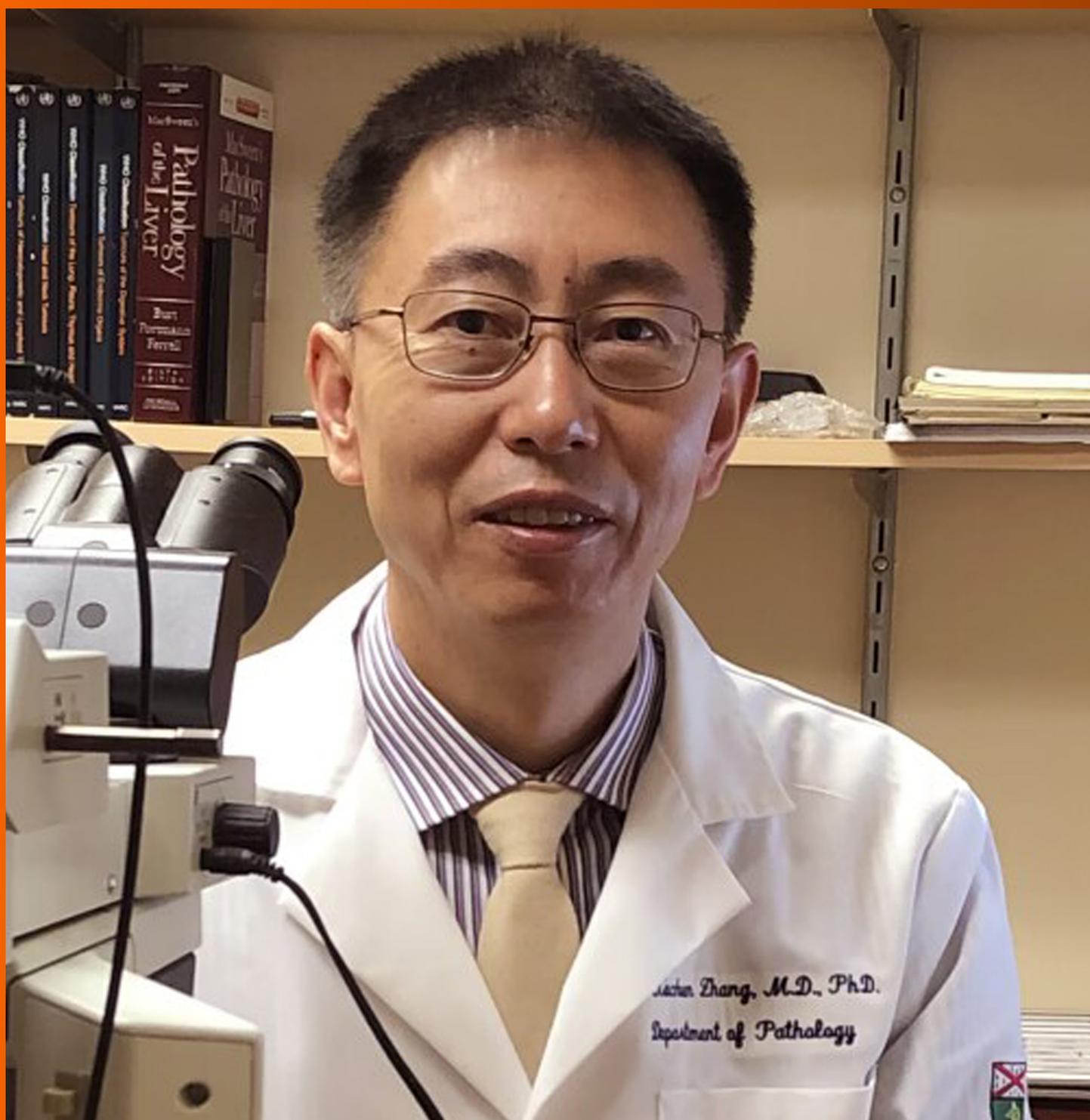


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The primary aim of *World Journal of Hepatology* (*WJH*, *World J Hepatol*) is to provide scholars and readers from various fields of hepatology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJH mainly publishes articles reporting research results and findings obtained in the field of hepatology and covering a wide range of topics including chronic cholestatic liver diseases, cirrhosis and its complications, clinical alcoholic liver disease, drug induced liver disease autoimmune, fatty liver disease, genetic and pediatric liver diseases, hepatocellular carcinoma, hepatic stellate cells and fibrosis, liver immunology, liver regeneration, hepatic surgery, liver transplantation, biliary tract pathophysiology, non-invasive markers of liver fibrosis, viral hepatitis.

