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NUTRITIONAL STATUS AND SARCOPENIA IN CHRONIC LIVER DISEASE: PREVALENCE, ASSESSMENT, AND CLINICAL CORRELATIONS IN A NORTH INDIAN COHORT

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Abstract:
Background: Chronic liver disease (CLD) is a progressive condition marked by sustained hepatic inflammation, fibrosis, and parenchymal remodeling, leading to cirrhosis, portal hypertension, liver failure, and hepatocellular carcinoma. Malnutrition, particularly protein-energy malnutrition (PEM) and sarcopenia, is a frequent but under-recognized complication in CLD that adversely affects outcomes. Accurate assessment of nutritional status is often complicated by fluid retention and systemic alterations in these patients.
Materials and Methods: This cross-sectional observational study was conducted over two years in the Department of Gastroenterology, MM Institute of Medical Sciences, Mullana and included 100 patients. Their clinical and biochemical parameters were determined which included CBC, LFT, RFT, PT/INR and Viral markers, nutritional status was assessed using Subjective Global Assessment (SGA), anthropometry (BMI, MAC, MAMC, TSFT, Hand Grip Strength), and CT-derived L3 Skeletal Muscle Index (L3SMI). Disease severity was graded by Child–Turcotte–Pugh (CTP) score, and associations with complications (hepatic encephalopathy, acute kidney injury, variceal bleeding, spontaneous bacterial peritonitis) were analysed.
Results: The mean age was 51.6 ± 12.4 years; 77% were male. Alcohol-related CLD was the most common etiology (54%). Malnutrition (SGA B or C) was present in 74% of patients. A significant association was observed between worsening CTP class and prevalence of malnutrition ($p < 0.000001$). Sarcopenia prevalence was 66%, highest in CTP C. Anthropometric measures and hand grip strength declined progressively with worsening nutritional status ($p < 0.0001$). Sarcopenia was most frequent in alcohol-related CLD (81.5%). Variceal bleeding was the most common complication (41%), followed by AKI (28%) and hepatic encephalopathy (21%).

Keywords: Chronic Liver Disease (CLD), Protein-Energy Malnutrition (PEM), Sarcopenia, Subjective Global Assessment (SGA), L3 Skeletal muscle index (L3SMI)

Introduction:

Chronic liver disease (CLD) ranges from hepatic inflammation to cirrhosis and hepatic failure and remains a key contributor to global morbidity and mortality (1). In India, rising rates of alcohol-related liver disease, viral hepatitis, and MASLD are substantial drivers (2). Malnutrition affects 20–80% of

CLD patients, with prevalence rising with disease progression(3,4). Sarcopenia—loss of skeletal muscle mass and strength—is a significant prognostic indicator, associated with increased morbidity and mortality (5). Standard metrics like BMI are unreliable in CLD due to confounding by ascites and fluid overload. Alternative approaches, including SGA, anthropometry, functional testing, and imaging-based muscle evaluation, are recommended.
This study aimed to assess malnutrition and sarcopenia prevalence in CLD, examine correlations with CTP class, and determine relationships with major complications.

Methods:
This cross-sectional observational study was conducted over two years in the Department of Gastroenterology, MM Institute of Medical Sciences, Mullana, Ambala, and included 100 adults (≥18 years) diagnosed with chronic liver disease (CLD) based on clinical, laboratory, and imaging criteria. Patients with hepatocellular or extrahepatic malignancy, chronic kidney disease, age <18 years, or unwillingness to provide consent were excluded.
After obtaining informed consent, a detailed history and physical examination were performed, and relevant clinical and biochemical parameters were recorded. Ethical approval was obtained from the Institutional Ethics Committee. Nutritional status was assessed using the Subjective Global Assessment (SGA), while anthropometric evaluation included body mass index (BMI), mid-arm circumference (MAC), mid-arm muscle circumference (MAMC), triceps skinfold thickness (TSFT), and handgrip strength (HGS). Sarcopenia was evaluated using CT-derived L3 skeletal muscle index (L3SMI), and disease severity was graded using the Child–Turcotte–Pugh (CTP) classification. Complications documented during the study included hepatic encephalopathy (HE), acute kidney injury (AKI), variceal bleeding, and spontaneous bacterial peritonitis (SBP).
Statistical Analysis: Data were analysed using SPSS version 21. Comparisons employed chi-square test, ANOVA, and ROC analysis; $p < 0.05$ was considered statistically significant.

