Nutritional Status and Fatigue of Patients with Cirrhosis in Tertiary Hospitals, Yunnan Province, the People's Republic of China*

ภาวะโภชนาการและความเหนื่อยล้าของผู้ป่วยโรคตับแข็ง ในโรงพยาบาลระดับตติยภูมิ มณฑลยูนนาน สาธารณรัฐประชาชนจีน*

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Abstract

Nutritional status is one of the major concerns in patients with cirrhosis, which is likely to influence their perception of fatigue. This descriptive-comparative study aimed to examine the nutritional status and fatigue, and the difference of fatigue within different levels of nutritional status among patients with cirrhosis. Purposive sampling was used to select 133 participants from two tertiary hospitals in Yunnan province, the People's Republic of China. The research instruments included the Demographic Data form, Serum albumin concentration and the Fatigue Impact Scale (FIS). Data were analyzed by using descriptive statistics, the Kruskal-Wallis H test and the Mann-Whitney U for Post Hoc test.

The results of this study showed that:

1. The total mean concentration of serum albumin in participants was 32.71 g/L (SD = 7.01) with a range of 17.30 to 51.20.

2. The mean of the total FIS score was 33.00 (SD = 19.04) with a range of 5 to 123.

3. There were four pairs of different levels of nutritional status which showed a significant difference in fatigue: normal nutrition and moderate malnutrition ($p < .01$), normal nutrition and serious malnutrition ($p < .01$), mild malnutrition and moderate malnutrition ($p < .01$) and mild malnutrition and serious malnutrition ($p < .01$).

The results of this study could be useful for clinical nurses to be aware of fatigue symptoms among patients with cirrhosis by considering serum albumin concentration levels. Also, they may be useful in developing effective fatigue management programs and improving nutritional status.

Keywords: Nutritional status, Fatigue, Cirrhosis

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บทคัดย่อ

ภาวะโภชนาการเป็นปัญหาสำคัญอย่างหนึ่งในผู้ป่วยโรคตับแข็งซึ่งมีแนวโน้มที่จะส่งผลต่อความเหนื่อยล้า การศึกษาเชิงพรรณานาเปรียบเทียบครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาภาวะโภชนาการและความเหนื่อยล้าของผู้ป่วยโรคตับแข็ง และความแตกต่างของความเหนื่อยล้าในระดับภาวะโภชนาการที่แตกต่างกัน การคัดเลือกกลุ่มตัวอย่างใช้วิธีการสุ่มแบบเจาะจงเพื่อเลือกผู้ป่วยโรคตับแข็งจากโรงพยาบาลระดับตติยภูมิสองแห่ง ในมณฑลยูนนาน ประเทศสาธารณรัฐประชาชนจีน จำนวน 133 ราย เครื่องมือที่ใช้ในการวิจัย ประกอบด้วย แบบฟอร์มข้อมูลส่วนบุคคล ความเข้มข้นของอัลบูมินในเลือด และแบบวัดความเหนื่อยล้า (the Fatigue Impact Scale) วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา การทดสอบของครัสคาลและวัลลิส และแมนท์วิทนีย์ ยู สำหรับทดสอบความแตกต่างระหว่างกลุ่ม

ผลการศึกษาพบว่า

1. ค่าเฉลี่ยของความเข้มข้นของอัลบูมินในเลือดของกลุ่มตัวอย่างทั้งหมด เท่ากับ 32.71 กรัม/ ลิตร (SD = 7.01) พิสัย 17.30 ถึง 51.20

2. ค่าเฉลี่ยของคะแนนความเหนื่อยล้าของกลุ่มตัวอย่างเท่ากับ 33.00 (SD = 19.04) พิสัย 5 ถึง 123

3. ความเหนื่อยล้ามีความแตกต่างอย่างมีนัยสำคัญในกลุ่มที่มีระดับภาวะโภชนาการต่างกันสี่กลุ่ม ได้แก่ ภาวะโภชนาการปกติและภาวะทุพโภชนาการปานกลาง ($p < .01$) ภาวะโภชนาการปกติและภาวะทุพโภชนาการรุนแรง ($p = .01$) ภาวะทุพโภชนาการเล็กน้อยและภาวะทุพโภชนาการปานกลาง ($p < .01$) และ ภาวะทุพโภชนาการเล็กน้อยและภาวะทุพโภชนาการรุนแรง ($p < .01$)

ผลการศึกษานี้จะเป็นประโยชน์สำหรับพยาบาลในคลินิกในการตระหนักถึงอาการเหนื่อยล้าของผู้ป่วยโรคตับแข็งโดยพิจารณาจากระดับความเข้มข้นของอัลบูมิน และยังอาจพัฒนาโปรแกรมการจัดการความเหนื่อยล้าที่มีประสิทธิภาพและแก้ไขภาวะโภชนาการ

