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Original Research Article

Prevalence and Determinants of Undernutrition among Patients with Liver Cirrhosis: A Hospital-Based Cross-Sectional Study

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Abstract

Background: Undernutrition is a common but often neglected complication of liver cirrhosis. It adversely affects the course of the disease, predisposes to complications, prolongs the duration of hospitalization and affects negatively on the survival. The available data on the prevalence and determinants of undernutrition in Indian patients with cirrhosis are scanty but clinically significant. The aim of the present study was to assess the prevalence of undernutrition in patients with liver cirrhosis by using different nutritional tools like clinical, anthropometric, functional and biochemical parameters.

Methods: A cross sectional observational study was conducted among 120 adult patients diagnosed clinically and ultrasonographically for liver cirrhosis attending the Department of Medicine, Assam Medical College and Hospital, Dibrugarh. Nutritional status was assessed using a modified subjective global assessment (SGA) and anthropometric measurements such as body mass index (BMI), dry BMI, triceps skinfold thickness (TSF), waist circumference, waist-hip ratio, and handgrip strength (HGS). Biochemical parameters such as serum albumin, total cholesterol, total lymphocyte count, serum creatinine, hemoglobin, vitamin D, and vitamin B12 were also assessed. Severity of disease was evaluated by Child-Pugh classification. Descriptive and inferential tests were performed for the data analysis and $p<0.05$ was considered as statistically significant.

Results: Patients with liver cirrhosis had a high prevalence of undernutrition. The prevalence differed based on the assessment tools, with functional and anthropometric methods detecting significantly more patients than BMI only. Nutritional indices including handgrip strength, triceps skinfold thickness, serum albumin, lymphocyte count and cholesterol were significantly less in patients with advanced Child–Pugh class. Patients with undernutrition were more likely to have clinical signs of micronutrient deficiency. The handgrip strength was one of the most sensitive indicators of nutritional impairment.

Conclusion: Undernutrition is very common in patients with liver cirrhosis and it is strongly correlated with the disease severity. Routine nutritional screening with a combination of subjective, anthropometric, functional and biochemical methods should be incorporated into the standard f care for cirrhosis for early nutritional intervention and improved clinical outcomes.

Keywords: Liver Cirrhosis; Undernutrition; Malnutrition; Subjective Global Assessment; Handgrip Strength; Child–Pugh Score.

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Introduction

The end-stage of chronic liver injury is liver cirrhosis, defined by diffuse fibrosis, regenerative nodules, and distortion of the hepatic architecture and progressive loss of hepatic function [1]. It is still one of the leading causes of morbidity and mortality worldwide, causing more than a million deaths every year. In India, alcohol-related liver disease and chronic viral hepatitis are the main etiological factors responsible for cirrhosis [2].

Undernutrition is one of the most frequent systemic complications of chronic liver disease, and has been increasingly recognized as an independent determinant of poor clinical outcomes [3]. Undernutrition is seen with great variability in cirrhosis, from 20% in compensated disease to > 80% in patients with advanced decompensated cirrhosis depending on the methods used for assessment [4,5].

The pathogenesis of undernutrition in cirrhosis is multifactorial. Reduced dietary intake due to anorexia, nausea, early satiety from ascites, altered taste perception, and dietary restrictions often contribute to inadequate intake. In addition, altered carbohydrate, lipid and protein metabolism, increased resting energy expenditure, chronic inflammation, hormonal imbalance, accelerated skeletal muscle catabolism as well as impaired digestion and absorption contribute to protein-energy malnutrition [6–8].

Traditional nutritional assessment is heavily dependent on body mass index, which can be unreliable in cirrhosis due to fluid retention, ascites, and peripheral edema, masking significant loss of lean body mass [9].

Therefore, several complementary methods such as Modified Subjective Global Assessment (SGA), triceps skinfold thickness, mid-arm muscle circumference, handgrip strength and biochemical nutritional markers have been recommended to get a complete nutritional assessment [10].

