Progress in Nutrition 2017; Vol. 19, N. 1: 26-32 - DOI: 10.23751/pn.v19i1.4470

Original article

Nutritional status of liver transplant candidates

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Summary. *Aim:* The aim of the present study was to determine nutritional status, food consumption frequency, and malnutrition rate of the patients on the waiting list for liver transplantation as nutrition has high risk in such patients. *Method:* In this, study nutritional status of a total of 102 liver transplant candidates, 41 women and 61 men, was evaluated. Data on anthropometric measurements, frequency of food consumption and eating habits of the patients was collected via a survey. Obtained data was recorded and expressed on computers using the SPSS 13.3 package program. *Results:* The average weight and height of the patients on the waiting list for liver transplantation was 78.5±15.5 kg (81.81±52.33 kg for men; 73.6±38.89 kg for women) and 1.66±0.92 m (170.66±26.78 cm for men; 158.32±19.79 cm for women), respectively. Considering their BMI, 37.6% of patients were found overweight and 37.6% were obese. According to SDG results, 28.4% (n=29) of the patients had moderate Protein-Energy Malnutrition (PEM). 76.5% of the patients skipped meals and 53.9% of those skipped meals as they had distaste at eating. While 12.7% of patients did not eat anything when they were tired or sad, 41.2% ate less than ever. 75.5% of the patients consume salty/ low-sodium food. *Conclusion:* Obesity may be as threatening as malnutrition for patients with chronic liver disease. Therefore, nutritional status one of the variables affecting morbidity and mortality of liver transplantation candidates should be well monitored, and changes should be made when necessary.

Key words: nutrition, liver transplant candidates

Introduction

Most of the patients waiting for a liver transplant have varying degrees of malnutrition. Malnutrition depends on several factors, such as reduction of food and calorie intake, poor appetite, dietary restrictions, intestinal absorption disorders, nutrient metabolism abnormalities (carbohydrates, lipids and proteins), and increase in hypermetabolic proinflammatory cytokine levels (1).

Nutritional therapy is one of the most important elements in the treatment of liver diseases, particularly in liver transplant candidates, and should be considered as required supportive care for clinical therapy (2). Monitoring of patient's food consumption is crucial not only for evaluation of nutritional status but also for early diagnosis and treatment of the diseases commonly seen in these patients, such as obesity, hyperlipidemia, and osteoporosis (3). Nutritional status is known to be associated with the complications after liver transplantation and high mortality (4, 5).

It has been founded that the liver transplantation candidates with preoperative malnutrition are at higher risk for intraoperative blood loss, prolonged stay in intensive care unit, high mortality, and increased post-transplant hospital costs (6).

Resting energy metabolism in patients that undergo liver transplantation is related to some alterable potential factors change. The percentage of pre-transplant adipose tissue and fat intake has been reported to be associated with hypometabolism (7). Many techniques have been proposed to detect malnutrition in patients with liver diseases (8). However, due to water retention and acid the widely used nutritional param-

eters may be misleading in patients with liver diseases (9). As the Subjective Global Assessment (SGA) utilized for diagnosis of malnutrition is the most affordable and a practical method, it ensures ease of use in patients with liver diseases (10). Accordingly, besides determining the nutritional status of patients and assessing the amount of oral intake, the method is also useful for determination of the physical and functional capacity of the patients.

This study was designed and carried out to determine nutritional status, food consumption frequency, and malnutrition rate of the patients waiting for liver transplant.