คำสำคัญ: ภาวะโภชนาการ ความเหนื่อยล้า โรคตับแข็ง

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Background and Significance

Cirrhosis is advanced chronic liver disease, which is defined by irreversible chronic injury of the liver, and diffuse fibrosis associated with nodular liver regeneration (Di Pascoli et al., 2017). The prevalence of cirrhosis worldwide is estimated to be at around 1% of the population (Di Pascoli et al., 2017). China bears the greatest number of cirrhosis cases, with up to 7 million cases (about 0.5% of the total Chinese population) (Xiao et al., 2019). Each year, the exact number of cirrhosis cases admitted in Tertiary Hospitals, Yunnan Province, is unknown. However, most patients with cirrhosis tend to seek medical help from tertiary hospitals because the proportion of superior resources is relatively low in primary-level medical and health institutions (Liang, Huang & Zhang 2020).

Cirrhosis trajectories include two stages: compensated cirrhosis is often asymptomatic, while decompensated cirrhosis mainly presents portal hypertension and decreased liver function (Chinese Society of Hepatology, 2020). Nutritional status relating to cirrhosis is an important factor affecting patients' health-related quality of life (Rojas-Loureiro, Servín-Caamaño, Pérez-Reyes, Servín-Abad, & Higuera-de la Tijera, 2017), which is associated with incidences of complications such as ascites, hepatic encephalopathy, and infections (Chinese Society of Hepatology, 2020). Serum albumin is a common tool used to measure nutritional status with its reflection for the severity and prognosis of disease, and can help categorize the level of nutritional status (Łapiński & Łapińska, 2019). Its disadvantage of being affected by water retention can be mini - mized by excluding participants who develop ascites.

Due to complications of cirrhosis, patients with cirrhosis suffer a variety of symptoms, such as fatigue, abdominal distension, pain, drowsiness, loss of weight, loss of appetite, poor sleep, feelings of sadness, dry mouth and anxiety (Bao, Wang, Lei, & Liu, 2014). Among the many symptoms in patients with cirrhosis, fatigue is considered as the most common and prominent. Bao et al., (2014) reported that fatigue ranked first in incidence, frequency, and severity among all the symptoms reported by patients with cirrhosis. Elderly patients with cirrhosis may be prone to fatigue more easily. Ekerfors et al. (2019) found that an age > 65 is one of the significant variables to predict fatigue in patients with cirrhosis.

The cause of fatigue in cirrhosis is believed to be related to conditions such as metabolic abnormality, inflammation, and peripheral and central nerve interaction (Gerber, Weinstein, Mehta, & Younossi, 2019; Louati & Berenbaum, 2015; Swain & Jones, 2019). Therefore, alteration in nutritional status is likely to affect perception of fatigue. Abnormalities of metabolism often lead to a lack of energy because nutritional status features such as insufficient glycogen, hyper-metabolism, and poor nutritional intake often occur in patients with cirrhosis (Chinese Society of Hepatology, 2020). Negative energy balance, abnormal protein synthesis, and muscle depletion can lead to skeletal muscle loss, weakness, and decreased physical performance (Ekerfors et al., 2019), thus also leading to immune dysfunction, and increasing the risk for infection and inflammation, which in turn contributes to fatigue (Louati & Berenbaum, 2015). Moreover, nutritional status is implicated in neurological complications, and even contributes to developing hepatic encephalopathy, leading to physical, cognitive and emotional impairments (Pérez-Reyes et al., 2016). If patients have a satisfactory nutritional

status, they may have more chances to relieve their fatigue because improved nutritional status of patients with cirrhosis helps to protect patients against complications, inflammation and hepatic encephalopathy (Pérez-Reyes et al., 2016).

However, there was no information about the fatigue of patients with cirrhosis in China, and it remained unknown whether there was any difference in fatigue among different levels of nutritional status in patients with cirrhosis. In this study, we analyzed the level of nutritional status and fatigue, and also explored the differences in fatigue within different levels of nutritional status among patients with cirrhosis. The results of this study provided fundamental knowledge about nutritional status and fatigue in patients with cirrhosis. The gained knowledge serves to benefit the detection, prevention, and management of nutritional status and fatigue among patients with cirrhosis, in nursing practice.

Objectives

1. To identify the nutritional status and fatigue in patients with cirrhosis admitted to tertiary hospitals in Yunnan province, the People's Republic of China.

