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Research Article

IMPACT OF NUTRITIONAL SUPPLEMENTATION ON CLINICAL OUTCOME OF CHRONIC LIVER DISEASE PATIENTS

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ABSTRACT

Background: Protein calorie malnutrition (PCM) is present in chronic liver disease (CLD) patients and the degree is directly related to the severity of the disease. We carried out this study to determine the prevalence of PCM in CLD patients and to assess the impact of nutritional supplementation on the nutritional status and clinical outcome using a customized diet chart. **Methodology:** A Prospective interventional clinical study was conducted on 65 CLD patients in Shree Krishna Hospital, Karamsad, Gujarat. Socio demographic characteristics of all patients collected and nutritional status assessment was done by Modified Subjective Global assessment, Anthropometry, Hand grip dynamometer and Serum albumin. Diet was assessed by 24 hour recall and diet modification as high carbohydrate, high protein and low fat with vitamin supplementation as per recommended daily allowance was done according to customized diet chart. Patient compliance was verified telephonically once every fifteen days initially for one month and then every month for six months by 24 hour diet recall and a diet diary. Reassessment of nutritional status was done after 3 and 6 months using the same parameters. The degree of morbidity by Child Pugh score and D'Amico clinical staging of cirrhosis, mortality and frequency of hospitalization was assessed. **Results:** Prevalence of malnutrition by indices: Body Mass Index-16.92 %, Mid Arm Circumference - 67.69%, modified Subjective Global Assessment (SGA) -80%, Serum albumin -87.69 %, Mid Arm Muscle Circumference (MAMC)-96.92%, Triceps Skin Fold Thickness and Hand Grip strength -100%. There was a statistically significant correlation ($p<0.001$) between reduction of CLD severity as assessed by CPS and D' Amico staging and increasing concentration of serum albumin after nutritional supplementation. There was also a statistically significant improvement in nutritional status as evidenced by an increase in BMI from 21.75 to 22.04 kg/m2 ($p=0.016$), increase in serum albumin from 2.42 to 2.59 mg/dl (value -0.008) and improvement in modified SGA grading ($p=0.03$). There was a significant decrease in the CLD severity score CPS (mean +SD 9.11+2.24 to 8.71+_2.27; before and after nutritional intervention respectively) and improvement in staging by D'Amico (from stage 3 to stage 1 patients by 19.14%) after nutritional supplementation. There was a significant decrease in number of hospitalizations with mortality of 1.67%. **Conclusion:** Malnutrition in CLD patients improved significantly after nutritional supplementation as seen by improvement in BMI and modified SGA. There was a statistically significant improvement in the severity of CLD accompanied by a decrease in frequency of hospitalization and lower mortality rate upon nutritional supplementation.

INTRODUCTION

Protein-calorie malnutrition (PCM) is common to all stages of chronic liver disease (CLD) and may be present in 65–90% of patients with advanced disease. Irrespective of the etiology of CLD, malnourishment usually develops at an early stage of the disease, the degree of malnutrition being directly related to the severity of liver disease, leading to poor prognosis of patients. [1]

Poor food intake, malabsorption, increased intestinal protein loss, decreased protein synthesis and hyper-metabolism are common causes of PCM. Malnutrition is an independent risk factor for predicting clinical outcomes in CLD patients who are prone to develop life threatening complications such as refractory ascites, spontaneous bacterial peritonitis, hepato-renal syndrome, variceal hemorrhage, post-transplant mortality and increased postoperative complications and mortality. [2]

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Assessment of nutritional status and supplementation with nutrient reduce the risk of complications and to improve the overall morbidity and mortality in CLD. An energy content of 35–40 kcal/kg/day with carbohydrates and lipids making up to 50–60% and 25-30% of total daily calories respectively has been recommended for these patients. In earlier years, restriction of intake of proteins was practiced in patients with liver disease in order to avoid the after effects of excessive ammonia production on the development of hepatic encephalopathy. However, patients with compensated cirrhosis are now advised to take 1.2–1.5 g of protein/kg/day with caution to be observed in cases of severe hepatic encephalopathy unresponsive to supportive measures. Personalization of diet with regulation of intake of protein, sodium and micronutrients may be required in some CLD patients. [3]