Of these, handgrip strength has been shown to be a simple, inexpensive, reproducible and highly sensitive indicator of muscle strength and sarcopenia. In several studies, reduced handgrip strength has been shown to be strongly associated with disease severity, hospitalization, post-operative complications and mortality in patients with cirrhosis [11,12].

Previous studies have shown that worsening nutritional status is associated with an increase in the Child-Pugh class and Model for End-stage Liver Disease (MELD) score, emphasizing the close interplay between hepatic dysfunction and nutritional decline [13-15].

However, published data from the northeastern India are sparse. Considering the lack of regional evidence and importance of early nutritional intervention, present study was carried out to determine the prevalence of undernutrition among patients with liver cirrhosis using different assessement tools like clinical, anthropometric, functional and biochemical parameters in a tertiary care hospital.

Aim: To determine the prevalence of undernutrition and to assess the association of undernutrition with disease severity in patients with liver cirrhosis using clinical, anthropometric, functional and biochemical nutritional assessment tools.

Objectives

1. To investigate the prevalence of undernutrition in patients with liver cirrhosis.
2. Nutritional status was evaluated by Subjective Global Assessment (SGA), body mass index (BMI), BMI based on dry-weight, triceps skinfold thickness (TSF), handgrip strength (HGS) and biochemical parameters.
3. To compare the nutritional status of patients among the different Child-Pugh classes.
4. To assess the correlation between nutritional status and severity of liver cirrhosis.
5. To find out the best bedside nutritional assessment methods to detect undernutrition in patients with liver cirrhosis.

Materials and Methods

Study Design and Setting: This hospital-based cross-sectional observational study was conducted in the Department of Medicine, Assam Medical College and Hospital, Dibrugarh, India, over a period of one year (July 2018 to June 2019). The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment.

Study Population: A total of 120 consecutive adult patients (≥20 years) with clinically and ultrasonographically confirmed liver cirrhosis were included in the study. Patients with hepatic encephalopathy, hepatocellular carcinoma, chronic kidney disease, diabetes mellitus, HIV infection, tuberculosis, chronic obstructive pulmonary disease, previous abdominal surgery, or those unwilling to participate were excluded.

Data Collection: Demographic characteristics, clinical history, physical examination findings, and laboratory investigations were recorded using a predesigned proforma. Disease severity was assessed using the Child–Pugh classification.

Nutritional assessment was performed using multiple validated methods, including Subjective Global Assessment (SGA), body mass index (BMI), dry-weight BMI, waist circumference, waist–hip ratio, triceps skinfold thickness (TSF), and handgrip strength (HGS).

Biochemical parameters evaluated included hemoglobin, serum albumin, total lymphocyte count, serum creatinine, total cholesterol, vitamin D, and vitamin B12 levels.

Outcome Measures: The primary outcome was the prevalence of undernutrition among patients with liver cirrhosis. Secondary outcomes included comparison of nutritional status across Child–Pugh classes and evaluation of the association between anthropometric, functional, and biochemical nutritional parameters and disease severity.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Chi-square test, Fisher's exact test, one-way ANOVA, or Student's t-test, as appropriate.

A p-value <0.05 was considered statistically significant.

Results

Baseline Characteristics of the Study Population: A total of 120 patients with clinically and ultrasonographically confirmed liver cirrhosis were included in the present study.

Nutritional assessment was performed using multiple validated methods including Subjective Global Assessment (SGA), anthropometric measurements, functional assessment, and biochemical markers. Disease severity was classified according to the Child–Pugh scoring system.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variable	Value
Total sample size	120
Mean age (years)	**50.34 ± 9.41**
Male : Female ratio	**3.44 : 1**
Commonest presenting symptom	Abdominal distension (74.17%)
Pedal oedema	40.83%
Jaundice	35.00%

The study population predominantly consisted of middle-aged adults with a marked male preponderance, reflecting the epidemiological profile of chronic liver disease in India. Abdominal distension due to ascites was the most frequent presenting complaint, followed by pedal oedema and jaundice, indicating that many patients presented with advanced decompensated cirrhosis.