2. To examine the differences in fatigue among differing nutritional status levels among patients with cirrhosis admitted to tertiary hospitals in Yunnan province, the People's Republic of China.

Research Questions

1. What is the nutritional status and fatigue of patients with cirrhosis admitted to tertiary hospitals in Yunnan province, the People's Republic of China?

2. Is there a significant difference in fatigue experienced, among differing levels of nutritional status, in patients with cirrhosis admitted to tertiary hospitals in Yunnan province, the People's Republic of China?

Conceptual Framework

The conceptual framework of this study was derived from the literature review. Nutritional status, being a result of the interaction of food intake, absorption and utilization of nutrients (Bedogni, Battistini, Severi, & Borghi, 1996) will affect fatigue via alteration of metabolism, change muscle performance, and increase or decrease risk of complications, considering fatigue may be caused by metabolic abnormality, inflammation, and peripheral and central interaction (Gerber et al., 2019; Louati & Berenbaum, 2015; Swain & Jones, 2019). Fatigue in patients with cirrhosis is a sense of tiredness or lack of energy, which significantly interferes with the desire or ability to perform basic, daily, physical and intellectual functions (Canadian MS Research Group, 1987). If patients with cirrhosis have differing nutritional statuses, as reflected by albumin concentration at different levels, they may experience fatigue in varying degrees of severity (in each of its physical, cognitive, and psychosocial dimensions). This can be measured by the Fatigue Impact Scale (FIS). The results of this study can serve as basic information for nutrition and fatigue management in patients with cirrhosis, in order to control the progression of the disease and promote their daily lives.

Methodology

Population and sample

The target population was defined as patients diagnosed with cirrhosis. The sample size for this study was calculated based on G* power analysis, and computer software (G*-Power 3.1) was used. Because there were no

relevant earlier findings, a modest size of .3 was adopted for effect size. The risk of a Type I error (α) was usually employed at .05, and the conventional standard for power (1-β) was .8, with a 20% risk of Type II error (Polit & Beck, 2017). With serum albumin levels divided into 4 groups, a sample size not less than 128 was acceptable. Considering the possible loss of participants, 20% of the sample size was added. Thus, the number of proposed participants for this study was 154. The purposive sampling method was used. Samples were selected in equal proportion within each setting. Inclusion criteria for this study were: 1) being diagnosed with cirrhosis, either in the compensated or decompensated stage by physicians. The dif- ference between the two stages of cirrhosis is that in the decompensated stage, patients developed portal hypertension and compli- cations of cirrhosis, while those in the compensated stage are often asymptomatic (Chinese Society of Hepatology, 2020); 2) being over 18 years of age; 3) having the ability to communicate in the Chinese language; 4) being willing to participate in this study (patients who planned for surgery were included); and 5) being the participant's first day of admission (to minimize the influence of treatment procedures on fatigue experienced by participants during their hospital stay). Exclusion criteria for this study were: 1) being a drug addict or having alcohol addiction; 2) having any type of cancer; and 3) having complications such as shock from esophageal ruptures or ascites.

Research Instruments

The research instruments for this study consisted of three parts: 1) The Demographic Data Form, developed by the researchers; 2) The Clinical Information Form developed by the researchers. The assessment of nutritional status by albumin concentration was done in the first test after admission within 24 hours after admission, in order to avoid effects of treatments such as human albumin or plasma infusion. Based on the assumptions of a previous study, nutritional status was defined as "normal" when serum albumin concentration ≥ 35.00g/L, while malnutrition was defined as "mild" when serum albumin concentration was 30.00-34.99 g/L, "moderate" when 21.00-29.99 g/L, and "serious" when < 21.00 g/L (Łapiński & Łapińska, 2019); and 3) The Chinese version of the Fatigue Impact Scale (FIS), developed by (Fisk, Ritvo, Ross, Haase, Marrie,& Schlech, 1994). This scale assesses patients' perceptions of the functional limitations that fatigue has caused over the past month and contains 40 items in three dimensions: cognitive functioning, physical functioning and psychosocial functioning. Items' responses are measured on a 5-point rating type scale, ranging from 0, meaning "no problem," to 4 meaning "extreme problem" (Fisk et al., 1994). The Chinese version of the Fatigue Impact Scale was translated by the Mapi Research Trust. The validity of the FIS was confirmed by the original developers (Fisk et al., 1994), and the structure and items of the original scale were not changed in the Chinese version. The internal consistency reliability for this study, tested with 10 participants who met the inclusion criteria showed a Cronbach's alpha coefficient of .942.

