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Nutritional Assessment in Cirrhotic Patients Using Mini Nutritional Assessment (MNA) Proforma: A Cross-Sectional Study

Sadaf Ambreen[1*] and Sidra[1]

[1]Department of Human Nutrition and Dietetics, Women University, Mardan, Pakistan

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***Corresponding Author:**
Sadaf Ambreen
Department of Human Nutrition and Dietetics, Women University, Mardan, Pakistan
sadafambreen@wumardan.edu.pk

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ABSTRACT

Malnutrition is a significant issue in liver cirrhosis patients and has an impact on their health and life. However, it is often overlooked, as it may not be detected on a routine nutrition assessment of these patients. Any fluid build-up and metabolic changes obscure the true nutritional status, making it difficult to assess. **Objective:** To evaluate the nutritional status of liver cirrhosis patients using the Mini Nutritional Assessment (MNA) tool and explore the correlation between malnutrition and complications related to this condition. **Methods:** A cross-sectional study was conducted on 330 liver cirrhosis patients at the School of Health Sciences, University of Management and Technology, Lahore, Pakistan, from October 2022 to April 2023. The data regarding demographic data, liver cirrhosis-related factors (including ascites, portosystemic encephalopathy, and liver cirrhosis etiology), and MNA score were gathered by pre-designed questionnaires. Data were entered into SPSS version 25.0 for analysis. **Results:** The mean BMI (kg/m2) of the patients was 22.4 ± 2.8, and their mean age was 54.7±11.8 years. Patients were categorized into three groups based on their MNA scores: malnourished, at risk of malnutrition, and normal nutritional status. Interestingly, 144 (44%) of patients were malnourished, followed by 122 (37%) who were at risk of malnutrition, and 64 (19%) were well-nourished. Patients with liver cirrhosis were older, had moderate to severe ascites, variceal hemorrhage, and HBV etiology. **Conclusion:** To enhance outcomes and lower complications, the current findings highlight the need to use small nutritional assessment tools to identify malnutrition in cirrhotic patients.

INTRODUCTION

Cirrhosis is the end outcome of most chronic liver illnesses, which leads to portal hypertension and end-stage liver disease [1]. Numerous factors contribute to it, including alcohol consumption, metabolic problems, and chronic hepatitis (HCV is the most prevalent cause in developed nations) [2]. Globally, chronic liver disease (CLD) causes over 2 million deaths every year [3, 4]. The occurrence of malnutrition in liver cirrhosis is a result of a multifaceted pathophysiology. Patients suffer from impaired nutrient absorption from reduced oral intake (due to anorexia), early satiety (due to ascites), taste alteration, and dietary restrictions (due to hepatic encephalopathy), as well as fat malabsorption from bile acid deficiency, portal hypertensive gastropathy, and bacterial overgrowth in the small intestine. In addition, changes in macronutrient metabolism caused by insulin resistance, elevation of gluconeogenesis, abnormalities in the metabolism of amino acids, and increased protein catabolism lead to a catabolic state in patients. Many cirrhotic patients, especially those with alcohol related liver disease, are hypermetabolic, which further contributes to protein-energy wasting. All these metabolic abnormalities drive the progressive loss of skeletal muscle mass and function, resulting in sarcopenia and frailty. Malnutrition affects 65–90% of individuals with decompensated cirrhosis [5, 6]. Malnutrition worsens the course of liver disorders and