Hence, screening of all CLD patients for PCM can identify those at risk of depletion of nutrition and developing complications. There is no consensus about the best method for quantification and classification of malnutrition. Probably the best approach recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN), involves the use of multipara-metric tests. [4]

In the present study, we assessed the nutritional status of CLD patients followed by diet modification with customized nutritional regimen, and evaluation of its impact on clinical outcome, morbidity and mortality at regular follow up using Child Pugh score (CPS) and D'Amico clinical staging of cirrhosis.[5][6][7]

MATERIALS AND METHODS

This interventional clinical study was conducted on 65-treatment naïve CLD patients registered as either outpatient or inpatient in the department of Medicine, Shree Krishna Hospital, Karamsad, Gujarat. The study design was explained to the patients and written informed consent was taken from all those who were willing to participate in it.

Inclusion criteria: Patients with CLD above the age of 18 years and who were willing to participate in the study.
Exclusion criteria: CLD patients with malignancy / AIDS / Other co morbidities like tuberculosis, end stage renal disease, chronic congestive heart failure, respiratory failure, sepsis were excluded from the study.

Socio-demographic data was collected for all the patients. Nutritional assessment was done by assessing the following: modified Subjective Global Assessment (SGA), Anthropometric measurements, Hand-grip dynamometer and Serum albumin. Patient's diet was assessed by twenty four hour food recall and diet modified by a customized diet chart prepared for each patient. Patient compliance to the customized diet was verified by a telephonic interview and was also followed up by a physician's assessment once a fortnight, initially, for the first month and subsequently once a month for the next six months. A personalized diet diary was maintained by the physician for each patient on each follow up. Patient's nutritional status was reassessed at the end of three and six months using the same parameters as were used before intervention and the prevalence of PCM was determined. The degree of morbidity, mortality and frequency of hospitalization during the study period was assessed using the CPS and D'Amico clinical staging of cirrhosis.

Diet included frequent small feedings in day and carbohydrate rich bedtime snack. Energy content 25-40kcal/kg/day, protein 1.5g/kg/day , carbohydrates 45-65% of total calories, fat 25-30% of total calories and micronutrients and vitamins up to RDA (recommended daily allowance). Malnutrition as per various criteria is 1) BMI<18.4kg/mt 2 , 2) MAC-Male <26.4cm and Female<25.7cm, 3) TSFT-Male <12.5mm and Female <16.5mm, 4) MAMC-Male <25.3 cm and Female <23.2cm, 5) HGS- Male <26kg and Female <18 kg , 6) Serum Albumin<3.5g/dl

Statistical analysis used: Descriptive statistics [Frequency (%), Mean (SD)] and Pearson correlation coefficient. Anthropometric parameters and CLD severity parameters CPS and D'Amico staging data was compared at 0 month and 6 months by using Paired 't' test, Descriptive statistics [Frequency (%), Mean (SD)] and Pearson correlation coefficient. For Modified SGA parameter, Stuart Maxwell test was used, for frequency of hospitalization, Mean with SD was used.

RESULTS

The male to female ratio was 53:12 (82:18%). The mean age of patients was 50.18+10.16 years and ranged from 30 to 82 years. The breakup of etiology of CLD is depicted in Table 4. Briefly, majority (63.08%) of the patients had alcoholic liver disease, and viral infections were the cause of CLD (~22 %). The percentage of malnutrition at start of study as per various parameters is as follows: Body mass index-16.92 %, Mid arm circumference (MAC) -67.69%, modified SGA -80%, serum albumin -87.69 %, Mid arm muscle circumference (MAMC) 96.92%, Triceps skin fold thickness (TSFT) and Hand grip strength (HGS) -100% [Table 1].

Table 1 Percentage of Malnutrition as Per Anthropometric and Laboratory Parameters.