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Observational Study

Evaluation of the nutritional status of patients with liver cirrhosis

Barbara Janota, Aneta Krupowicz, Kinga Noras, Ewa Janczewska

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Progressive malnutrition coexists with liver diseases, particularly in patients with cirrhosis. Early diagnosis of malnutrition in patients with advanced stages of chronic liver disease and the implementation of appropriate nutritional treatment for malnourished patients should be an integral part of the therapeutic process.

AIM

To evaluate the nutritional status of patients with various severities of advanced liver fibrosis, using various nutritional status parameters.

METHODS

This study involved 118 patients with liver cirrhosis who were classified into three groups according to their Child-Pugh score. The nutritional status of the patients in each group was assessed using different methods. The average values obtained from the measurements were calculated for each research group. The influence of disease stage on the examined parameters of nutritional status was determined using one-way analysis of variance. To investigate the relationship between the parameters determining nutritional status and the stage of disease advancement, a correlation analysis was performed.

RESULTS

The Child-Pugh A group had the highest mean body weight (76.42 kg), highest mean body mass index (BMI) (26.72 kg/m²), and largest mean arm circumference (27.64 cm). In the Child-Pugh B group, the mean scores of all examined variables were lower than those of the Child-Pugh A group, whereas the mean body weight and BMI of the Child-Pugh C group were higher than those of the Child-Pugh B group. There was a very strong correlation between the Child-Pugh classification

and subjective global assessment score; a very strong correlation between the Child-Pugh classification and arm circumference; a strong correlation between the Child-Pugh classification and body weight, albumin concentration, fat-free mass index, muscle mass index, phase angle, and BMI; and an average correlation between Child-Pugh classification and fat mass index. Notably, these indicators deteriorated with disease progression.

CONCLUSION

Advanced liver fibrosis leads to the deterioration of many nutritional status parameters. The extent of malnutrition increases with the progression of liver fibrosis. The Child-Pugh score reflects the nutritional status.

Key Words: Liver cirrhosis; Fibrosis; Nutritional status; Malnourishment; Sarcopenia

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Core Tip: Early diagnosis of malnutrition in patients with advanced stages of chronic liver disease and the implementation of appropriate nutritional treatments for malnourishment should be an integral part of the therapeutic process. It is important to properly assess the nutritional status of these patients as this can be the basis for therapeutic plans. It is advisable to determine which method of assessing nutritional status is appropriate for patients with cirrhosis since they usually develop specific complications of progressive organ failure.

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INTRODUCTION

Liver fibrosis develops in response to damaging factors with various etiologies (Table 1)[1]. It is a consequence of chronic liver disease[1,2]. Collagen deposition, scarring, and excessive accumulation of extracellular matrix elements have been observed[1]. The formation of scar tissue leads to the loss of contact between hepatocytes, blood vessels and bile ducts, resulting in the impairment of organ function[3]. Cirrhosis is the final stage of advanced fibrosis of the liver parenchyma [4]. The Global Burden of Disease estimates that cirrhosis affects 50 million adults worldwide and causes one million deaths annually[5]. The clinical advancement of the disease and risk of mortality can be assessed using the Child-Pugh scale. The scale considers ascites, hepatic encephalopathy, prothrombin time, serum bilirubin, and albumin and divides patients into three groups: (1) With good prognosis; (2) with moderate prognosis; and (3) with poor prognosis[6,7].

Chronic liver disease with advanced fibrosis and cirrhosis may be accompanied by progressive malnutrition[8]. Malnutrition is caused when the amount of food consumed is less than the required amount (hypoalimentation), often due to an incorrect understanding of the essence of the so-called “liver diet”, digestive and absorption disorders that are caused by the slowing down of digestive processes (including secretion of bile acids), metabolic disorders consisting of limited protein synthesis and increased protein catabolism, and acceleration of basic metabolic processes[9]. The complications of liver cirrhosis include hepatic encephalopathy, ascites and decreased concentrations of albumin, coagulation factors, and transport proteins[9,10]. Early diagnosis of malnutrition in patients with advanced stages of chronic liver disease and implementation of appropriate nutritional treatment for malnourished patients should be an integral part of the therapeutic process[11,12] to provide support to the patient, prevent complications, and improve treatment and prognosis[13,14].

Malnutrition is usually diagnosed by assessing the patient's nutritional status. For this purpose, anthropometric measurements and a subjective global assessment (SGA) scale (SGA of nutritional status) are commonly used[15,16]. Laboratory tests, hand grip strength measurements that enable sarcopenia identification and body composition analysis using electrical bioimpedance are carried out for a thorough analysis of the nutritional status[17-21]. Among the numerous methods of assessing nutritional status, it is important to determine which one is the most appropriate for patients with liver fibrosis given the specific complications of progressive organ failure.