Table 2: Distribution According to Child–Pugh Classification

Child–Pugh Class	Number	Percentage (%)
A	19	15.83
B	44	36.67
C	57	47.50
Total	**120**	**100**

Figure 1: Distribution of Child–Pugh Classes

Nearly half of the study population belonged to Child–Pugh Class C, while only one-sixth were classified as Child–Pugh Class A. This indicates that most patients sought medical attention after significant progression of liver disease. The predominance of advanced disease also explains the high prevalence of nutritional impairment observed throughout the study.

Table 3: Subjective Global Assessment (SGA)

Nutritional Category	Number	Percentage (%)
Well nourished (A)	44	36.67
Moderate undernutrition (B)	54	45.00
Severe undernutrition (C)	22	18.33
Total	**120**	**100**

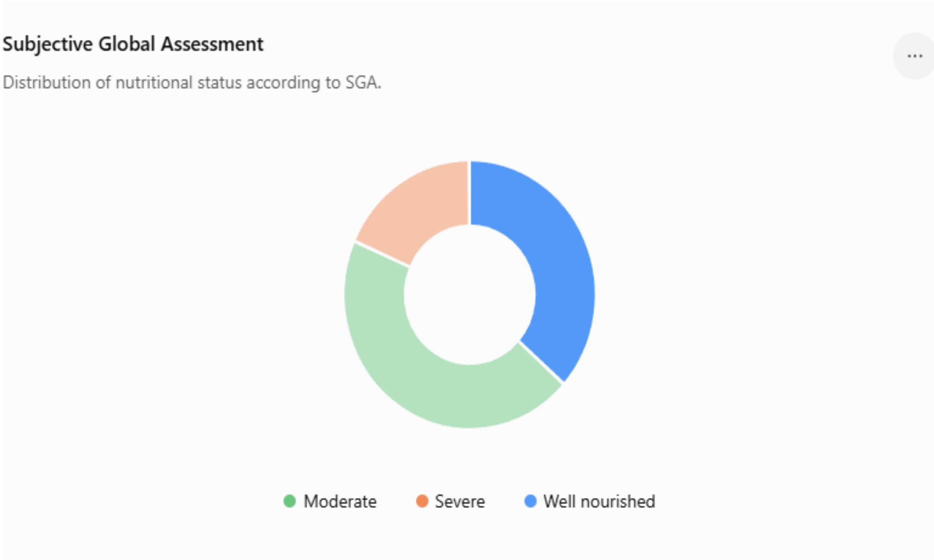

Figure 2: Subjective Global Assessment

Modified Subjective Global Assessment identified 63.33% of patients as undernourished (moderate and severe combined), confirming that malnutrition is highly prevalent among individuals with liver cirrhosis. Moderate undernutrition was the commonest nutritional category, suggesting that many patients were already experiencing clinically relevant nutritional decline before reaching severe protein-energy malnutrition.

Table 4. Nutritional Status According to Body Mass Index

BMI Category	Percentage (%)
Undernutrition	16.66
Normal	4.17
Overweight	55.00
Obesity	24.17