PARAMETERS	PERCENTAGE OF MALNUTRITION
BMI	16.92
MAC	67.69
SGA	80
S.ALBUMIN	87.69
MAMC	96.92
TSFT	100
HGS	100

Table 2 Comparison of antropometric parameter and laboratory parameter over a period of 6 months

VARIABLE	BASELINE [0MONTH] MEAN(SD) N=60	6 MONTH MEAN(SD) N=60	P-VALUE
BMI	21.75(3.66)	22.04(3.64)	0.017
TSFT	10.70(1.12)	10.51(1.14)	0.045
MAC	25.09(1.98)	24.78(2.22)	0.004
MAMC	21.68(1.94)	21.48(2.10)	0.018
HGS	6.49(0.81)	6.39(0.79)	0.049
SERUM ALBUMIN	2.42(0.69)	2.59(0.70)	0.008

There was statistically significant change in BMI over a period of 6 months from a mean of 21.75 to 22.04 kg/m2 (p=0.016). There was a significant difference in Serum albumin (SA) (p

value- 0.008) over time (Table 2). After nutritional supplementation, out of 13 patients in SGA –A at zero months, 12 remained in SGA-A and 1 changed to SGA-B at 6 months. Out of 52 patients in SGA-B at zero months, 39 remained in SGA-B, 3 changed to SGA-A and 5 changed to SGA-C at six months and 5 were drop outs. Hence overall, there was an increase in number of patients in SGA-A from 20% to 25%, a decrease in SGA-B patients from 80% to 66.67% and an increase in SGA-C patients to 8.33% (Stuart Maxwell test, p value -0.03). [Table 3, 4].

According to modified SGA grade for malnutrition, at 0 months, in SGA- B group, there were 31 patients (65.95%) with chronic alcoholic liver disease, 8 patients (17.02%) with chronic hepatitis B, 4 (7.69%) with cryptogenic, 1 (2.12%)

Table 3 Sga Comparison Over 6 Months

	SGA A	**SGA B**	**SGA C**
0 MONTHS	12 (20%)	48(80%)	0
3 MONTHS	14(24.19%)	44(74.19%)	1(1.6%)
6 MONTHS	15(25%)	40(66.67%)	5(8.3%)

Table 4 comparison of modified sga over 6 months

	CHI2	**DF**	**PROB>CHI2**
SYMMETRY (ASYMPTOTIC)	**6.00**	**2**	**0.0498**
MARGINAL HOMOGENEITY (STUART-MAXWELL)	**6.00**	**2**	**0.0498**

Symmetry (exact significance probability) 0.0391

with chronic hepatitis C , chronic hepatitis B and C, Nonalcoholic SteatoHepatititis and Primary Biliary Cirrhosis, and no patients in SGA C category. Over a period of 6 months, the number of patients in SGA-B category with chronic alcoholic liver disease decreased from 31 to 27 (p=0.04) with a corresponding increase in the SGA-C category by 4[Table 5].

remained in CPS-C and 8 became CPS-B at six months. So there was improvement in CPS-B to CPS-A grade patients by 37.5 % and from grade C to CPS-B by 30.7%. After nutritional supplementation over a period of six months of study, there was a significant decrease in mean value of CPS 9.11 to 8.71 [Table 6].

Table 6 CPS comparison over 6 months

	CPS A	CPS B	CPS C
0 MONTHS	10	24	26
6 MONTHS	16	22	22

Table 7 SDA comparison over 6 months

SDA	**STAGE 1**	**STAGE 2**	**STAGE 3**	**STAGE 4**
0 MONTH	4	4	47	5
6 MONTHS	12	8	40	0

At zero months, 4 (6 %) patients were in D'Amico clinical staging of cirrhosis (SDA) Stage 1, 4(.6 %) in Stage 2, 47 (78.3%) in stage 3 and 5 (8.33 %) in Stage 4 of SDA. At six months 12 (20 %) patients were classified in Stage 1, 8 (13.3 %) in Stage 2, 40 (66.66%) in stage 3 and 0 in Stage 4. Out of 47 patients in SDA-3 at zero months, 38 remained in SDA-3, 9 became SDA-1. So there was improvement in SDA -3 stage patients to SDA -1 by 19.14%. There is increase in number of patients in Stage A to 20% , decrease in no of patients in Stage 3 by 15% and 100% decrease in Stage 4 over 6 months after nutritional supplementation [Table 7].

There was no significant correlation between anthropometric parameters of malnutrition with SDA and CPS. But there was a significant negative correlation found between serum albumin with CPS and SDA [Tables 8 and 9].