This study aimed to assess the nutritional status of patients diagnosed with advanced liver fibrosis at the cirrhosis stage using various methods of nutritional status assessment. In addition, we assessed whether the Child-Pugh score correlates with patients' nutritional status and which methods of assessing nutritional status are appropriate for patients with advanced liver fibrosis.

Table 1 Causes of liver fibrosis leading to cirrhosis

Etiological factor	Diseases causing liver fibrosis
Viral infections	Chronic hepatitis B
	Chronic hepatitis D
	Chronic hepatitis C
	Chronic hepatitis E
Autoimmune	Autoimmune hepatitis
	Primary biliary cirrhosis
	Primary sclerosing cholangitis
	Autoimmune cholangitis
Metabolic	Nonalcoholic fatty liver disease
	Hemochromatosis
	Wilson's disease
	α_1 -antitrypsin deficiency
Toxic	Alcoholic liver disease
	Drugs, industrial toxins

MATERIALS AND METHODS

Description of the study group and criteria for patient inclusion

This study was conducted between May and November 2020 and included 118 Caucasian adult patients of Polish nationality who attended the ID Clinic in Mysłowice, Poland. First, informed consent was obtained to ensure voluntary participation. The following inclusion criteria were used: Liver cirrhosis based on clinical symptoms, imaging studies, and transient elastography[22] and no extrahepatic, acute, or chronic disease affecting the nutritional status. Liver cirrhosis was diagnosed by non-invasive transient elastography method using the Fibroscan® 502 Touch device, while in patients with ascites, which is a contraindication to elastography, the diagnosis was established based on clinical data, imaging, and laboratory results. The causes of cirrhosis in the study group were: Alcoholic hepatitis in 49 patients (42%), hepatitis C virus infection in 42 (36%), hepatitis B virus infection in 17 (14%), non-alcoholic steatohepatitis in 10 patients (8%). The study included 55 women and 63 men aged 37-81 years, who were classified into three groups according to the Child-Pugh scale. The Child-Pugh A group included 52 patients (Child-Pugh B: 34 patients; C: 32 patients). The mean age in each group was 58.84 years (Child-Pugh A), 56.94 years (Child-Pugh B), and 58.78 years (Child-Pugh C). The study was reviewed and approved by the Hospital Review Board. The study's planning, conduct, and reporting were in line with the tenets outlined in the Declaration of Helsinki.

Assessment of nutritional status

The nutritional status of patients in each group was assessed using the following methods: (1) Anthropometric measurements: Body weight (kg), height (cm), and body mass index (BMI) (kg/m^2), calculated according to the World Health Organization classification[23]; (2) Measurement and calculation of the circumference of the shoulder muscle [mid-arm muscle circumference (MAMC)]. $\text{MAMC} = \text{circumference of the arm in the middle of its length (mm)} - 3.14 \times \text{the thickness of the skin fold over the triceps muscle (mm)}$ [12]; and (3) Body composition analysis by the bioelectrical impedance method, using the In Body 770 device. This device has received international certifications from the International Organization for Standardization (ISO), namely ISO 9001: 2015 and ISO 13485: 2016, and medical certification from the International Electrotechnical Commission (IEC), namely EN60601-1 and IEC 60601-1-2.

The following parameters were specified: (1) Fat-free mass index (FFMI) (kg/m^2): The cut-off points for FFMI were based on the criteria for diagnosing malnutrition developed by the European Society for Clinical Nutrition and Metabolism consensus statement: < 15 for women and $< 17 \text{ kg}/\text{m}^2$ for men[24]; (2) Muscle mass index (MMI): The cutoff points for determining the MMI were established based on the standards of the measuring device[25]; (3) Fat mass index (FMI): The cutoff points for determining FMI were based on the standards of the measuring device[25]; (4) Extracellular water content (ECW) (kL): The cutoff points for determining the ECW were based on the standards of the measuring device[25]; (5) Phase angle (PA) (Xc/R)[26]: The cutoff points for determining the PA were based on the standards provided by the measuring device[22,25]; (6) Grip strength (kg) was measured using a DHD-3 SAEHAN hand dynamometer. The cutoff points for the assessment of weak muscle strength were based on European studies[27]. Grip strength values of 26-32 kg in men and 16-20 kg in women were classified as moderately strong, while those < 26 kg and < 16 kg were classified as weak grip strength[27]; (7) Laboratory albumin test results: Value of 3.5-5.0 g/dL were considered normal albumin concentrations[28]; and (8) A questionnaire survey was conducted using the SGA scale for the subjective assessment of nutritional status[29].