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raises mortality. Hepatic encephalopathy, infection, variceal hemorrhage, and refractory ascites are all common in disease-related malnourished patients [7]. Furthermore, in liver disorders, malnutrition is a predictor of death on its own [8, 9]. However, early screening, assessment, and treatment of malnutrition in cirrhotic patients is important as it helps in prevention of complications and improves disease outcomes [10]. Malnutrition in cirrhosis is a serious problem and is independently linked to both morbidity and mortality and a higher utilization of health care resources. Poor nutritional status is a significant risk factor for life-threatening complications, such as hepatic encephalopathy, spontaneous bacterial peritonitis, variceal bleeding, and refractory ascites among patients with cirrhosis. Nutrition status has been correlated with extended length of hospital stay, increased rate of readmission, and suboptimal survival rates in every study conducted. In addition, malnutrition hurts immune function and can lead to infection or sepsis. With respect to liver transplantation, it has been demonstrated that patients who are malnourished have poorer post-hepatectomy outcomes such as increased postoperative intensive care unit (ICU) length of stay, increased infection rates, and decreased overall survival. Malnutrition also restricts eligibility for transplantation at some centers, further emphasizing the importance of early detection and intensive nutritional treatment. Four screening instruments are typically used for patients at risk of malnutrition: the Mini Nutritional Assessment, the Nutrition Risk Scoring-2002 (NRS-2002), the Subjective Global Assessment (SGA), and the Malnutrition Universal Screening Tool (MUST) [10-12]. According to several studies, the Mini Nutritional Assessment (MNA) has been extensively tested for validity and reliability in both older non-cirrhotic people and cirrhotic patients [13, 14]. The MNA is an easy-to-use, non-invasive, economical, and trustworthy instrument that may be computed by non-dietetic experts with little training [15]. Mid-arm circumference and mid-arm muscular area are utilized as nutritional assessment measures to measure fat-free mass. A useful method for evaluating nutrition in cirrhotic patients was hand grip strength, which was determined using a dynamometer. The cut-off values of the MNA score (>=24 for normal nutrition, 17-23.5 at-risk, and <17 for malnourished) were applied as in the standard validated MNA classification system, which has been widely validated in older non-cirrhotic and cirrhotic patients [13, 14]. These cut-offs have been internationally agreed and are known to be the most sensitive and specific to identify malnutrition in a clinical setting [12]. Age was divided into three categories (18-40, 41-60 and >60 years) according to established clinical thresholds: 40 years to separate younger/older adults with different metabolic profiles and 60 years corresponding to the World Health Organization's definition of older age and the greater physiological decline experienced by older adults in cirrhosis, related to sarcopenia and frailty. The same age groupings were used in previous nutrition studies of cirrhosis patients [16, 17].

Although malnutrition in cirrhotic patients is common, there is a lack of studies and data coming from our area about the systematic use of the MNA as a screening tool for the evaluation of nutritional status in our population, most of them being based only on conventional anthropometric measures and reflect the effects of fluid retention. This study aims to assess the nutritional status of cirrhosis patients using the Mini Nutritional Assessment scoring system and to find out the relationship between complications of liver cirrhosis and malnutrition.

METHODS

This descriptive cross-sectional study was conducted at the School of Health Sciences, University of Management and Technology, Lahore, Pakistan, from October 2022 to April 2023. A random sample of 330 cirrhotic patients aged ≥18 years was enrolled for the study. Ethical approval for the study was obtained from the institution's Ethics Review Committee. Ethical considerations were followed as nonjudgmental conduct, respect, autonomy of the subject, and keeping their information confidential. The Helsinki Declaration ethical principles were followed by replacing the identity of the subjects with folio numbers, and this was done to ensure confidentiality; signed written informed consent was obtained from each subject who participated in the study. The sample size was calculated as $n = Z2 \times p(1-p)/d2$, where n is the sample size, Z = 1.96 (for 95% confidence level), p = 0.65 (prevalence of malnutrition among cirrhotic patients from previous studies [6]), and d = 0.05 (margin of error). The sample size was calculated using the formula $n = Z^2pq/d^2$. Anticipating a 65% prevalence of malnutrition (including those at risk) based on previous literature, and allowing for a 5% margin of error and 5% non-response, the target sample was 368. However, upon final analysis using the strict MNA cut-off (<17) for severe malnutrition, the observed prevalence was 44% (144/330). With our final sample of 330 patients, this provides a 95% confidence interval of 44% ± 5.36% (38.64% to 49.36%), which remains well within clinically acceptable limits for the primary outcome. Between October 2022 and April 2023, 330 patients suffering from cirrhosis (age ≥ 18 years) were recruited from the hepatology outpatient clinic and inpatient wards of the Department of School of Health Sciences using a systematic random sampling technique. Patients were numbered, and each k-th patient (with k equal to the total number of eligible patients divided by the desired number of patients in the sample) was chosen until the desired number of patients was selected. This probability-based sampling approach was used to ensure