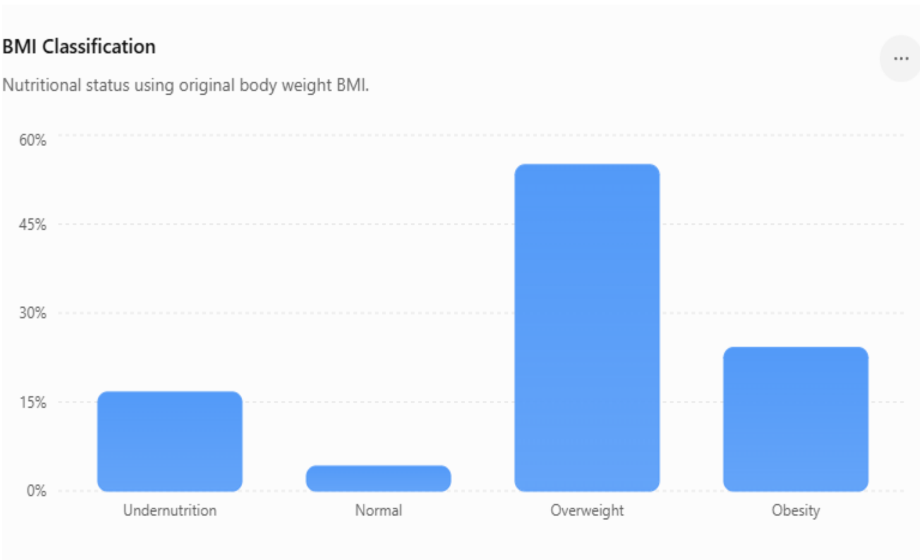

Figure 3: BMI Classification

Assessment based on original body weight suggested that only 16.66% of patients were undernourished, whereas the majority appeared overweight or obese. This finding is misleading in patients with cirrhosis because ascites and peripheral oedema substantially increase body weight, thereby masking true nutritional depletion. Consequently, conventional BMI underestimated the burden of malnutrition in this population.

Table 5: Nutritional Status According to Dry Weight BMI

Dry BMI Category	Percentage (%)
Undernutrition	70.83
Normal	17.50
Overweight	7.50
Obesity	4.17

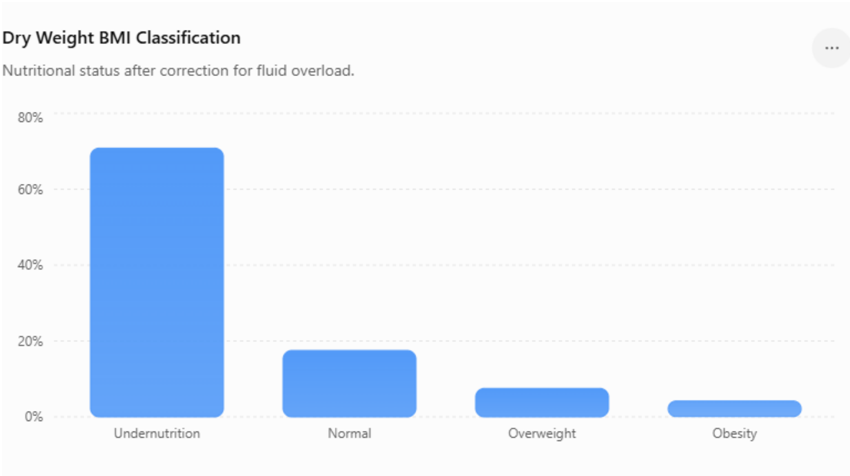

Figure 4: Dry Weight BMI Classification

After correcting body weight for fluid retention, the prevalence of undernutrition increased dramatically from 16.66% to 70.83%.

This finding clearly demonstrates that conventional BMI substantially underestimates nutritional impairment in patients with cirrhosis.

Dry-weight BMI provides a more realistic estimate of nutritional status and should be preferred in patients with ascites or generalized oedema.

Anthropometric, Functional, and Clinical Assessment of Nutritional Status: Anthropometric measurements, functional assessment, and clinical examination were performed in all 120 patients to comprehensively evaluate nutritional status. These assessment methods identified a substantially higher prevalence of undernutrition than conventional BMI, demonstrating the limitations of body weight-based nutritional assessment in patients with liver cirrhosis complicated by fluid retention.