All measurements were taken on each patient on the same day.

Calculations and statistical analyses

Average values obtained from the analyses and measurements were calculated for each group. One-way analysis of variance was used to determine the influence of disease stage on the examined nutritional status parameters. The hypotheses were verified using an F-test for analysis of variance. The significance level of $\alpha = 0.05$ was assumed. Fisher's Least Significant Difference test was used to identify homogeneous groups. Correlation analysis was performed to examine the relationship between the parameters that determine nutritional status and the degree of disease advancement. Statistical analysis was performed using the R statistical package. To obtain transparent conclusions regarding the most appropriate methods of assessing the nutritional status of patients with liver fibrosis, the results of our research were compared with those of other recent studies.

RESULTS

Tables 2 and 3 present the results of the anthropometric measurements of body weight, BMI, and arm circumference, assigned to groups according to the Child-Pugh classification. The results were not significantly different depending on the etiology of cirrhosis.

The Child-Pugh A group had the highest mean body weight (76.42 kg), highest mean BMI (26.72 kg/m²), and largest mean arm circumference (27.64 cm). In the Child-Pugh B group, the mean scores of all examined variables were lower than those of the Child-Pugh A group, whereas the mean body weight and BMI of the Child-Pugh C group were higher than those of the Child-Pugh B group. The mean circumferences of the arm muscle were as follows: 27.64 cm (Child-Pugh A); 25.95 cm (Child-Pugh B); and 25.20 cm (Child-Pugh C).

Underweight was the most common condition in the Child-Pugh B group; this group had the highest proportion of patients with normal body weight. Overweight and obesity were predominant in the Child-Pugh A group.

Tables 4 and 5 show the results of the body composition analysis: FFMI (kg/m²), MMI (kg/m²), FMI (kg/m²), ECW (L), and PA (Xc/R) (reactance/resistance) of patients assigned to groups according to the Child-Pugh classification.

The highest mean values of FFMI, MMI, FMI, and PA were achieved by patients in the Child-Pugh A group. The mean ECW increased for each subsequent group; however, no significant differences were observed among the groups.

In all, 13.4% of the Child-Pugh A group and 64.7% of the B group had FFMI scores below the cutoff point. In the C group, almost half of the participants had scores below the cutoff. Only one person (1.9%) in the A group had MMIs below the cutoff point. In the B group, 29.4%, and in the C group, 56.2% had MMIs below the cutoff point.

Further, 42.3% of the Child-Pugh A group, 52.9% of the B group, and 59.7% of the C group had FMIs below the cutoff point; 26.9% in Child-Pugh A group, 11.7% in the B group, and 12.5% in the C had FMIs that were exceedingly higher than the cutoff point.

The prevalence of high ECW (above the standard) increased with disease progression. In the Child-A group, half of the patients had above-standard ECW, whereas 70% and over 90% of the Child-B and Child-C groups had above-standard ECW.

Further, 73% of the Child-Pugh A group, 74.6% of the B group, and 100% of the C group had suboptimal PA.

The hand grip strengths of patients in the groups according to the Child-Pugh classification are presented in Figure 1.

In the Child-Pugh A group, patients aged over 70 years had weak or medium grip strength, as expected for this age group. In the B group, men aged 60-69 years had weak grip strength. In the C group, men aged 50-59 years and women aged over 70 years had weak grip strength. Overall, hand grip strength was lower in the B group than in the A group, while the C group had the lowest grip strength.

Honestly Significant Difference Tukey's Test shows the statistically significant differences between the three groups. Significant effects of the Child-Pugh group, gender, and age on handgrip strength have been proven.

Tables 6 and 7 show the albumin concentrations of the patients according to the Child-Pugh classification. The mean serum albumin concentration in the A group was within the reference range. The mean albumin concentration was below the reference range in the B group and significantly lower than the accepted norm in the C group.

Albumin concentrations were below the reference range in 7.6% of the A group. In the B group, 79.4% of the patients had reduced albumin levels. All the participants in the C group had concentrations below the reference range.

Table 8 presents the results of the SGA scale according to the Child-Pugh classification. In the A group, the majority of patients (78.8%) were properly nourished. In the B group, 41.1% of the respondents were properly nourished, 32.3% were at risk of malnutrition, and 26.4% were malnourished. In the C group, 18.7% were properly nourished, but the majority were at risk of malnutrition (37.5%) and malnourishment (43.7%).