Comparing frequency of admission before the study and during the period of study, it was found that there was a significant decrease in the frequencies of hospitalizations after intervention

Table 5 percentage of etiology of CLD as per SGA

	SGA-0 MONTHS			**SGA -6 MONTHS**		
CAUSE OF CLD	A	B	C	A	B	C
ALCHOLIC LIVER DISEASE	7 (53.85%)	31 (65.95%)	0	7 (46.67)	27(67.5)	4(80)
CHRONIC HEPATITIS B	1(7.69%)	8(17.02%)	0	2(13.33)	7(17.5)	0
CHRONIC HEPATITIS C	2(15.38%)	1(2.12)	0	2(13.33)	0	1(20)
CHRONIC HEPATITIS B+C	0	1(2.12)	0	1(6.65)	0	0
CRYPTOGENIC	1(7.69%)	4(8.51)	0	1(6.65)	4(10)	0
NASH	2(15.38%)	1(2.12)	0	2(13.33)	1(2.5)	0
PBC	0	1(2.12)	0	0	1(2.5)	0
TOTAL	13	47	0	15	40	5

At zero months, 10(23.08%) patients were classified to belong to Child Pugh score (CPS)-A, 24 (36.9%) to CPS- B and 26 (40%) to CPS –C. At six months, 16 (26.67 %) patients were grouped into CPS-A, 22 (36.67 %) into CPS-B and 22 (36.67%) into CPS-C. So, out of 10 patients in CPS –A at 0 month, 7 remained in CPS-A and 3 changed to CPS-B at 6 months. Out of 24 patients in CPS-B at zero month, 11 remained in CPS-B, 9 became CPS-A and 4 changed to CPS-C at six months. Out of 26 patients in CPS-C at 0 month, 18

with nutritional supplementation. While in the prestudy period, 36 patients were admitted once, after nutritional intervention, six patients had no admissions, 29 of them had one time admission, and one patient had two admissions. Of the 17 patients who had two admissions in the pre study period, in 10 patients, it got reduced to one admission and seven of them continued to have two admissions during nutritional intervention. In six patients who had three admissions during

pre study, only three of them continued to have three admissions, two had two admissions and one had one time admission during study period. One patient with four admissions during pre-recruitment period of the study had a reduced frequency to two admissions after nutritional supplementation. Hence we conclude that nutritional support helped in reducing the frequency of admission in CLD patients (p<0.001). [Table 10][Table 11]. In support was our finding of a statistically significant negative correlation between serum albumin values and frequency of hospitalization. This meant that an association between the concentration of serum albumin and a decrease in frequency of hospitalization was observed during the 6 months of study period (p value <0.001, r value 0.052) [Table 12].

Table 8 Correlation between Nutrional Parameters and Chronic Liver Disease Severity Score- Cps

	CPS	
BMI	**R VALUE**	**P VALUE**
0 MONTHS	0.1989	0.1122
3 MONTHS	0.0493	0.7038
6 MONTHS	0.0625	0.6354
TSFT		
0 MONTHS	0.0654	0.6046
3 MONTHS	-0.1222	0.3440
6 MONTHS	-0.2436	0.0607
MAC		
0 MONTHS	-0.0402	0.7508
3 MONTHS	-0.1818	-0.1574
6 MONTHS	-0.3250	0.0113
MAMC		
0 MONTHS	-0.0798	0.5276
3 MONTHS	-0.1634	0.2044
6 MONTHS	-0.2993	0.0202
HGS		
0 MONTHS	-0.0987	0.4341
3 MONTHS	-0.1634	0.2044
6 MONTHS	-0.1111	0.3981
S.ALBUMIN		
0 MONTHS	-0.7494	<0.001
3 MONTHS	-0.7933	<0.001
6 MONTHS	-0.8211	<0.001
TSFT		
0 MONTHS	0.1950	0.1195
3 MONTHS	-0.0556	0.6678
6 MONTHS	-0.2150	0.0990
MAC		
0 MONTHS	0.3833	0.0016
3 MONTHS	-0.0493	0.7037
6 MONTHS	-0.2759	0.0328
MAMC		
0 MONTHS	0.3128	0.0112
3 MONTHS	-0.0489	0.7058
6 MONTHS	-0.2455	0.0587
HGS		
0 MONTHS	-0.2529	0.0421
3 MONTHS	-0.0923	0.4756
6 MONTHS	-0.0747	0.5702
S.ALBUMIN		
0 MONTHS	-0.1913	0.1269
3 MONTHS	-0.5082	<0.001
6 MONTHS	-0.5509	<0.001