Results:
A total of 100 patients with chronic liver disease (CLD) were included in the study. Out of these, 77 (77%) were males and 23 (23%) were females, with a male-to-female ratio of approximately 3.3:1. The mean age of the patients was 51.6 ± 12.4 years. The most common etiology of CLD was alcohol-related liver disease (n = 54), followed by MASLD (n = 18;), HCV-related CLD (n = 14), and HBV-related CLD (n = 13; 13%). Dual infection (HBV + HCV) was noted in 1 (1%) patient. Based on the Child–Turcotte–Pugh (CTP) classification, 15 (15%) patients were in class A, 45 (45%) in class B, and 40 (40%) in class C. Ascites was present in 78 (78%) patients.
Nutritional assessment using Subjective Global Assessment (SGA) showed that 26 (26%) patients were well nourished (SGA A), 46 (46%) were moderately malnourished (SGA B), and 28 (28%) were severely malnourished (SGA C). The prevalence of malnutrition increased with disease severity—only 3/15 (20%) in CTP A were malnourished, whereas all 40/40 (100%) in CTP C were malnourished. Sarcopenia, as defined by CT-derived L3 Skeletal Muscle Index (L3SMI) using Indian cut-offs, was present in 66 (66%) patients. Prevalence was highest in alcohol-related CLD (n = 44/54; 81.5%), followed by HBV (n = 9/13; 69.2%), HCV (n = 9/14; 64.3%), and MASLD (n = 4/18; 22.2%). Sarcopenia prevalence rose with disease stage: 6/15 (40%) in CTP A, 29/45 (64.4%) in CTP B, and 31/40 (77.5%) in CTP C.
The most common complication at presentation was variceal bleeding (n = 33; 41%), followed by acute kidney injury (AKI) (n = 22; 28%), hepatic encephalopathy (HE) (n = 21; 21%), and spontaneous bacterial peritonitis (SBP) (n = 4; 4%). Overall, 80 (80%) patients had at least one complication.
Anthropometric and functional measures—mid-arm circumference (MAC), mid-arm muscle circumference (MAMC), triceps skinfold thickness (TSFT), and hand grip strength (HGS)—showed a consistent downward trend with worsening nutritional status. In males, the optimal cut-offs for predicting malnutrition were: MAC < 26.67 cm (sensitivity 71.9%, specificity 84.6%), MAMC < 24.4

cm (sensitivity 85.9%, specificity 76.9%), TSFT < 8.73 mm (sensitivity 45.3%, specificity 100%), and HGS < 23.3 kg (sensitivity 75%, specificity 76.9%).

Table 1. Baseline demographic and clinical characteristics of study participants

Variable	**Total (n=100)**
Age (years), mean ± SD	51.6 ± 12.4
Gender	Male (77%), Females (23%)
Etiology of CLD	Alcohol-related: 54 (54%) MASLD: 18 (18%) HCV: 14 (14%) HBV: 13 (13%) HBV + HCV: 1 (1%)
CTP classification	Class A: 15 (15%) Class B: 45 (45%) Class C: 40 (40%)
Complications	Ascites: 78 (78%) Variceal bleeding: 33 (33%) Acute kidney injury: 22 (22%) Hepatic encephalopathy: 21 (21%) Spontaneous bacterial peritonitis: 4 (4%)

Table 2. Nutritional status and sarcopenia by Child–Turcotte–Pugh (CTP) class

Parameter	**CTP A (n=15)**	**CTP B (n=45)**	**CTP C (n=40)**	**p-value**
SGA classification				
Well nourished (A)	12 (80%)	11 (24.4%)	0 (0%)	
Moderate malnutrition (B)	2 (13.3%)	23 (51.1%)	21 (52.5%)	<0.001*
Severe malnutrition (C)	1 (6.7%)	11 (24.4%)	19 (47.5%)	
Sarcopenia (L3SMI)	6 (40%)	29 (64.4%)	31 (77.5%)	0.003*