The percentages of patients classified as malnourished in each Child-Pugh group, based on BMI, FFMI, MMI, FMI, ECW, albumin level, and SGA scale are presented in Figure 2.

We found that as the percentage of patients classified as malnourished increased with the advancement of the disease according to the Child-Pugh classification, the indicators deteriorated, except BMI and FFMI.

Correlations between the indicators of nutritional status are presented in Figure 3. There was a strong correlation between the Child-Pugh classification and SGA score; a very strong correlation between the Child-Pugh classification and arm circumference; a strong correlation between the Child-Pugh classification and body weight, albumin concentration, FFMI, MMI, PA, and BMI; and an average correlation between the Child-Pugh classification and FMI. The indicators decreased with disease progression.

Table 2 Mean values of anthropometric measurements in groups according to Child–Pugh classification (n = 118)

Parameter	A	B	C
	n = 52	n = 34	n = 32
Body weight (kg)	76.4 ¹	64.1 ¹	68.9 ¹
BMI (kg/m ²)	26.7 ¹	21.9 ¹	23.9 ¹
Myocardial circumference (cm)	27.6 ¹	25.9 ¹	25.2 ¹

¹Mean values are significantly different at $P < 0.05$.

BMI: Body mass index.

Table 3 Nutritional status expressed by body mass index in relation to standards (n = 118)

BMI	A		B		C	
	n = 52	%	n = 34	%	n = 32	%
Underweight	2	3.8	8	24	3	9.3
Correct body weight	18	35	20	59	17	53
Overweight	21	40	6	18	11	35
Obesity	11	21	0	0	1	3.1

BMI: Body mass index.

Table 4 Mean measurement values of body composition components (n = 118) in groups according to Child–Pugh classification

Component	A	B	C
	n = 52	n = 34	n = 32
FFMI (kg/m ²)	18.5 ¹	16.6 ¹	16.6 ¹
MMI (kg/m ²)	10.1 ¹	8.8 ¹	8.55 ¹
FMI (kg/m ²)	7.9 ¹	5.25 ¹	6.7 ¹
ECW (l)	0.388 ¹	0.396 ¹	0.406 ¹
PA (Xc/R)	5 ¹	4.4 ¹	3.9 ¹

¹Mean values are significantly different at $P < 0.05$.

FFMI: Fat free mass index; MMI: Muscle mass index; FMI: Fat mass index; ECW: Extracellular water; SGA: Subjective global assessment; PA: Phase angle.

DISCUSSION

The effect of liver fibrosis on the patients is reflected by nutritional status measurements. The percentage of underweight individuals, defined by BMI, which was interpreted in our study as possible malnutrition, was higher in the Child-Pugh C group (23.5%) than in the B group (9.3%). Similarly, among 56 patients with liver cirrhosis examined by Łapiński and Łapińska[30], malnutrition determined by BMI was found in 7% of the cohort. BMI assessment is important due to its proven relationship with mortality in patients with chronic liver failure[31]. However, this indicator may not be an appropriate tool for assessing the nutritional status of patients with advanced liver disease given the fact that the body composition is not taken into account, including possible edema and ascites, which are complications of the disease[32, 33]. Fluid retention affects the BMI, resulting in malnourished patients being classified as overweight.

In our cohort, the average circumference of the arm muscle, which reflects the amount of muscle tissue and indicates the risk of sarcopenia, decreased with disease progression. This indicator (in contrast to BMI) does not change with the occurrence of edema[34]. Similar results were obtained by Crisan *et al*[34], who examined the impact of dietary behavior and nutritional status on the outcomes of 101 hospitalized patients with cirrhosis. According to them, malnutrition examined by measuring the circumference of the arm muscle was predominant among the patients with organ decompensation as opposed to those without decompensation[34]. Moreover, in a study conducted by Gnanadeepam *et al* [35], who evaluated the level of weakness in the course of cirrhosis in 81 patients with organ decompensation, arm circumference was correlated with the level of weakness coexisting with the disease.

Table 5 Nutritional status expressed by body composition results in relation to standards (n = 118)

Component		A		B		C	
		n = 52	%	n = 34	%	n = 32	%
FFMI (kg/m ²)	Below standard	7	13.4	22	64.7	15	46.8
	Standard	45	86.5	12	35.2	17	53.1
MMI (kg/m ²)	Below standard	1	1.9	10	29.4	18	56.2
	Standard	51	98	24	70.5	14	43.7
FMI (kg/m ²)	Below standard	22	42.3	18	52.9	19	59.7
	Standard	16	30.7	12	35.2	9	28.1
	Above standard	14	26.9	4	11.7	4	12.5
ECW (L)	Normal	26	50	10	29.4	3	9.3
	Above standard	20	38.4	14	41.1	7	21.8
	Much above standard	6	11.5	10	29.4	22	68.7
PA (Xc/R)	Below standard	38	73	27	74.6	32	100
	Standard	14	26.9	7	20.5	0	0

FFMI: Fat free mass index; MMI: Muscle mass index; FMI: Fat mass index; ECW: Extracellular water; SGA: Subjective global assessment; PA: Phase angle.