Materials and Methods

In this study, a total of 102 liver transplant candidates, 41 females and 61 males, who were aged over 18 years and had been followed up by the liver Transplantation Team at the Gastroenterology Department of Turkish High Specialty Hospital between October 2011 and May 2012 were analyzed regarding their nutritional status. The study was conducted with the approval of the Training Planning and Transplantation Committee. All patients were informed of the study, and their consent was obtained. Demographic characteristics, frequency of food consumption, and food preferences of the patients were identified through a survey filled out by the participants. Body weight was measured using scales with sensitivity of 100 g. Patients wore a thin dress and did not wear shoes when they got on scales. Standing height of the patients was measured using a standard stadiometer with sensitivity of 0.1 cm. Anthropometric measurements were performed by researchers at the right side of the body and recorded. BMI (kg/m^2) was assessed according to the adaptation of Campillo et al. (12) for cirrhotic patients. Accordingly, the optimal cut-off value was found 22.0, 23.0 and 25.0 kg/m^2 in patients with no acid, moderate and severe acid, respectively (11, 12). The Subjective Global Assessment (SGA) was applied in line with the protocol of Detsky et al. (10) according to that protocol, history of weight loss, daily calorie intake, gastrointestinal symptoms, functional capacity, and physical signs of malnutrition (reduction of subcutaneous tissue and/or muscle mass, edema, ascites) were evaluated. Patients were classified as well-nourished A, moderately malnourished B, and severely malnourished C according to their scores.

Study data was analyzed with the SPSS 13.0 (Statistical Package for the Social Sciences). In this descriptive study, continuous variables were expressed using mean ± SD values while categorical variables were expressed with numbers and in percentage.

Results

The average age and height was respectively 46.78±11.67 years and 1.66±0.92 m among the 102 liver transplant candidates composing of 41 women (40.2%) and 61 men (59.8%). The average weight and height of the patients on the waiting list for liver transplantation was 78.5±15.5 kg (81.81±52.33 kg for men; 73.6±38.89 kg for women) and 1.66±0.92 m (170.66±26.78 cm for men; 158.32±19.79 cm for women), respectively. The mean BMI was found 28.52±5.2kg/m^2.

28.4% of the patients showed moderate PEM according to SGA results. BMI was below 22.0 kg/m^2 in 9.8%, between 22.0 and 23.0 kg/m^2 in 5.9%, and between 23.0 and 25.0 kg/m^2 in 9.8% of the patients. While 37.6% of the patients were overweight, 37.6% had different degrees of obesity. 24.5% of the patients did not have history of hospitalization, but 29.4% had been hospitalized and received inpatient treatment at least for three times (up to 15 times). 76.5% of the patient skipped meals. While 53.9% of those skipped meals as they had distaste at eating, 31.4% reported that they did not have time to eat or they forgot to eat. While 12.7% of patients did not eat anything when they were tired or sad, 41.2% ate less than ever. Only 46.1% of patients received training on diet required for patients with liver diseases (Table 1).

It was identified in this study that 5.9% of the patient did not consume milk or yoghurt and 29.4% consumed less than 1 cup of milk per day. While 60.8% of the patients reported that they consumed one or fewer portion vegetables per day, 28.5% consumed 2 portions and only 10.7% reported to consume 3 to 5 portions of vegetables per day. 25.5% of the patients were found to eat one or fewer portion of fruits on daily basis. 10.8%

Table 1. BMI, SGA and some findings of patients with liver transplantation candidates

	n (102)	%
BMI (kg/m²)		
Normal (18.50–21.99)	10	9.8
Normal (22.00-22.99)	6	5.9
Normal (23.00–24.99)	10	9.8
Overweight (25.00–29.99)	38	37.3
Obese I (30.00–34.99)	22	21.6
Obese II (35.00–39.99)	13	12.7
Obese III (>40.00)	3	2.9
SGA		
SGA-A (well-nourished)	73	71.6
SGA-B (moderately malnourished)	29	28.4
The number of hospitalizations		
None	25	24.5
1	24	23.5
2	23	22.6
3 and ↑	30	29.4
The frequency control		
Monthly	24	23.5
Bimonthly	18	17.7
6 months	30	29.4
Depending on the status	30	29.4
Skipping meals		
Meals not skip	24	23.5
Morning	28	27.5
Noon	46	45.1
Evening or snack	4	3.9
Why not skip meals		
Weight loss	2	2.0
Can not wanted	55	53.8
Forgets-opportunity not find ... etc	45	44.2
The effect of eating to be sad and tired		
Do not eat any	13	12.7
Less than usual	42	41.2
More than usual	9	8.8
Does not change	38	37.3
Receive dietary education		
Yes	47	46.1
No	55	53.9