Table 3: Mean values of anthropometric data and hand grip strength for Male cases:

SGA Group	**TSFT (mm)**	**MAC (cm)**	**MAMC (cm)**	**Hand Grip (kg)**
A	12.59	28.33	25.14	27.30
B	10.54	25.78	22.69	23.15
C	8.47	24.77	22.48	21.21
p value	<0.0001	<0.0001	<0.0001	<0.0001

Table 4: AUC for MAC to predict malnutrition in Males and Females

SGA Group	**TSFT (mm)**	**MAC (cm)**	**MAMC (cm)**	**Hand Grip (kg)**
A	17.28	25.99	24.04	20.39
B	14.73	28.97	25.75	19.62
C	15.15	23.71	22.29	20.74
p value	<0.0001	<0.0001	<0.0001	<0.0001

Discussion:

This study evaluated the nutritional status of patients with chronic liver disease (CLD) and its relationship to disease severity, complications, and etiology. The results confirm that malnutrition and

sarcopenia are highly prevalent in CLD, with prevalence increasing alongside Child–Turcotte–Pugh (CTP) class, in keeping with previous Indian and international reports.

Malnutrition, as defined by the Subjective Global Assessment (SGA), was present in 74% of patients. Notably, all patients with CTP C disease were malnourished. Even in CTP A cirrhosis, 20% were malnourished, underscoring that cirrhosis per se—through mechanisms such as hypermetabolism, bile acid deficiency impairing fat absorption, and muscle proteolysis—can lead to nutritional deficits. Our findings parallel previous reports. Carvalho et al. (102) documented malnutrition in >75% of advanced liver disease patients, including 95% of CTP C, 84% of CTP B, and 46% of CTP A cases. Similarly, Maharshi et al.(6) reported malnutrition rates of 44.5%, 73.3%, and 94.4% in CTP A, B, and C patients, respectively. Janota et al. (7) further demonstrated a progressive decline in anthropometric and bioimpedance measures with advancing CTP class.

In our analysis, skinfold thickness, mid-arm circumference (MAC), mid-arm muscle circumference (MAMC), and HGS effectively differentiated well-nourished patients (SGA A) from those with mild or severe malnutrition (SGA B and C). BMI, however, did not differ significantly between nutritional categories, highlighting its unreliability in the presence of ascites or edema.

Bedside tools such as HGS and anthropometry, which are minimally influenced by fluid status, emerged as valuable for early detection of malnutrition. In our cohort, HGS in male patients demonstrated the highest diagnostic accuracy for malnutrition (AUC = 0.84), with a prevalence of 77% when assessed via HGS criteria. These results are in line with Maharshi et al. (6), who reported higher malnutrition prevalence via HGS (71.4%) compared with conventional methods (59.5%). Tai et al. (8) also demonstrated significant differences in anthropometry across SGA classes in decompensated cirrhosis, consistent with our observations.

Using Indian reference cut-offs from Benjamin et al.(9), the prevalence of sarcopenia in our cohort was 66%, consistent with global estimates. Tantai et al. in 2022 (10) reported a 40–70% prevalence in cirrhosis, with sarcopenia conferring a 2.5-fold increase in mortality risk. Montano-Loza et al.(11) found reduced median survival in sarcopenic patients (19 vs 34 months). Prevalence estimates vary by diagnostic criteria, as noted in Simon et al.(12), who reported a pooled sarcopenia prevalence of 33%, rising with disease severity (33% in CTP A, 36% in CTP B, 46% in CTP C). Our data reflected a similar gradient.

In our study, sarcopenia was most pronounced in alcoholic liver disease, as also noted by Maharshi et al(6). Mechanisms include direct myotoxic effects of alcohol, reduced dietary intake, gastrointestinal disturbances, systemic inflammation, and alcohol-induced gut dysbiosis.