Table 6 Mean serum albumin values according to Child–Pugh classification (n = 118)

Factor	A	B	C
Albumin concentration (g/dL)	4.181	3.281	2.71 ¹

¹Mean values are significantly different at $P < 0.05$.

Table 7 Nutritional status expressed by the obtained results of albumin concentration in relation to the standards (n = 118)

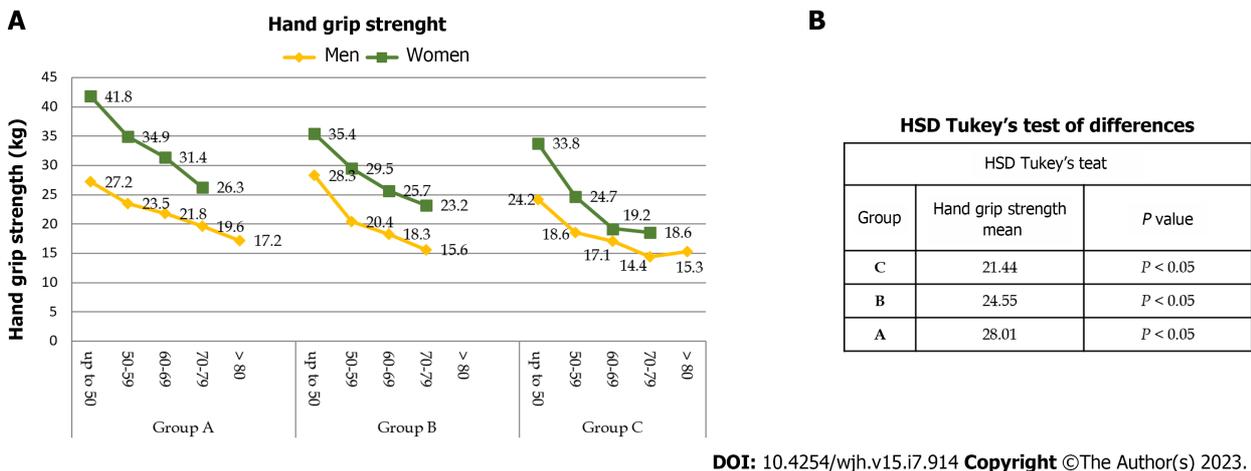
Albumin concentration (g/dL)	A		B		C	
	n	%	n	%	n	%
Below standard	4	7.6	27	79	32	100
Standard	48	92.3	7	21	0	0

Table 8 Nutritional status expressed by the results of the subjective global assessment scale (n = 118)

SGA	A		B		C	
	n = 52	%	n = 34	%	n = 32	%
Proper nutritional status	41	78.8	14	41.1	6	18.7
Risk of malnutrition	8	15.3	11	32.3	12	37.5
Malnutrition	3	5.7	9	26.4	14	43.7

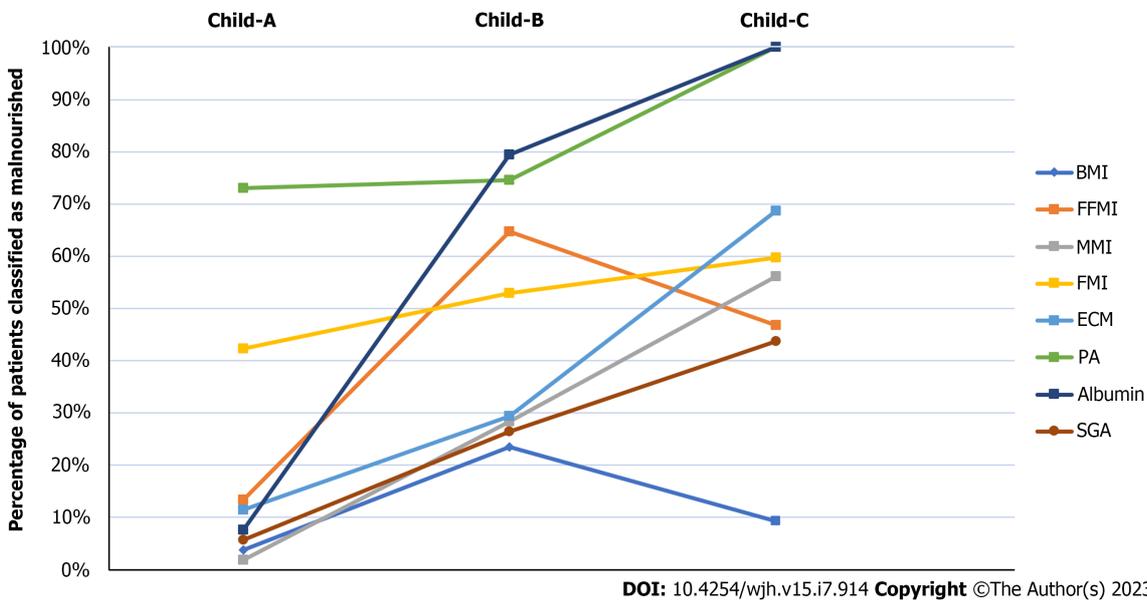
SGA: Subjective global assessment.