Table 2. Food preferences and consumption frequency of patients (n=102)

	n	%
Milk, yogurt consumption*		
Does not drink	6	5.9
Less than 1 cup per day	30	29.4
1-2 cups per day	53	52.0
More than 3 cups a day	13	12.7
Vegetable consumption**		
The first portion and less	62	60.8
2 servings	29	28.5
3 to 5 servings	11	10.7
Fruit consumption**		
The one portion and less	26	25.5
2 servings	28	27.5
3 servings	24	23.5
4 servings	15	14.7
5 servings	9	8.8
Oil type		
Butter	9	8.8
Margarine	2	2.0
Vegetable oil	69	67.6
Olive oil	22	21.6
Meat consumption		
Every Day	9	8.8
1-2 times at week	77	75.5
1-2 times at months	12	11.8
less frequently	4	3.9
Legumes comsumption		
1-2 times at week	61	59.8
1-2 times at months	14	13.7
less frequently	27	26.5
Egg consumption		
Every Day	27	26.5
1-2 times at week	59	57.8
1-2 times at months	9	8.8
less frequently	7	6.9
Soup, rice, etc.		
Every Day	92	90.2
1-2 times at week	10	9.8

**1cup= 200 ml ** 1 serving=150-200 g*

patients consumed butter and margarine. 8.8% consumed meat every day, 11.8% consumed one or two times per month, and meat consumption of 3.9% was less than one or two times per month. 13.7% of the patients consumed legumes one or two times per month while 26.5% consumed less frequently. 8.8% reported to eat egg one or two times per month and 6.9% consumes egg less frequently (Table 2).

Consumption of nuts was reported to be on daily basis, one or two times per week, one or two times per month, and less frequent in 12.7%, 29.4%, 24.5, and 33.3% of the patients, respectively. Consumption of coke, soda, etc. was on daily basis, one or two times per week, one or two times per month 2.9%, 10.8%, and 4.9% of the patients. According to findings of the study, 75.5% of the patients were following salty and

low-sodium food. 54.9% of the patients were non-smokers, but 20.6% of the patients consume alcohol. It was also identified in the study that some patients excessively consumed some specific food/ beverages with the belief that they were beneficial for their health. For example, 21.6% of the patients drank herbal teas (fennel, chamomile, sage, linden, etc.); 6.9% consumed various herbs (licorice root, burdock, thistle, chamomile, fennel, dandelion, turmeric, lavender, etc.); 9.8% drank commercial fruit juices, 10.8% drank mineral water, 46.1% consumed some vegetables (artichokes, broccoli, etc.), and 51% consumed honey, jam and molasses (1-2 bowls per day. About 300 grams to 500 grams per day.) (Table 3).

Table 3. Consumption of some foods, smoking and alcohol consumption status of patients

Status of comsumption	**Yes**	
	n	**%**
Nuts consumption		
Every Day	13	12.7
1-2 times at week	30	29.4
1-2 times at months	25	24.5
less frequently	**34**	**33.3**
Coke and etc. consumption		
Every Day	3	2.9
1-2 times at week	11	10.8
1-2 times at months	5	4.9
less frequently	**83**	**81.4**
Salt consumption		
Saline / less salty	77	75.5
Salt-free	**25**	**24.5**
Smoking status		
Does not drink	56	54.9
1-10 days	20	19.6
Day 11-20	10	9.8
More than 20 days	**16**	**15.7**
Alcohol consumption		
Yes	21	20.6
No	**81**	**79.4**
Herbal tea		
Various herbs	7	6.9
Ready juice	10	9.8
Soda mineral water	11	10.8
Artichoke, brokoli..vb vegetables	47	46.1
Excess honey, jam, molasses	52	51.0

