4%)
Female	61(36.5%)
Mean age	44.0 ± 5.305
MeanSun exposure in minutes	41.0± 5.30
Body mass index	23.492 ± 2.663
Level of serum SGPT (U/L)	69.484 ± 31.428
Cause of Chronic Liver Disease	
HBV	20 (11.9%)
HCV	140 (83.8%)
Alcohol	7(4.1%)
Total	167 (100%)
The socioeconomic situation(rupees)	
Less than 25000 rupees	45 (26.9%)
25000-50000 rupees	113 (67.6%)
Above 50000 rupees	9 (5.3%)
Vitamin D Level	
Less than 20 ng/mL	95 (56.88%)
Greater than 20 ng/mL	72 (43.11%)
Deficiency of Vitamin D	
Absent	72 (43.11%)
Present	95 (56.88%)

Table 2. Deficiency of vitamin D: Relation to Gender, BMI, age, Socioeconomic status, and etiology of chronic liver disease

Variable	Deficiency of vitamin D			P value
	Yes N=95	No N=72	Total	
Gender				
Male	60(35.9%)	46(27.5%)	106(63.4%)	0.927
Female	35(20.9%)	26(15.6%)	61(36.5%)	
Age in years				
18-33	45(26.9%)	30(17.9%)	75(44.9%)	0.176
25-30	50(29.9%)	42(25.1%)	92(55.0%)	
Body mass index(kg/m^2)				
18-24	46(27.5%)	28(16.7%)	74(44.3%)	0.604
25-30	50(29.9%)	43(25.7%)	93(55.6%)	
Cause of Chronic Liver Disease				
Hepatitis B	16(9.5%)	4(2.3%)	20(11.9%)	0.034
Hepatitis C	78(46.7%)	62(37.1%)	140(83.8%)	
Alcohol	3(1.7%)	4(25.7%	7(4.1%)	
Monthly income				
<25000 rupees	28(16.7%)	17(10.1%)	45(26.9%)	0.336
25000-50000 rupees	62(37.1%)	51(30.5%)	113(67.6%)	

>50000 rupees	4(2.39%)	5(2.9%)	9(5.3%)	

Discussion

Low vitamin D levels have been shown in numerous studies to significantly raise the risk of death from all causes as well as cardiovascular and hepatic disorders in the general population. (3-8) In individuals with various types of chronic liver disease, inadequate levels of vitamin D are associated with a higher risk of death, complications from portal hypertension, bacterial infections, and the severity of fibrosis. (9-10) The Present study was conducted to find out the prevalence of vitamin D deficiency in individuals with chronic liver disease. In our study, a deficiency of vitamin D was observed in 56.88% of participants. Our study findings are similar to those of the trial conducted by Azeem et al., who examined individuals with chronic liver diseases to explore the prevalence of vitamin D deficiency among them. They reported 56% prevalence. In our study, vitamin D deficiency was most common in Males, at 35.9%, compared to females, at 20.9%. (11) Khiire et al also reported similar findings. (9) Vitamin D levels must be routinely appropriately checked to increase the overall survival of patients with cirrhosis. Our study revealed that the deficiency of vitamin D was relatively high, increasing with age and BMI, and was more prevalent in males. No association was found between sun exposure time and the outcome. The literature has extensively studied this hormone's pleiotropic effects, which include controlling the transcription of over 200 genes related to immunomodulation, inflammation, fibrogenesis, cellular growth, and differentiation. (12-13) Han et al. presented two unique pools of 1,25 (OH)2D3 with different goals. (12) The first group, which is part of the standard kidney-liver loop, facilitates the active transport of calcium along the intestinal mucosa, supporting intestinal calcium absorption, preserving blood calcium homeostasis, and allowing calcium to accumulate in the bones.. The immune system and the local calcitriol production by immune cells (monocytes, macrophages, dendritic cells, B and T cells, and lymphocytes) that may result in immunological control (perhaps with a protective role against infections) are found in the second pool. These dual pools may result in two distinct functions of homeostasis, which are paracrine and endocrine; however, they are not well defined. According to Petta et al., "a complicated relationship involving liver damage, vitamin D, and hereditary factors that cause vitamin D deficiency" best describes current knowledge of vitamin D pathophysiology in relation to liver disease/cirrhosis. (14) When comparing our study to that of Petta et al., the median vitamin D levels for CLD individuals were 22.51 ng/mL (controls: 33.15 ng/mL). (16) 95 individuals in the present investigation had vitamin D deficiency, indicating that many CLD patients had low vitamin D Levels, which may lead to a variety of musculoskeletal symptoms. (15) In our study, Vitamin D reserves were found to be deficient in 56.88% of the patients (<20 ng/mL). Numerous thorough trials and investigations have demonstrated vitamin D insufficiency in individuals with cirrhosis. The vitamin D levels of 345 cirrhotic individuals were found to be considerably low in a research by Zhao et al.(16) In Spain, another research by Fernendiz et al. revealed that 88% of the individuals with liver disease had inadequate levels of vitamin D.(17) Eighty percent of the CLD patients in the study conducted by Kumar et al. were found to be vitamin D deficient. (18) Based on vitamin D deficiency, age groups, gender, BMI, socioeconomic level, sun exposure, and cause of chronic liver disease, the following were calculated. Our study found that vitamin D insufficiency was significantly associated with the cause of CLD, and our findings are similar to the study conducted by Azeem et al.(11)

Conclusion

Our study concluded that the frequency of vitamin D deficiency was relatively high in the participants with chronic liver disease (56.88%) and was most prevalent in Male individuals. This finding is comparable to those of several other national and international studies. It also highlights the importance of vitamin D replacement in patients with chronic liver disease to improve their survival. However, further studies, particularly multicenter studies with large sample sizes, are needed to confirm these results.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMS-033-24)
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Conflict of interest

The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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