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representativeness of the study population. A self-administered sociodemographic questionnaire included name, age, gender, and diagnosis of the patients. The MNA consists of 18 items that are based on four indicators of assessment: anthropometric, general, dietary, and subjective. There are two parts to the entire MNA (six screening and 12 assessment items) that can be completed in approximately 15 minutes. The MNA includes 18 items, from four domains of assessment: anthropometric, general, dietary, and subjective. The entire MNA consists of two parts: six screening items (Part 1) and 12 assessment items (Part 2) and can be administered within approximately 15 minutes. The screening part is intended to identify current mobility or cognitive issues, a decrease in body mass index (BMI), "psychological stress or acute disease," or a fall in eating or weight during the previous three months. Part 1's "screening score" may reach a maximum of 14 points. An interviewer moves on to Part 2 if the score is 11 or less, which denotes "possible malnutrition." A score of 12 to 14 shows normal nutritional status and no need for additional evaluation. In the assessment part, the quantity and frequency of particular foods and fluids, the number of full meals consumed each day, the feeding method, whether the person lives independently, and the existence of polypharmacy or pressure ulcers are all determined in Part 2. The practitioner measures the mid-arm and mid-calf circumferences after the patient reveals their nutritional and health state. The MNA score is 0–30 and divided into three groups: Normal nutrition (24-30), Severely at risk of malnutrition (score 17-23.5), Malnourished (score less than 17). BMI was computed by dividing the individual's weight in kilograms by the square of their height in meters. The Immunochromatographic Test (ICT) was used to evaluate other pertinent data, such as the reason for liver cirrhosis. To determine the surface antigens for Hepatitis B and Hepatitis C, 5cc blood was drawn from patients.

Data were analyzed using SPSS version 25.0. Data were summarized using descriptive statistics (frequencies, means, and standard deviations), and the Chi-square test was used to examine associations between categorical variables. Malnutrition was a dependent variable in binary logistic regression, where independent variables were identified. Variables with univariate significance ≤ 0.10 and clinically meaningful factors (age, gender, etiology of cirrhosis, ascites, variceal bleed, and portosystemic encephalopathy) were selected by a **forward stepwise selection approach**. The model performance was assessed using the Hosmer–Lemeshow goodness-of-fit test, classification accuracy (sensitivity and specificity), and Nagelkerke R^2. A p-value<0.050 was deemed to be statistically significant.

RESULTS

The subjects' mean age in years is 54.73 ±11.8, with an age range of 59 years, with the youngest participant at 22 and the oldest at 81. The average BMI (kg/m^2) of patients is 22.4 ± 2.8, $Z^2 \times p(1-p)/d^2$ with BMI range is 17 kg/m^2. The average MNA score of the study subjects is 19.0 ± 4.4, with an MNA score range of 17.0 (Table 1).

Table 1: Descriptive Statistics of Age, BMI, and MNA of the Study Respondents

Variables	Mean ± SD	Range	Min	Max
Age (years)	54.7 ± 11.8	59	22	81
BMI kg/m^2	22.4 ± 2.8	18	14	32
MNA	19.0 ± 4.4	17	10	27

Nutrition status of the study participants by MNA score using the pie chart. Out of 330 patients, a total of 144 (44%) were malnourished, 122 (37%) were at risk of malnutrition, and 64 (19%) were well-nourished (Figure 1).

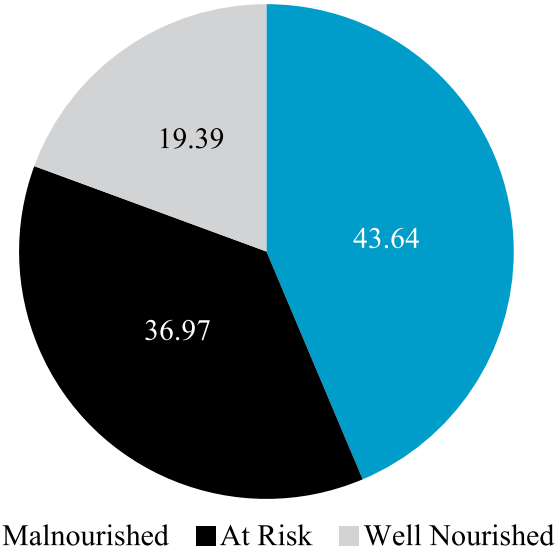

Figure 1: Nutritional Status of Cirrhotic Patients by MNA Score Age, BMI, and MNA of the Study Respondents