Table 6: Waist Circumference Assessment

Category	Number (n)	Percentage (%)
Obesity	107	89.17
Normal	13	10.83
Total	**120**	**100**

Based on waist circumference, 89.17% of patients were classified as obese. However, this finding should be interpreted cautiously because abdominal ascites markedly increases waist circumference independent of body fat. Therefore, waist circumference alone is an unreliable nutritional indicator in patients with advanced liver disease.

Table 7: Waist–Hip Ratio Assessment

Category	Number (n)	Percentage (%)
Obesity	111	92.50
Normal	9	7.50
Total	**120**	**100**

Similarly, waist–hip ratio classified 92.50% of participants as obese. The disproportionately high prevalence reflects the influence of ascites rather than excess adiposity, indicating that waist-based anthropometric indices have limited utility in cirrhotic patients with fluid overload.

Table 8: Triceps Skinfold Thickness According to Age- and Sex-Specific Percentiles

Nutritional Status	Number (n)	Percentage (%)
Normal	11	9.17
Moderate undernutrition (<10th percentile)	22	18.33
Severe undernutrition (<5th percentile)	87	72.50
Total undernutrition	**109**	**90.83**

Triceps skinfold thickness identified 90.83% of patients as undernourished, making it the most sensitive anthropometric indicator in the present study. More than two-thirds of participants had severe depletion of subcutaneous fat stores, indicating advanced protein-energy malnutrition despite apparently normal or increased body weight in many patients.

Table 9: Handgrip Strength Assessment

Nutritional Status	Number (n)	Percentage (%)
Undernourished	93	77.50
Normal	27	22.50
Total	**120**	**100**

Reduced handgrip strength was present in 77.50% of patients, demonstrating substantial impairment of skeletal muscle function. Functional decline was more prevalent than undernutrition detected by conventional BMI, highlighting the value of handgrip strength as an early and practical bedside marker of sarcopenia in liver cirrhosis.

Table 10: Physical Signs of Nutritional Deficiency

Clinical Sign	Number (n)	Percentage (%)
Loss of hair	51	42.50
Pallor	36	30.00
Peripheral neuropathy	34	28.33
Glossitis	28	23.33
Angular stomatitis	26	21.67
Purpura	24	20.00
Bleeding gums	22	18.33

Clinical examination demonstrated a high prevalence of micronutrient deficiency manifestations.

Hair loss was the most common physical sign, followed by pallor and peripheral neuropathy.

The coexistence of multiple deficiency signs reflects chronic depletion of both macro- and micronutrients in patients with advanced liver disease and supports the need for routine nutritional screening.

Biochemical Nutritional Assessment and Association with Disease Severity: Biochemical markers of nutritional status and micronutrient levels were evaluated in all 120 participants. These objective laboratory parameters were further analyzed according to Child–Pugh classification to determine their relationship with disease severity. Overall, worsening liver function was associated with progressive deterioration in biochemical nutritional indices and increasing prevalence of micronutrient abnormalities.

Table 11: Biochemical Markers of Nutritional Status

Parameter	Number (n)	Percentage (%)
Anemia	105	87.50
Hypoalbuminemia	102	85.00
Low Serum Creatinine	35	29.17
Hypocholesterolemia	47	39.17
Lymphocytopenia	87	72.50

Biochemical evidence of nutritional compromise was highly prevalent among the study population. Anemia and hypoalbuminemia affected more than four-fifths of patients, while lymphocytopenia was observed in nearly three-quarters. Reduced serum cholesterol and creatinine further reflected impaired protein reserves and loss of skeletal muscle mass. Collectively, these laboratory findings corroborated the high burden of undernutrition detected by anthropometric and functional assessment methods.

Table 12: Micronutrient Status

Micronutrient	Number (n)	Percentage (%)
Low Vitamin D	102	85.00
Elevated Vitamin B12	98	81.67

Vitamin D deficiency was present in 85.00% of patients, indicating that hypovitaminosis D is a common feature of chronic liver disease. Conversely, elevated serum vitamin B12 levels were detected in 81.67%, likely reflecting impaired hepatic storage and release rather than adequate nutritional status. These abnormalities became increasingly frequent with worsening liver dysfunction.