Table 10 Frequency of hospitalisation –before and during study period of 6 months

NO OF HOSPITALISATION DURING 6 MONTHS OF PRESTUDY	NO OF HOSPITALISATION DURING 6 MONTHS OF STUDY				
	0	1	2	3	TOTAL
1	6	29	1	0	36
2	0	10	7	0	17
3	0	1	2	3	6
4	0	0	1	0	1
TOTAL	6	40	11	3	60

DISCUSSION

We found that majority of subjects had alcoholic liver disease (63.08%) followed by chronic hepatitis B (15.38%). In contrast Khalil et al. had reported HCV infection as the major cause of cirrhosis (61.7%).

TABLE 11: Number of hospitalization over 6 months

VARIABLE	BASELINE MEAN(SD)	BASELINE MEDIAN(IQR)	END LINE MEAN(SD)	ENDLINE MEDIAN(IQR)	P-VALUE
NO OF HOSPITALIZATION	1.53(0.74)	1[1,2]	1.18(0.67)	1[1,1]	<0.001

T**able 12** Correlations between Frequency of Hospitalisation And S. Albumin

CORRELATION BETWEEN FREQUENCY OF HOSPITAILISATION AND S.ALBUMIN	S. ALBUMIN	
HOSPITALIZATION DURING STUDY	R VALUE	P VALUE
	-0.52	< 0.001

Table 9 Correlation Between Nutrional Parameters And Chronic Liver Disease Severity Score- SDA

	SDA	
BMI	**R VALUE**	**P VALUE**
0 MONTHS	0.1906	0.1284
3 MONTHS	-0.0134	0.9178
6 MONTHS	0.0347	0.7923

in patient with cirrhosis (41.6%) followed by alcoholic liver disease (33%), cryptogenic cirrhosis (19.4%) and autoimmune liver disease (0.05%).[9] In the study by Putadechakum et al., the most common etiology of patient's cirrhosis was alcoholic liver disease (63.6%)[6] whereas Monsef et al., found viral hepatitis (65%) to be the most common cause of liver cirrhosis.[8] Results are similar to article written by Heidelbaugh et al.[10] and National Vital Statistics Report on

Chronic liver disease/cirrhosis in which majority of cases had alcoholic cirrhosis of liver.

Prevalence of malnutrition according to various nutritional parameters in this study: BMI-16.92 %, MAC-67.69%, SGA - 80%, Serum albumin -87.69 %, MAMC-96.92%, TSFT and HGS-100%. So it's difficult to diagnose the nutritional status of these patients, because the prevalence of malnutrition ranged from 16.9% (by BMI) to 100% (by TSFT and HGS) according to the different methods used. There was low agreement in results obtained by different methods. So for determination of prevalence of malnutrition multiple parameter approach was needed. These results are consistent with findings of study by Monsef et al. in which prevalence of malnutrition by BMI was 7% and 100% by SGA and TSFT respectively. [8]

SGA is clinical method of malnutrition evaluation that determines the degree of malnutrition based on changes in weight ,change in dietary intake, the presence of GI symptoms (nausea/vomiting/diarrhea), patient's functional capacity, as well as physical assessment of subcutaneous fat, muscle wasting, edema, and ascites. It is the only screening tool for malnutrition recommended by the American Society for Parenteral and Enteral Nutrition (ASPEN). It is simple and cost effective. However requires a trained professional, especially to perform the physical assessment accurately. But in study by Detsky, multivariate analysis showed that SGA ratings were most affected by loss of subcutaneous tissue, muscle wasting, and weight loss. A high degree of interobserver agreement was found (kappa = 0.78%, 95% confidence interval 0.624 to 0.944, $p < 0.001$) which concluded that SGA can easily be taught to a variety of clinicians and easily reproducible. [11]