Ethical Considerations

The protocol was met with approval from the Ethics Committee of the Faculty of Nursing, Chiang Mai University (Study code: 2020-EXP028). Afterwards, approval for the data collection was obtained from the directors of nursing of the two tertiary hospitals. Confidentiality and anonymity of the individual responses were guaranteed by a statement included in the information sheet.

Participants gave their informed consent before distribution of the questionnaire.

Data Collection

The participants were recruited from the wards of gastroenterology departments in the two selected hospitals. The researcher then met the participants in the ward, and explained the study's methods, benefits, and ethical consideration to them. Patients who agreed to participate in this study were asked to sign an informed consent form. The Fatigue Impact Scale questionnaires were provided to participants to complete. It took approximately 10-20 minutes for each participant. Clinical information including albumin concentration was taken from the patients' medical records. The finished questionnaires were kept in a cabinet.

Data Analysis

The Statistical Package for Social Science (SPSS) 13.0 was used to analyze the data, and the significance level was set at .05. Descriptive statistics were used to describe demographic characteristics, clinical information (including serum albumin concentration) and FIS score of participants. After testing data distribution using Kolmogoro-Smirov's test, scores for FIS were not normally distributed ($P<.05$); the Kruskal-Wallis H test was used to explore differences of total FIS scores within the nutritional status groups and the Mann-Whitney U test was used for post hoc.

Results

The sample size of this study was originally planned as 154, but the effective responses resulted in 133 samples. For the other 21 participants, 15 failed to fully complete the questionnaire, and 6 could not provide the serum albumin concentration. The 133 participants, with a mean age of 54.78 (SD = 11.46), were included in this study. More than half of the participants (68.42%) were female. A majority of participants (71.43%) were diagnosed with decompensated cirrhosis, which was more than twice the number of those with compensated cirrhosis.

This study showed the mean of albumin concentration of all participants was 32.00 g/L (SD = 7.01, range = 17.30-51.20). Of the 133 participants, 35.30 % (n = 47) had normal nutrition, 21.80% (n = 29) had mild malnutrition, 40.60% (n = 54) had moderate malnutrition and 2.30% (n = 3) had serious malnutrition.

The mean of the total FIS score in this study was 33.00 (SD = 19.04, range = 5-123). Concerning the difference in fatigue within various levels of nutritional status among participants, the average total FIS score for participants with normal nutrition, mild malnutrition, moderate malnutrition and serious malnutrition was 22.27 (SD = 12.18), 22.10 (SD = 12.37), 46.79 (SD = 17.89) and 51.00 (SD = 9.54), respectively. The details are shown in Table 1.

Table 1 Mean, Range and Standard Deviation of Total FIS Score Among Each Group of Nutritional Status

Nutritional status	Albumin Concentration	Range of FIS Score	Mean of FIS Score	SD of FIS Score
Normal nutrition	35g/L	9-64	22.27	12.18
Mild malnutrition	30-34.9g/L	5-77	22.10	12.37
Moderate malnutrition	21-29.9g/L	26-123	46.79	17.89
Serious malnutrition	<21g/L	42-59	51.00	8.54

The results of the Kruskal-Wallis H Test showed that there were statistically significant differences for fatigue ($\chi 2 = 76.70$, $P = .000$, $df = 3$) among at least two categories of participants with different nutritional statuses (but which pair of groups remained unknown). Therefore, a post hoc test using the Mann-Whitney U test was conducted to compare each pair and clarify which groups of nutritional statuses had differences in fatigue. The results showed that significant differences in fatigue existed in the following four pairs of participants: participants with 1) normal nutrition and moderate malnutrition, 2) normal nutrition and serious malnutrition, 3) mild malnutrition and moderate malnutrition, and 4) mild malnutrition and serious malnutrition. The details are shown in Table 2.

Table 2 Results of differences in fatigue among differing nutritional status levels

	Nutritional status	N	Mean rank	Z	P
Total FIS score	Normal nutrition	47	37.93	-.29	0.77
	Mild malnutrition	29	39.43		
	Normal nutrition	47	29.61	-6.85	0.000[a]
	Moderate malnutrition	54	69.62		
	Normal nutrition	47	24.15	-2.58	0.001[a]
	Serious malnutrition	3	46.67		
	Mild malnutrition	29	18.03	-6.64	0.000[a]
	Moderate malnutrition	54	54.87		
	Mild malnutrition	29	15.10	-2.62	0.01[a]
	Serious malnutrition	3	30.00		
	Moderate malnutrition	54	28.48	-1.00	0.32
	Serious malnutrition	3	38.33		

a Grouping variable: Nutritional

Discussion

Nutritional status

The results of this study showed that more than half of the participants (64.66%) had malnutrition. Nutritional status is a significant issue of concern in patients with cirrhosis. Patients with cirrhosis frequently have malnutrition due to inadequate nutritional intake, low absorption, and increased losses (Madan et al., 2016). The impact of malnutrition is substantial and omnifarious. Rojas-Loureiro et al. (2017) reported that malnutrition is a significant factor related to impairment of health-related quality of life among patients with cirrhosis. It is also one of the significant predictive factors for complications in patients with cirrhosis (Pérez-Reyes et al., 2016).