Discussion

The average weight and average BMI of the 102 patients on the waiting list for liver transplant were 78.35±15.53 and 28.52±5.22, respectively. There was no patient with BMI below 18.5. In these patients, acid and/or edema may have influenced the detection of malnutrition in terms of BMI. Because 28.4% of patients were found to have moderate PEM regarding SGA results. SGA is a method evaluating functional food intake, weight loss, physical and functional capacity, and presence of acid and edema in line with qualitative and quantitative variables, and this ensures its practicality and ease to use. However, SGA should be analyzed carefully and by experts. Due to the harmful effects of liver failure on other organ systems, liver transplant candidates often develop severe or moderate malnutrition. Loss of skeletal muscle mass is common in catabolic cases. The prevalence of malnutrition is high in patients with chronic liver diseases (5, 13, 14). Varying degrees of malnutrition may be seen in patients receiving outpatient therapy (15) or inpatient treatment for liver cirrhosis (16) as well as those undergoing liver transplantation (3, 17, 18).

Gottschall et al (19) reported that 38% of patients with cirrhosis developed malnutrition according to their SGA results. Figueiredo et al (20) reported that the rate of patients developing malnutrition in their study was over 60%. Ferreira et al (21) found the rate of malnutrition 74.7% in the patients waiting for liver transplantation. Our findings are slightly lower compared to other studies. It may be due to the fact that our study population composed of the patients, who were followed up on outpatient basis.

As BMI > 24.99, a significant indicator of obesity, was observed in 75.5% of the patients and 37.6% of those had BMI >30, it can be concluded that obesity is as crucial as malnutrition in liver transplant patients. Campillo et al (12) found the BMI cut-off value as 22.0, 23.0 and 25.0 kg/m^2 in patients with no acid, moderate and severe acid, respectively. BMI, with these cut-off values, has been reported to be a reliable parameter for detection of malnutrition in patients with cirrhosis, and its diagnostic performance may alter with exclusion of peripheral edema and acid (12).

Çelebi et al. (22) stated that of the patients with non-alcoholic fatty liver disease 39.5% were overweight and 18.4% were obese according to BMI. Their results are close to the results of the present study. In a similar population, Singal et al. (23) classified 68% of the study subjects as overweight/obese with an average BMI of 28±6.

Hepatic stenosis was detected in 75% extremely obese patients and also 24% of those developed NASH and 3-11% developed cirrhosis. Also it has been indicated that there is a correlation between the severity of fibrosis and obesity independent of age and diabetes. All findings specified above show the importance of weight control for primary protection of these patients (24). Prevalence of NASH in obese people is 6 times higher than in normal- weight people (25). Additionally, there are some data claiming that obesity creates higher risk for fatty liver compared to alcohol (26).

Complications including metabolic syndrome, obesity and hepatic stenosis are risk factors for fibrillation (27) and cancer (28) in patients with chronic liver disease. If the patients with obesity or fatty liver disease can change their diet and living style in the required direction, they may prevent progression of cancer. However, malnutrition leads to a decline in protein synthesis as a result of liver failure and deterioration of energy metabolism in the patients with cirrhosis. Protein malnutrition causes decrease in skeletal muscle mass in cirrhosis patients, as well. Therefore, instead of limiting diets designed for weight control, individual diets ensuring slow and steady weight loss (considering both ascites/ edema ad nutrition status) should be applied.

Most of the liver transplant candidates had to receive inpatient treatment for several times. Three out of every four patients were at least once hospitalized and received inpatient treatment. While 24.5% of the patients did not have history of hospitalization, 29.4% had been hospitalized and received inpatient treatment at least for three times (up to 15 times). Approximately one fourth of the patients had routine monthly check-ups.