There are no reports on the use of SGA for malnutrition screening from India. Modified subjective global assessment designed by Shirodkar M, Mohandas KM is used for Indian population as large proportion of Indian patients are unable to recall their body weight to calculate the percentage weight loss so change in weight is considered.[12]

In this study, prevalence of malnutrition by SGA parameter was 80%. In study by Ciocîrlan et al. 66% of patients were malnourished by SGA criteria (SGA B or C), and in another similar study by Alvares-da-Silva et al. 28% patients were malnourished by SGA.[13], [14]In study by Fernades et al., through SGA, 20.2% of the patients were classified as malnourished[15]. Naveau et al. found that SGA had a sensitivity of 22% in patients with liver cirrhosis for detection of malnutrition and underestimated the nutritional status in 57% of patients and overestimated it in 6% of study population. [16]

In this study there was increase in patients in SGA-A from 20% to 25% over period of six months. There was decrease in SGA-B patients from 80% to 66.67% and increase in SGA-C patients to 8.33% .This study results were consistent with study done by Putadechakum et al which showed a significant improvement in the SGA class A from 10 patients (45.5%) to 16 (72.7%) and 18 (81.8%) at the 4th and 8th weeks, respectively. Patients in the SGA class B significantly decreased from 11 patients (50.0%) to 5 (22.7%) at the 4th and 8th weeks, respectively. [6] Roongpisunthinpong et al. reported that SGA compared to standard anthropometry correlates well with liver disease severity, thus indicating the usefulness of SGA in patients with chronic liver disease. [16]

Although anthropometric tools such as the MAMC and hand grip strength are known to be better predictors of malnutrition in adult patients with cirrhosis, these tools are not necessarily practical for everyday use. The SGA, compared to standard anthropometry, is much more applicable in clinical practice and has previously been demonstrated to be highly predictive of malnutrition in advanced cirrhosis .We demonstrated in this study that SGA grade C subjects with cirrhosis had significantly lower anthropometric measurements compared to SGA grade B cases, indicating that the SGA was able to differentiate nutritional status fairly well.

The lowest rates of malnutrition among all tools used was diagnosed by BMI (16.9% which is consistent with results of study by Monsef et al. (7%) and Fernandes et al (5.4 %).[8][15] The identification of a smaller numbers of patients with diagnosis of malnutrition by the use of this method compared with other methods utilized, is possibly related to the hydropic retention associated with hepatic insufficiency, which hampers and/or impedes the identification of weight loss despite a real reduction of body tissue.

In this study, prevalence of malnutrition was 100% by TSFT which is consistent with findings with study by Monsef et al. In review article on Nutrition in liver cirrhosis by Nardi et al. stated that, skin fold anthropometry is considered a useful technique for assessment of body composition in patients with chronic liver disease. It is of value in detecting mild or moderate signs of malnutrition, which are difficult to recognize clinically. [18] In cross sectional study by Caregaro et al. stated that, because of limitations of other nutritional indexes, skin fold anthropometry represents-at present-the most reliable clinical measure of nutritional status in patients with chronic liver disease. [19]

In study by Teiusanu et al., a descriptive prospective analysis of patients with cirrhosis, the nutritional status determined by using combination of BMI , TSFT and MAMC showed that Triceps skin fold thickness and mid-arm circumference decreased significantly according to the Child Pugh score and thus a positive correlation was found between these two parameters and the severity of cirrhosis.[20]

In this study prevalence of malnutrition was 100 % by HGS parameter which is consistent with study by Monsef et al. which stated 90% malnutrition by HGS. [8]In study by Fernandes et al. highest proportion of malnourished patients was detected by HGS, with 69.3% of the cases. [15] In study by Alvares-da-Silva et al, among patients with cirrhosis, 88% were Child-Pugh A and only 12% were Child-Pugh B. Among these, prevalence of malnutrition was 28% by SGA, 18.7% by PNI (Prognostic nutritional Index), and 63% by HG ($P< 0.05$). HG, but not SGA or PNI, predicted a poorer clinical outcome in patients with cirrhosis because major complications such as uncontrolled ascites, hepatic encephalopathy, spontaneous bacterial peritonitis, and hepatorenal syndrome developed in 65.5% of malnourished patients versus 11.8% of well-nourished ones ($P< 0.05$). [13]