Table 13. Overall Prevalence of Undernutrition According to Different Assessment Methods

Assessment Method	Undernutrition (%)
Subjective Global Assessment	63.33
Original BMI	16.66
Dry Weight BMI	70.83
Triceps Skinfold Thickness	90.83
Handgrip Strength	77.50

Interpretation: Considerable variability was observed among different nutritional assessment methods. Conventional BMI identified the lowest prevalence of undernutrition, whereas triceps skinfold thickness identified the highest. Dry-weight BMI and handgrip strength also detected substantially more cases than conventional BMI, demonstrating that fluid overload significantly masks nutritional depletion in cirrhotic patients. These findings emphasize the importance of using multiple complementary assessment tools rather than relying solely on body weight.

Table 14: Nutritional Status According to Child–Pugh Class

Nutritional Parameter	Child A	Child B	Child C	p value
Moderate SGA (%)	7.41	20.37	72.22	<0.001
Severe SGA (%)	4.56	13.63	81.81	0.0017
Dry BMI Undernutrition (%)	4.72	37.64	57.64	<0.001
Severe TSF Undernutrition (%)	9.19	34.49	56.32	0.00075
Handgrip Undernutrition (%)	7.53	33.33	59.14	<0.001

All validated nutritional assessment tools demonstrated a significant increase in undernutrition with advancing Child–Pugh class. Moderate and severe malnutrition assessed by SGA, dry BMI, TSF, and handgrip strength were predominantly observed among patients with Child–Pugh Class C. These findings indicate that deterioration in liver function is closely associated with progressive nutritional decline.

Table 15. Mean Nutritional and Biochemical Parameters According to Child–Pugh Class

Parameter	Child A	Child B	Child C	p value
BMI (kg/m²)	21.95 ± 2.63	23.09 ± 2.29	24.61 ± 1.63	<0.001
Dry BMI (kg/m²)	20.20 ± 3.33	18.40 ± 2.71	17.93 ± 2.42	0.007
TSF (mm)	6.58 ± 1.92	4.80 ± 1.66	3.95 ± 1.58	<0.001
Handgrip Strength (kg)	31.07 ± 5.55	24.99 ± 4.13	21.16 ± 4.22	<0.001
Hemoglobin (g/dL)	10.10 ± 2.28	9.26 ± 2.22	7.23 ± 1.70	<0.001
Albumin (g/dL)	3.40 ± 0.39	2.56 ± 0.56	1.94 ± 0.35	<0.001
Creatinine (mg/dL)	1.03 ± 0.26	0.89 ± 0.30	0.72 ± 0.22	<0.001
Cholesterol (mg/dL)	133.26 ± 15.04	121.27 ± 25.50	103.60 ± 25.11	<0.001
Vitamin D (ng/mL)	26.57 ± 6.21	23.30 ± 5.86	17.38 ± 5.56	<0.001
Vitamin B12 (pg/mL)	1344.24 ± 576.77	1787.95 ± 715.88	2057.51 ± 724.85	0.0008

Progressive worsening of liver disease was associated with significant deterioration in nearly every nutritional parameter. Dry BMI, triceps skinfold thickness, handgrip strength, hemoglobin, serum albumin, serum creatinine, cholesterol, and vitamin D all declined significantly from Child–Pugh Class A to Class C. Conversely, conventional BMI increased because of progressive fluid retention, while serum vitamin B12 levels increased with disease severity owing to impaired hepatic metabolism and release of stored cobalamin. These findings underscore the close relationship between hepatic dysfunction and nutritional deterioration.