The study presents the correlates of malnutrition based on MNA scores. Malnutrition prevalence increased significantly with advancing age (p<0.001), rising from 20 (59%) in patients aged 18-40 years to 96 (87%) in those over 60 years. Gender did not significantly influence nutritional status (p=0.450). The etiology of liver cirrhosis showed significant disparities (p=0.008), with HBV-related cirrhosis having the highest burden of malnutrition 92 ((90%), compared to HCV-related (73%, n=120) and other causes (84%, n=54). Patients with moderate ascites (92%, n=248), history of variceal bleeding (93%, n=110), and Grade 2 Portosystemic Encephalopathy 96 (104) had significantly higher rates of malnutrition compared to those without these complications (all p<0.001). These findings demonstrate that malnutrition is not merely a reflection of poor dietary intake but is closely associated with the

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severity of portal hypertension and hepatic failure, suggesting obligatory nutritional monitoring and management in individuals with these high-risk clinical indicators(Table 2).

Table 2: Correlates of Malnutrition Based on MNA among Study Participants(n=330)

Variables	Categories	Nutrition Status (MNA < 24), Yes, n (%)	Malnutrition based on MNA, No, n (%)	Total, n (%)	p-value
Age (years)	18-40	20 (59%)	14 (41%)	34 (10.3%)	<0.001
	41-60	150 (81%)	36 (19%)	186 (56.4%)	
	> 60	96 (87%)	14 (13%)	110 (33.3%)	
Gender	Male	136 (81%)	32 (19%)	168 (50.9%)	0.450
	Female	130 (80%)	32 (20%)	162 (49.1%)	
Cause of Liver Cirrhosis	HCV	120 (73%)	44 (27%)	164 (49.7%)	0.008
	HBV	92 (90%)	10 (10%)	102 (30.9%)	
	Others	54 (84%)	10 (16%)	64 (19.4)	
Ascites	Nil	6 (18%)	28 (82%)	34 (10.3%)	<0.001
	Mild	12 (46%)	14 (54%)	26 (7.9%)	
	Moderate	248 (92%)	22 (8%)	270 (81.8%)	
Variceal Bleed	Yes	110 (93%)	8 (7%)	118 (35.8%)	<0.001
	No	156 (74%)	56 (26%)	212 (64.2)	
PSE	Nil	70 (56%)	56 (44%)	126 (38.2%)	<0.001
	Grade 1	92 (96%)	4 (4%)	96 (29.1%)	
	Grade 2	104 (96%)	4 (4%)	108 (32.7%)	

Adjustments were made in the multivariable logistic regression model for all clinically relevant variables found in the literature and from a priori considerations: gender, clinically relevant ages, cause of cirrhosis, ascites, variceal bleed, and Portosystemic Encephalopathy. This study recognizes that some residual confounding due to unmeasured factors (including disease duration, MELD/Child-Pugh scores, medications, comorbidities, and socioeconomic status) may exist. Multivariate logistic regression analysis identified ascites (OR: 0.2; 95% CI: 0.10-0.47; p<0.001) and PSE (OR: 0.3; 95% CI: 0.17-0.67; p=0.002) as significant independent predictors. Since the dependent variable was coded as 1 = Not malnourished (MNA ≥ 17) and 0 = Malnourished (MNA < 17), an odds ratio of less than 1 indicates a reduced likelihood of having a normal or at-risk nutritional status. This is equivalent to an increased likelihood of being malnourished. The inverse of these ORs shows that patients with ascites have 5.0 times higher odds (1/0.2) of being malnourished, and patients with PSE have 3.3 times higher odds (1/0.3) of being malnourished compared to those without these complications(Table 3).

Table 3: Odds Ratio of Variables for Likelihood of Malnutrition of Cirrhotic Patients

Variables	S.E.	p-value	Odds Ratio (95% CI)
Ascites	0.38	<0.001	0.2 (0.10-0.47)
PSE	0.35	0.002	0.3 (0.17-0.67)
Cause of Liver Cirrhosis	0.28	0.520	0.9 (0.53-1.55)
Variceal bleed	0.53	0.160	0.5 (0.17-1.31)
Age in categories	0.32	0.120	0.6 (0.32-1.14)