Body composition data indicated a decrease in the average FFMI, skeletal MMI, and PA, with an increase in disease severity and a simultaneous increase in the average ECW. Considering the coexistence of liver diseases with disturbances in the balance between the amount of intracellular and extracellular water and the tendency of water to accumulate outside the cells, the ECW index, without considering water retention in the body, can lead to incorrect estimations of the nutritional status of the patients[36]. In patients with liver diseases, when interpreting the results of body composition analysis, it is advantageous to use the PA, which indicates the ratio of the water level inside the cells to that in the



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Figure 1 Arithmetic mean of the measurement of hand grip strength expressed in kilograms, considering the Child-Pugh classification, age, and sex of the patients. Honestly Significant Difference Tukey's Test of differences ($n = 118$). A: Arithmetic mean of the measurement of hand grip strength; B: Tukey's Test of differences. HSD: Honestly Significant Difference.



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Figure 2 Percentage of patients classified as malnourished in Child-Pugh groups, based on body mass index, fat free mass index, muscle mass index, fat mass index, extracellular water, albumin concentration, and subjective global assessment score. BMI: Body mass index; FFMI: Fat free mass index; MMI: Muscle mass index; FMI: Fat mass index; ECM: Extracellular water; PA: Phase angle; SGA: Subjective global assessment.

extracellular spaces[37]. Luengpradidgun *et al*[38] also noted that among 30 patients in their study group with cirrhosis and sarcopenia, measurements based on electrical bioimpedance revealed that only six patients had co-occurring malnutrition. These data indicate the need for caution when assessing the nutritional status of this patient group.

The average hand grip strength in the study groups decreased with disease progression. This result was expected because progressive sarcopenia accompanies chronic liver inflammation that eventually leads to fibrosis[38]. Similar results were obtained by Nishikawa *et al*[39], who examined 241 patients with chronic liver disease and classified them according to Child-Pugh scores into groups A and B. Lower grip strength was observed in group B than in group A.

The blood test results indicated a decrease in the mean concentration of serum albumin levels with disease progression, as expected. The deterioration of the organs results in decreased albumin production. Previous studies have indicated the need for including albumin therapy in the treatment plan of patients with advanced liver fibrosis and cirrhosis[40,41].

We used the standardized SGA scale for assessing the nutritional status of the patients; the SGA scale is commonly used in the assessment of patients with liver diseases at risk of malnutrition[12,42]. Aldana Ledesma *et al*[42] compared various tools for assessing malnutrition and sarcopenia in patients with cirrhosis and observed the highest percentage of properly nourished patients in the Child-Pugh A and B groups. This finding is similar to the results of the present study.

When assessing the nutritional status of patients with advanced liver fibrosis, it is necessary to consider their overall condition. The correct assessment method should consider factors such as low protein synthesis, extracellular water accumulation, edema formation, and loss of muscle mass. Furthermore, the extent of hepatic fibrosis, as a result of