Signal et al (29) reported poor quality of life as the cause of risk of infection, frequent hospitalization, complications, mortality, and post-transplant costs. Slow and steady weight loss through appropriate nutrition and regular exercise is still the most effective treatment method for obese patients. In the present study, the patients were asked whether they did physical exercise or not; however, no positive response could be obtained. They put forward weakness and fatigue as the reasons for not doing exercise. Absence of physical exercise and insufficient food consumption –which may have caused by weakness and fatigue- creates a vicious cycle resulting in malnutrition. In contrast, sedentary lifestyle may bring up obesity, metabolic syndrome and constipation.

Presence of acid causes distress and difficulty in breathing; therefore, it may be the reason of the decrease in physical activity. Decrease of physical activity observed in patients on the waiting list for liver transplant is probably associated with loss of muscle mass due to severe liver diseases, and is attributed to poor quality of life (30).

Acid, nausea, vomiting, constipation, and diarrhea-related problems make diet of patients more important. All these problems affect eating patterns of patients. 12.7% of the patients did not eat anything when they were tired, weak or unhappy while two out of every five patients consumed less food than ever. Half of the patients stated that they had distaste at eating, and one out of every three people reported that they forgot eating or did not have time to eat. This condition creates a vicious cycle by negatively adequate and balanced nutrition negatively. Only less than half of the patients had education/real information on diet. It may be due to the fact that patients are not referred to a dietician until they have serious nutrition problems.

While 29.4% of the patients consumed less than 1 cup of milk per day, 5.9% reported that they did not consume milk or yogurt at all. Even, some of the patients told that they did not consume milk as it was prohibited. Although patients were encouraged to eat plenty of vegetables, three out of every five patients consumed 1 portion or fewer vegetables. Only one out of every ten patients was found to eat three portions or more vegetables. Fruit consumption (73.5% of the patients consumed ≤ 3 portions of fruits per day) was higher compared to vegetable consumption. 10.8% of the patients consume butter and margarine due to either economic reasons or for their flavor. In the light of these findings we believe that patients were not given adequate diet education or they did not abide by their

diet. There was no study in literature examining food consumption of such patients; therefore, it was not possible to compare our results with literature.

It has been indicated regarding severity and etiology of liver damage that malnutrition is more severe in patients with alcoholic cirrhosis in comparison to the ones with non-alcoholic cirrhosis (5, 16). Because of religious beliefs, alcohol consumption is not as high in society as it is in western societies. Nevertheless, one out of every five patients in our study consumed alcohol. As the patients were aware that alcohol was unhealthy or hid their alcohol consumption due to socio-cultural reasons, alcohol consumption rate was low in this study. Thus, we can tell that malnutrition and obesity were the main causes of the problems experienced by the patients involved in our study.

Limiting sodium and liquid intake is necessary and widely recommended in presence of edema and acid (31). However, as very strict salt restriction changes flavor of food, it may reduce food consumption, and thus, worsen the situation even further for the patients, who already suffer from malnutrition. In the present study, only one fourth of the patients stated that they are on no-added-salt diet, 42.2% told that they followed a reduced sodium diet but could not give up salt completely. Whereas the patients with edema and acid (53.9%) should have cut salt out completely. Additionally, the patient claiming that they were following a no-added-salt diet were consuming salty cheese and bread on daily basis and reported that they did not have access to salt-free cheese/ bread or could not even if available due to financial reasons. Some of the patients affirmed that due to sodium restriction recommended in their diet they avoid food with high salt content, such as pickles (n=7), cheese (n=1), 2 coke-soda, any kind of salty food (n=3), sausage (n=1), and mineral water (n=1). This indicates that patients did not have sufficient information on sodium restrictions or did not appropriately follow the diet.

Conclusion

Obesity may be as threatening as malnutrition for patients with chronic liver disease. Nutrition-related problems (malnutrition/ obesity) of such patients can be evaluated using the SGA and BMI. Nutritional status, one of the variables affecting morbidity and mortality of liver transplantation candidates, should be well monitored; required changes should be made, and patients should be given detailed information on required diet type.

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