Currently, The European Working Group on Sarcopenia in Older People (EWGSOP) recommends measurement of handgrip strength as a practical measure of muscle strength. [19] Our study suggested that there was no statistical significant correlation between liver severity by Child Pugh score and HGS which is consistent with study by Fernades et al [15] and

not consistent with findings of Piquet et al. and Gaikwad et al.[21][22]

In study by Fernandes et al., HGS does not present statistically significant relation with the Child-Pugh classification as highest percentage of malnourished patients (93.2%), classified through HGS as Child A and B, and only 6.8% as Child C, reinforcing the non-relation with Child-Pugh. [15]

In study by Piquet et al. showed best relation of HGS with the nutritional status progress of the cirrhotic patient, as in the study, 89% of the malnourished patients were classified as Child-Pugh B and C. [21] In study by Gaikwad et al., 80 Patients with alcoholic liver disease were included and nutritional assessment was done using the Subjective Global Assessment (SGA), HGD and other conventional parameters. Mortality rates and complications were compared to nutritional status. Results showed correlation between HGS and Child-Pugh score in predicting short term mortality. [22]
In this study, prevalence of malnutrition by MAC and MAMC was 67.6 % and 96.92% which is consistent with results of study by Tai et al. [5]

In this study, there was no statistically significant correlation between MAMC, MAC and liver disease severity by CPS or D'Amico staging. In study by Ciocîrlan et al. there was no correlation between MAMC and the severity of liver disease. Possible explanation was 31% of patients were Child-Pugh C and 75% had ascites. Fluid overload with ascites and peripheral edema which may lead to overestimation of nutritional status by MAMC and lack of correlation with disease severity.[14]Study by Teiusanu et al., showed positive correlation between TSFT, MAMC with liver disease severity by CPS.[20]

The use of biochemical tests for nutritional assessment in individuals with liver disease is questioned, because it may represent liver dysfunction and does not necessarily represent changes in nutritional status .Albumin, prealbumin, and other hepatic proteins such as transferrin are negative acute-phase proteins so decrease in response to infection/inflammation, injury, or trauma. This decrease in albumin and prealbumin levels occurs regardless of the patient's nutrition status and the levels increase again only when the stressor on the body is removed. [22] Piquet et al. found that the decrease in albumin in patients with cirrhosis is related to liver function and not to nutritional indices. [21]

In our study prevalence of malnutrition by albumin parameter was 87.6% .There was correlation between liver severity by CPS and D' Amico et al staging and serum albumin. The findings are not consistent with study by Khalil et al. [9] In this study according to SGA grade for malnutrition at zero month, in SGA- B 65.35% patients with chronic alcoholic liver disease with no patients in SGA-C category. After nutritional supplementation of 6 months, patients in SGA-B category with alcoholic liver disease decreased significantly by 20.58% with increase in patients with alcoholic liver disease in SGA-C by 4%.Differences in malnutrition between various etiologies of cirrhosis were explored in this study. The frequency of malnutrition in alcohol-related cirrhosis was higher than other etiologies and the SGA demonstrated a trend towards more severe malnutrition in adults with alcoholic cirrhosis compared to other types of cirrhosis. This is consistent with study results by Tai et al. [5]

There was statistically significant change in value of BMI over period of six months from 21.75 to 22.04 kg/m2 and serum albumin from 2.49 to 2.52mg/dl. There was no significant change in values of MAC, MAMC, TSFT, and HGS. In study by Putadechakum et al.BMI was increased from 21.4 to 21.9 kg/m2. No significant change in other nutritional parameters such as fat mass, Triceps skin fold thickness, albumin, and prealbumin was observed. The results of present study revealed that, the severity of liver cirrhosis was classified according to Child Pugh class more in class B and C. This finding agrees with Tai et al.who reported that; all patients had advanced liver disease with 16 (44.4%) cases of Child-Pugh B and 20 (55.6%) cases of Child-Pugh C cirrhosis and this result also agrees with Zuberi BF et al.who reported that out of 109 patients, Child class A, B & C has 30, 38 & 41 patients respectively.[23]