Variceal bleed was present in 33% of patients, variceal bleeding showed no correlation with malnutrition or sarcopenia, consistent with literature suggesting that portal hypertension severity—not nutritional status—drives bleeding risk. AKI occurred in 22% of patients and was significantly associated with sarcopenia ($p = 0.011$) and malnutrition ($p = 0.007$). These results are supported by EASL(13), AASLD(14), and INASL(15) guidelines, which note that sarcopenia reduces physiological reserve, predisposes to circulatory dysfunction, and heightens systemic inflammation, thereby increasing susceptibility to AKI.

Hepatic encephalopathy found in 21% of patients, but was not statistically associated with nutritional status in our cohort. However, prior studies (Montano-Loza et al.,(11); Dasarathy et al.(16)) have demonstrated that muscle loss reduces extrahepatic ammonia clearance, predisposing to HE and influencing its recurrence. Spontaneous bacterial peritonitis occurred in 4% of patients, precluding statistical association testing. Nonetheless, literature (Nardelli et al.(17)) supports a link between sarcopenia, impaired immunity, and increased infection risk in cirrhosis, including SBP.

Serum albumin was significantly lower in malnourished patients ($p = 0.0002$; AUC = 0.73; optimal cut-off = 2.8 g/dL). While albumin remains a useful nutritional marker, it also reflects hepatic synthetic capacity and systemic inflammation. Hemoglobin showed no association with nutritional status, consistent with findings by Shaheen Butt et al.(18) that anemia in CLD is multifactorial and not solely nutrition-related.

Malnutrition and sarcopenia were most frequent in alcoholic liver disease. Vieira et al.(19) and Oliveira et al. (20) reported more severe muscle depletion in ALD compared to viral or metabolic etiologies. Chronic alcohol use leads to anorexia, malabsorption, gut barrier dysfunction, and persistent inflammation. McClain et al. (21) highlighted the high prevalence and severity of protein–energy malnutrition (PEM) in ALD, worsened by hospitalizations and catabolic stress.

Conclusion:
Malnutrition and sarcopenia are highly prevalent in chronic liver disease, with severity increasing alongside CTP class and alcoholic etiology. Simple bedside measures, such as anthropometry and handgrip strength, offer reliable alternatives to BMI and can facilitate early detection. Routine nutritional screening and timely intervention should be integral to CLD management to improve outcomes.

Limitation:
This single-centre, cross-sectional study from a tertiary care setting may limit generalisability. The absence of follow-up precludes evaluation of survival or complication outcomes. Although CT-derived L3SMI is a reference standard, dietary intake and micronutrient status were not measured, and the SGA tool carries inherent subjectivity. The lack of statistical significance between malnutrition, sarcopenia, and hepatic encephalopathy was noted which may be due to the relatively small number of HE cases in our cohort, which reduces statistical power. Potential confounders, such as socioeconomic status, alcohol abstinence duration, and comorbidities, were not fully accounted for.