Discussion

The present study showed that undernutrition is very common among patients with liver cirrhosis and it progressively worsens with increasing severity of the disease. Using multiple nutritional assessment tools, the prevalence of undernutrition varied considerably with the method used. Only 16.66% of patients were identified as undernourished by conventional body mass index (BMI) whereas 63.33%, 70.83%, 77.50% and 90.83% patients were identified as undernourished by Subjective Global Assessment (SGA), dry-weight BMI, handgrip strength (HGS) and triceps skinfold thickness (TSF) respectively.

The results of this study suggest that the conventional BMI largely underestimates malnutrition in patients with cirrhosis due to ascites and peripheral edema and therefore should not be used as a single tool for nutritional assessment. Similar findings are also reported in the EASL and ESPEN clinical practice guidelines recommending a complete nutritional assessment based on different anthropometric and functional parameters rather than body weight alone [1,2].

Undernutrition is a frequent complication of chronic liver disease, observed in approximately 20–90% of patients depending on the severity of the disease and the method of assessment [1,2]. The high prevalence observed in the present study is in keeping with earlier studies reporting a marked increase in nutritional deterioration as hepatic function declines. D'Amico et al. identified undernutrition as an important factor in the poor prognosis of cirrhosis. Abbott et al. highlighted that nutritional assessment should be incorporated in the routine hepatology practice due to the independent effect of nutritional impairment on morbidity and mortality [4,5].

One of the most important results of the present study was the remarkable difference between the conventional BMI and the BMI based on dry weight. While most patients were classified as overweight or obese by the traditional BMI, correction for fluid retention showed that more than two-thirds of the patients were actually undernourished.

Ascites and peripheral edema artificially raise body weight and therefore mask protein-energy malnutrition. Similar results were reported by Campillo et al., Alberino et al., and Merli et al., who showed that conventional BMI is inaccurate for diagnosing cirrhotic patients with fluid overload and proposed other methods such as dry-weight BMI and complete nutritional evaluation [6–8]. The Subjective Global Assessment showed that 63.33% of the patients were moderately to severely malnourished. SGA is still one of the most accepted bedside nutritional screening tools, as it combines dietary history, weight loss, gastrointestinal symptoms, functional capacity and physical examination into a simple clinical evaluation [12]. However, the present study shows that SGA identified fewer malnourished patients than TSF or HGS, indicating that objective anthropometric and functional measurements may detect nutritional impairment earlier than clinical assessment alone. Recent nutritional guidelines also support similar conclusions recommending the use of SGA together with objective measurements to optimally assess nutrition in patients with chronic liver disease [1,2].

Triceps skinfold thickness was the most sensitive index of nutritional depletion among the anthropometric measures, identifying undernutrition in more than 90% of patients. TSF reflects depletion of peripheral fat stores and is minimally affected by fluid retention compared with BMI. This result is in agreement with previous studies indicating that TSF is a reliable estimate of fat stores in the body and correlates well with disease severity in patients with liver cirrhosis [6,15]. The high prevalence of severe TSF depletion in the present study reflects severe loss of subcutaneous fat associated with chronic protein-energy malnutrition.

In the most of patients handgrip strength was also significantly decreased and gradually diminished from Child-Pugh Class A to Child-Pugh Class C. Reduced muscle strength is an early sign of sarcopenia and reflects impaired muscle protein synthesis that is associated with chronic liver disease. In previous studies, HGS has been superior to several conventional anthropometric indices in predicting hospitalization, postoperative complications and mortality [13,15-18]. Handgrip dynamometry is inexpensive, reproducible and easy to perform at the bedside and thus represents an excellent screening tool for routine clinical practice. Clinical examination revealed a high prevalence of physical signs of nutritional deficiency such as hair loss, pallor, glossitis, angular stomatitis, peripheral neuropathy and bleeding gums. These findings are consistent with deficiencies in protein, iron, zinc, folate and B-complex vitamins, which are common in chronic liver disease due to poor dietary intake, malabsorption, altered metabolism, chronic inflammation and impaired hepatic storage [1,2]. Identification of these physical signs continues to be important in clinical practice because they provide useful bedside evidence of nutritional compromise, especially in resource-poor settings.