After nutritional supplementation over period of six months of study, there was significant decrease in chronic liver disease severity as shown by significant decrease in mean value of CPS 9.11 to 8.71 which is consistent with finding with study by Marchesini et al., CPS improved significantly from 9.1 to 7.9 (*P* - 0.0001).[24] In this study , as per staging by D Amico at zero months, 8(12.3 %) patients were in Stage 1 , 5 (7.69 %) in Stage 2, 47 (73.84%) in stage 3 and 5 (7.69 %) in Stage 4 .There was improvement in disease severity over period of six months as there was increase in number of patients in Stage A by 1.5% , decrease in no of patients in Stage 3 by 15% and 100% decrease in Stage 4. In this study, there was no significant correlation between anthropometric parameters of malnutrition with SDA and CPS. But there was significant negative correlation found between serum albumin with CPS and SDA.

Comparing frequency of admission before study and during period of study, it was found that frequency of admission had reduced significantly during study. As per study by Marchesini G et al., there was no significant decrease in hospital admission rate after enteral BCAA supplementation in patients with advanced cirrhosis. [24]

During six months period of this study percentage of mortality was 1.67% and percentage of drop outs was 7.69% compared to study by Marchesini G et al., in which 15 % patients (9 out of 59 patients) were lost to follow up due to noncompliance because of non-palatability of BCAA products.[24]

CONCLUSION

Majority patients of chronic liver disease in this study were males(81.5%)and majority of them were in age group between 50-60 years (48%) and <50 years (43%).Majority of patients (68%) were residing in rural area. There were 52.3 % patients employed and 3.78% unemployed. There were 23.08% patients graduates, 23.29% had primary education, 36.9% had secondary education and only 10.7% were illiterate. Most common cause of cause of chronic liver disease was alcoholic liver disease (63.08%) followed by chronic hepatitis B (15.38%). The diagnosis of malnutrition can be challenging in the early stages of cirrhosis. Although there is no consensus about the best method for quantification of malnutrition, probably, the best approach involves the use of multiparameter data, using the SGA scale, anthropometry, and hand grip strength and laboratory parameter in the initial assessment in order to identify the patients at risk of malnutrition. Prevalence of malnutrition according to various nutritional parameters in this study: BMI-16.92 %, MAC-67.69%, SGA -80%, Serum

albumin -87.69 %, MAMC-96.92%, TSFT and HGS-100%. SGA grade C subjects with cirrhosis had significantly lower anthropometric measurements compared to SGA grade B cases, indicating that the SGA was able to differentiate nutritional status fairly well. There was overall improvement in nutritional status according to SGA and BMI. There is statistically significant change in value of BMI over period of 6 months from 21.75 to 22.04 kg/m^2 (p value -0.017) and serum albumin from 2.42 to 2.59mg/dl (p value -0.008).. There is no significant change in values of MAC, MAMC, TSFT and HGS. There was statistically significant negative correlation between chronic liver disease severity by CPS and D' Amico et al staging and serum albumin (p value-<0.001) There is no significant correlation between anthropometric parameters of malnutrition with SDA and CPS.

In this study according to SGA, malnutrition was more common in chronic alcoholic liver disease. During study period of 6 months patients in SGA-B category with alcoholic liver disease decreased from 31 to 27 by 12.9 %. There was decrease in chronic liver disease severity as shown by decrease in mean value of CPS (9.11 to 8.71) and also improvement in staging by D Amico after nutritional supplementation as shown by improvement in patients from stage 3 to stage 1 patients by 19.14%. There was significant decrease in number of hospitalization during six months period of this study (p value -<0.001) with percentage of mortality 1.67% and percentage of drop out 7.69%. There was statistically significant negative correlation between serum albumin values and frequency of hospitalization which means as value of serum albumin improved there was decrease in frequency of hospitalization during six months of study.(p value-<0.001)

Therefore high protein with BCAA rich, high carbohydrate and low fat diet , with frequent small meals and late night protein rich snack with micronutrient supplementation improved nutritional status and chronic liver disease severity score as measured by CPS and Staging by D'Amico with decrease in number of hospitalization.

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