	Child	Body mass	SGA	Albumin	FFMI	MMI	FMI	ECW	PA	BMI	Arm muscle circumference
Child		-0.68	1.00	-0.61	-0.68	-0.62	-0.46	n.s	-0.67	-0.65	-0.87
Body mass	-0.68		-0.71	0.55	0.77	0.66	0.85	n.s	0.58	0.99	0.79
SGA	1.00	-0.71		-0.57	-0.66	-0.59	-0.45	n.s	-0.63	-0.67	-0.85
Albumin	-0.61	0.55	-0.57		0.95	0.99	0.80	0.63	0.96	0.64	0.88
FFMI	-0.68	0.77	-0.66	0.95		0.99	0.92	0.55	0.93	0.84	0.93
MMI	-0.62	0.66	-0.59	0.99	0.99		0.88	0.61	0.96	0.75	0.91
FMI	-0.46	0.85	-0.45	0.80	0.92	0.88		0.52	0.76	0.91	0.78
ECW	n.s	n.s	n.s	0.63	0.55	0.61	0.52		0.57	0.27	0.38
PA	-0.67	0.58	-0.63	0.96	0.93	0.96	0.76	0.57		0.67	0.93
BMI	-0.65	0.99	-0.67	0.64	0.84	0.75	0.91	0.27	0.67		0.82
Arm muscle circumference	-0.87	0.79	-0.85	0.88	0.93	0.91	0.78	0.38	0.93	0.82	

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Figure 3 Correlations between the analyzed indicators of nutritional status. No correlation coefficient means no significant relationship between the tested parameters ($P < 0.05$). SGA: Subjective global assessment; FFMI: Fat free mass index; MMI: Muscle mass index; FMI: Fat mass index; ECW: Extracellular water; PA: Phase angle; BMI: Body mass index.

chronic inflammation, is reflected by the nutritional status of the patients, where the greater the level of organ deterioration, the greater the decline in the nutritional status.

The strengths of our study are the extensive study methods of malnutrition measurement and statistical analysis, which allows choosing the most appropriate measurement tool in the future. Our study also has certain limitations. This study had a relatively small sample size from one medical facility; therefore, further studies with larger sample sizes are recommended to validate our findings.

CONCLUSION

Advanced liver fibrosis leads to a reduction in various nutritional status parameters. Malnutrition among patients worsens with the progression of liver fibrosis, and the level of deterioration of this organ is indicated by the Child-Pugh scores.

Owing to its multifactorial etiology and numerous related complications, the identification of malnutrition in the course of chronic liver diseases is difficult. Therefore, a comprehensive assessment method involving a combination of available clinical, anthropometric, and biochemical methods is required for this patient population. We found that serum albumin concentration, arm circumference, lean body mass, skeletal muscle mass, phase angle, hand grip strength, and SGA score were useful parameters for assessing the nutritional status of patients with liver cirrhosis.

ARTICLE HIGHLIGHTS

Research background

Chronic liver disease with advanced fibrosis and cirrhosis may be accompanied by progressive malnutrition. Early diagnosis of malnutrition in patients with advanced stages of chronic liver disease and implementation of appropriate nutritional treatment for malnourished patients should be an integral part of the therapeutic process.

Research motivation

Among the numerous methods of assessing nutritional status, it is important to determine which one is the most appropriate for patients with liver fibrosis given the specific complications of progressive organ failure.

Research objectives

The aim was to assess the nutritional status of patients diagnosed with advanced liver fibrosis at the cirrhosis stage using various methods of nutritional status assessment. We tried to find out which methods of assessing nutritional status are the most appropriate for patients with advanced liver fibrosis.

Research methods

The study group contained 88 patients with advanced liver fibrosis. Patients were classified into three groups according to the Child-Pugh scale. The nutritional status was assessed using many methods: Electrical bioimpedance method, albumin concentration, mid-arm muscle circumference, body mass index (BMI), subjective global assessment (SGA) of nutritional status scale, and hand grip strength. To draw conclusions, proper statistical analyzes were performed.

Research results

There was a strong correlation between the Child-Pugh classification and SGA score; a very strong correlation between the Child-Pugh classification and arm circumference; a strong correlation between the Child-Pugh classification and body weight, albumin concentration, fat-free mass index, muscle mass index, phase angle, and BMI; and an average correlation between the Child-Pugh classification and fat mass index. The indicators decreased with disease progression.

Research conclusions

Malnutrition among patients worsens with the progression of liver fibrosis, and the level of deterioration of this organ is indicated by the Child-Pugh scores. We found that serum albumin concentration, arm circumference, lean body mass, skeletal muscle mass, phase angle, hand grip strength, and SGA score were useful parameters for assessing the nutritional status of patients with liver cirrhosis.

Research perspectives

Another important step in the study of the nutritional status of patients with advanced liver fibrosis seems to be the analysis of patients' diets to prepare individualized recommendations, adequate to progressive malnutrition.

FOOTNOTES

Author contributions: Janota B designed research and wrote the paper; Krupowicz A collected data and wrote the paper; Noras K performed statistical analysis; Janczewska E designed research and supervised the paper.

Institutional review board statement: The study was reviewed and approved by the Hospital Review Board. Planning, conduct, and reporting of the study were in line with the tenets outlined in the Declaration of Helsinki.

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