The anthropometric findings were supported by the biochemical evaluation. The prevalence of hypoalbuminemia, anemia, lymphocytopenia, hypocholesterolemia and serum creatinine was high among the study participants, and all of them significantly worsened with increasing Child–Pugh class. Serum albumin reflects hepatic synthetic function, but persistent hypoalbuminemia also indicates severe protein-energy malnutrition. Similarly, low levels of cholesterol and creatinine are indicative of compromised liver function and progressive loss of skeletal muscle [1,2,16]. These biochemical abnormalities thus complement anthropometric evaluation and provide additional objective evidence of nutritional deterioration.

Deficiency of vitamin D was one of the most frequent micronutrient abnormalities seen in the present study and was found in 85% of patients. In chronic liver disease, the hepatic hydroxylation of vitamin D is impaired and this is often associated with reduced dietary intake, fat malabsorption and reduced sunlight exposure. Recent studies have strongly supported the association of vitamin D deficiency with advanced liver disease, sarcopenia, osteoporosis and poor clinical outcomes [1,2,15]. Routine assessment and correction of vitamin D deficiency should hence be considered as an important component of nutritional management in cirrhosis.

Interestingly, serum vitamin B12 concentrations increased with increasing Child-Pugh class. In advanced cirrhosis, high vitamin B12 levels reflect hepatocellular damage and decreased hepatic storage, rather than good nutritional status. Similar observations have been previously reported and indicate that an elevated serum vitamin B12 level should be interpreted with caution as it may be a marker of severe liver dysfunction rather than nutritional adequacy [15,16].

Another important finding of the present study was that nutritional deterioration was strongly associated with disease severity. Almost all nutritional indices (SGA, dry-weight BMI, TSF, HGS, serum albumin, cholesterol, hemoglobin, serum creatinine, and vitamin D) showed a significant deterioration from Child–Pugh Class A to Child–Pugh Class C.

These results are in agreement with previous reports showing that nutritional impairment parallels closely the progression of liver dysfunction and is an independent predictor of adverse clinical outcome [4–8]. Progressive anorexia, hypermetabolism, chronic inflammation, hormonal changes, impaired protein synthesis and recurrent infections are likely to contribute to worsening nutritional status with worsening liver disease [2, 16]. The strengths of the present study are the comprehensive evaluation of nutritional status using clinical, anthropometric, functional, biochemical and micronutrient parameters in the same cohort of patients.

This multi-dimensional assessment provides a more accurate estimation of nutritional status than studies that use only one method of assessment. But there are some limitations to be recognized. The study was performed at a single tertiary care center with a relatively small sample size limiting generalizability. Cross-sectional nature precluded evaluation of causal relationships or long-term outcomes. Advanced techniques for body composition such as computed tomography, dual-energy X-ray absorptiometry or bioelectrical impedance analysis were not available for comparison.

Overall, the present study confirms that undernutrition is a frequent and clinically relevant complication of liver cirrhosis, and that its frequency and severity increase with increasing severity of liver disease. Conventional Body Mass Index does not assess malnutrition in patients with fluid overload. Dry-weight Body Mass Index, Subjective Global Assessment, triceps skinfold thickness and handgrip strength are better measures of nutritional status. Therefore, routine comprehensive nutritional screening should be included in the standard management of patients with liver cirrhosis, to allow early intervention and improve clinical outcomes [1,2,15].

Conclusion

Undernutrition is a very common problem in cirrhotic patients and increases markedly with the severity of the disease. Conventional BMI alone does not point to malnutrition in the presence of fluid retention, but dry-weight BMI, Subjective Global Assessment, triceps skinfold thickness and handgrip strength are better indicators of nutritional status. Routine management of patients with liver cirrhosis should include comprehensive nutritional assessment to facilitate early detection and timely nutritional intervention, thus improving clinical outcomes and quality of life.

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