Conflict of interest – Nil

Bibliography:
1. Gan C, Yuan Y, Shen H, Gao J, Kong X, Che Z, et al. Liver diseases: epidemiology, causes, trends and predictions. Signal Transduct Target Ther. 2025 Feb 5;10(1):33.
2. Swaroop S, Vaishnav M, Arora U, Biswas S, Aggarwal A, Sarkar S, et al. Etiological Spectrum of Cirrhosis in India: A Systematic Review and Meta-analysis. J Clin Exp Hepatol. 2024 Mar 1;14(2):101291.
3. Shin S, Jun DW, Saeed WK, Koh DH. A narrative review of malnutrition in chronic liver disease. Ann Transl Med. 2021 Jan;9(2):172.
4. Balakrishnan B, Vijayalakshmi B, Shenoy K, Leena K, Jayakumar P, Mukkadan J. Prevalence of Sarcopenia in Liver Cirrhosis Patients and Determinants of Survival in Cirrhotic Population: A Prospective Cohort Study. J Clin Diagn Res [Internet]. 2024 [cited 2025 Aug 8]; Available from: https://www.jcdr.net/article_fulltext.asp?issn=0973-709x&year=2024&month=March&volume=18&issue=3&page=CC09-CC14&id=19159
5. Prusty PL, Singh SP, Swarup MS, Panda C, Hota SK, Meena BP. Sarcopenia: The Predictor of Mortality in Chronic Liver Disease Patients. J Clin Exp Hepatol. 2023 Jan 1;13:S48.
6. Maharshi S, Sharma BC, Srivastava S. Malnutrition in cirrhosis increases morbidity and mortality. J Gastroenterol Hepatol. 2015 Oct;30(10):1507–13.
7. Janota B, Krupowicz A, Noras K, Janczewska E. Evaluation of the nutritional status of patients with liver cirrhosis. World J Hepatol. 2023 July 27;15(7):914–24.
8. Tai MLS, Goh KL, Mohd-Taib SH, Rampal S, Mahadeva S. Anthropometric, biochemical and clinical assessment of malnutrition in Malaysian patients with advanced cirrhosis. Nutr J. 2010 June 24;9:27.
9. Benjamin J, Shasthry V, Kaal CR, Anand L, Bhardwaj A, Pandit V, et al. Characterization of body composition and definition of sarcopenia in patients with alcoholic cirrhosis: A computed tomography based study. Liver Int Off J Int Assoc Study Liver. 2017 Nov;37(11):1668–74.

10. Tantai X, Liu Y, Yeo YH, Praktiknjo M, Mauro E, Hamaguchi Y, et al. Effect of sarcopenia on survival in patients with cirrhosis: A meta-analysis. J Hepatol. 2022 Mar;76(3):588–99.
11. Montano-Loza AJ, Meza-Junco J, Baracos VE, Prado CMM, Ma M, Meeberg G, et al. Severe muscle depletion predicts postoperative length of stay but is not associated with survival after liver transplantation. Liver Transplant Off Publ Am Assoc Study Liver Dis Int Liver Transplant Soc. 2014 June;20(6):640–8.
12. Mazeaud S, Zupo R, Couret A, Panza F, Sardone R, Castellana F. Prevalence of Sarcopenia in Liver Cirrhosis: A Systematic Review and Meta-Analysis. Clin Transl Gastroenterol. 2023 July;14(7):e00584.
13. European Association for the Study of the Liver. EASL Clinical Practice Guidelines on nutrition in chronic liver disease. J Hepatol. 2019 Jan;70(1):172–93.
14. Runyon BA, AASLD Practice Guidelines Committee. Management of adult patients with ascites due to cirrhosis: an update. Hepatol Baltim Md. 2009 June;49(6):2087–107.
15. Puri P, Dhiman RK, Taneja S, Tandon P, Merli M, Anand AC, et al. Nutrition in Chronic Liver Disease: Consensus Statement of the Indian National Association for Study of the Liver. J Clin Exp Hepatol. 2021;11(1):97–143.
16. Dasarathy S. Consilience in sarcopenia of cirrhosis. J Cachexia Sarcopenia Muscle. 2012 Dec;3(4):225–37.
17. Nardelli S, Gioia S, Faccioli J, Riggio O, Ridola L. Sarcopenia and cognitive impairment in liver cirrhosis: A viewpoint on the clinical impact of minimal hepatic encephalopathy. World J Gastroenterol. 2019 Sept 21;25(35):5257–65.
18. Butt S, Ahmed P. A study of malnutrition among chronic liver disease patients. Pak J Nutr. 2009;8(9):1465–71.
19. Vieira PM, De-Souza DA, Oliveira LCM. Nutritional assessment in hepatic cirrhosis; clinical, anthropometric, biochemical and hematological parameters. Nutr Hosp. 2013;28(5):1615–21.
20. Oliveira KS, Oliveira LR, Fernandes SA, Coral GP. MALNUTRITION IN CIRRHOSIS: ASSOCIATION WITH ETIOLOGY AND HEPATOCELLULAR DYSFUNCTION. Arq Gastroenterol. 2020 Dec;57(4):375–80.
21. McClain CJ, Barve SS, Barve A, Marsano L. Alcoholic Liver Disease and Malnutrition. Alcohol Clin Exp Res. 2011 May;35(5):815–20.