DISCUSSION

Early nutritional diagnosis and intervention to enhance the nutritional status of malnourished patients has a positive impact on prognosis, implying that it can reduce mortality in cirrhotic patients. The first and most crucial step in identifying patients with potential malnutrition is to conduct a comprehensive nutrition evaluation using the most relevant instruments to analyse their food intake and body composition, followed by appropriate nutrition intervention [16]. In the current study, the majority of malnourished patients were in their middle adulthood, or older than 40 years. The same results are reported by another study [17]. The individuals' mean age of 54.73 ± 11.93 years is consistent with results from other studies [16, 18]. Multivariable logistic regression identified ascites (OR: 0.2; 95% CI: 0.10–0.47; p<0.001) and hepatic encephalopathy (PSE) (OR: 0.3; 95% CI: 0.17–0.67; p=0.002) as independent predictors of malnutrition. The lower ORs suggest that those with these complications were much more likely to be malnourished than well-nourished. The results are in line with the results of another prospective study conducted by Pentiuk *et al.* who found that ascites and hepatic encephalopathy were the strongest independent predictors of nutritional deterioration in a group of patients with cirrhosis [19]. The current study explored a significant percentage of malnutrition identified by the MNA score, as investigations in other studies also revealed that a considerable number of patients were malnourished as assessed by the MNA score [17, 20]. According to our findings, HBV is a major cause of liver cirrhosis, However, a presented different results that HCV is the main cause of liver cirrhosis in Pakistan [21]. Multivariate logistic regression analysis identified ascites (OR: 0.2; 95% CI: 0.10-0.47; p<0.001) and PSE (OR: 0.3; 95% CI: 0.17-0.67; p=0.002) as independent predictors of malnutrition. The odds ratios less than 1 indicate that the presence of these complications is associated with significantly reduced odds of being well-nourished, effectively translating to increased risk of malnutrition. A prospective study by Pentiuk *et al.* similarly found that ascites and hepatic encephalopathy were the strongest clinical predictors of nutritional deterioration in patients with cirrhosis, independent of Model for End-stage Liver Disease (MELD) score [19]. The present study showed that malnutrition was significantly associated with patients with severe ascites, variceal bleeding, and hepatic encephalopathy, which is in line with previous studies that reported a strong association between the presence of these complications and poor nutritional status in patients with liver disease [19, 21]. In addition, ascites and hepatic

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encephalopathy were found to be important predictors of malnutrition; this is in line with other studies which have found that these complications are associated with malnutrition and poor clinical outcome in liver cirrhosis patients[22, 23].

The limitations of this study are that it includes a cross-sectional design, which prevents causal inference. Therefore, all reported associations should be interpreted as correlations rather than causal effects; the temporal sequence between complications (ascites, PSE) and nutritional decline cannot be determined from this study design. It is equally plausible that malnutrition predisposes to these complications, that complications lead to nutritional deterioration, or that both occur concurrently through shared pathophysiological mechanisms. While the sample size is robust for estimating overall malnutrition prevalence, we acknowledge that subgroup analyses involving small clinical categories (e.g., patients without ascites, n=34) should be interpreted with caution due to uneven distribution and limited statistical power for these specific comparisons. Furthermore, the recruitment of participants from a single tertiary care centre may have introduced selection bias, as these patients often present with more advanced disease and complications, potentially limiting the generalizability of our findings to patients with milder disease managed in primary or community settings. Also, the single-center setting limits the generalizability of the study. Another limitation is that this study relies on subjective MNA components that may miss sarcopenia and micronutrient deficiencies. It lacks the assessment of dietary intake and physical activity, which can cause information bias. Future research should include longitudinal studies and prospective interventional trials to evaluate the impact of MNA-guided nutritional interventions on clinical outcomes. Comparative studies assessing MNA against objective sarcopenia measures and GLIM criteria should also be done.

CONCLUSIONS

This study reveals that malnutrition is very prevalent among cirrhotic patients, affecting nearly half of the study population, with ascites and Portosystemic Encephalopathy, which are identified as independent predictors of nutritional decline. The Mini Nutritional Assessment proved to be a practical and reliable screening tool for identifying malnutrition in these patients. Our study recommends integrating routine MNA screening into standard clinical care to enable early identification of at-risk individuals and guide timely nutritional interventions, which can ultimately reduce complications and improve clinical outcomes in this vulnerable population.

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Authors' Contribution

Conceptualization: SA
Methodology: SA, S
Formal analysis: SA
Writing and Drafting: SA
Review and Editing: SA, S

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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