However, this finding was lower than a study conducted by Łapiński & Łapińska (2019) which reported that malnutrition determined by serum albumin concentration was found in 84% (47/56) of its patients. Eating habits of participants and food culture in Yunnan province might explain the relatively lower prevalence of malnutrition in this study.

In this study, more participants reported that they had a normal diet rather than loss of appetite or food restrictions. Patients with a normal diet may have a better nutritional status than those who have poor appetites or restrictions in their diet. According to Madan et al. (2016), alcoholic etiology, protein restriction and a vegetarian diet are all associated with markers of poor nutrition. Food intake is the main source of nutrients for the human body, so patients with cirrhosis who are in a hypermetabolic state can easily suffer from malnutrition if they fail to take in key nutrients.

Besides, the food culture in Yunnan province has its own unique characteristics, which may influence the nutritional status of its residents to some extent. There are many ingredients, condiments and diverse cooking methods involved in the Yunnan diet (Wen & Li, 2019), which may promote healthy appetites for residents there, and thus improve nutritional status. Also, some ethnic minority diet cultures include the profound concept of health preservation. For example, the Hui people advocate eating meat, vegetables and fruits, while alcohol and excessive eating are forbidden (Yang, Tai, & Guo, 2018)

Fatigue

This study revealed that fatigue is a common symptom among patients with cirrhosis. Fatigue is a quite complex and multidimensional symptom. According to the Canadian MS Research Group (1987), attention to the impacts of fatigue is particularly important in patient care. The impacts of fatigue on patients with cirrhosis mainly relate to cognitive, physical, and psychosocial function. Cognitive fatigue concerns the impact of fatigue on the processes of concentration, reminiscence, intelligence and organization of thoughts (Fisk et al., 1994; Gerber et al. (2019) described the fatigue of patients with cirrhosis as a feeling of drowsiness, cognitive decline, "fuzzy" thinking, and/or decreased motivation. Physical fatigue refers to an impairment of motivation, effort, stamina and coordination (Fisk et al., 1994). It appears to be an experience of tiredness in the musculoskeletal system, such as muscle fatigue, and poor recovery from exercise (Gerber et al., 2019). Psychosocial fatigue refers to the impact of fatigue in relation to various aspects such as solitary feelings, one's workload, or the ability to cope (Fisk et al., 1994). For example, fatigue interferes with the functions of daily life, and can

affect one's mental state, leading to a sense of uncertainty among patients with cirrhosis (Lin, Huang, & Sun, 2018).

The findings of this study regarding fatigue reflected by FIS scores were somewhat higher than those of a previous study conducted by Ekerfors et al. (2019), in which the median total FIS score of 270 patients with chronic liver disease was 30.00.

Differences in the liver disease severity of participants between the two studies may be one of the major explanations. Participants in the two studies were all patients with chronic liver disease, but this study only included patients who had also developed cirrhosis. Fatigue experienced by patients with cirrhosis is likely to be associated with their disease status, such as inflammation, ascites, hepatic encephalopathy, anemia, impaired renal function or malnutrition. Besides, the higher proportion of female participants (n = 91, 68.42%) in this study may account for the relatively higher instances of fatigue reported by participants. Ekerfors et al. (2019) included 115 female participants and 119 male participants in their study, and concluded that female participants significantly experienced more severe fatigue than males. Females may experience more severe fatigue than males, due to their generally lower resistance and higher sensitivity.

Importantly, Yunnan is home to multi-ethnic living and profound cultural accumulation (Yue, 2017). The unique religious culture and beliefs are likely to affect the daily lives of residents, and even affect attitudes towards diseases and coping strategies of individuals. Some people may interpret and deal with illness and the symptoms they are experiencing in superstitious ways. For example, the Bimo religion of the Yi people is polytheistic, with ancestor, nature and totem worship as its main traditional beliefs (Yue, 2017).

Fatigue in cirrhosis patients can be affected by multiple factors. It mainly includes illness-related characteristics such as pain and disease; physical functions, such as disability and sleep quality; cognitive and emotional impairment, such as anxiety and depression; and personal components such as gender, age, work/ employment and environment (Louati & Berenbaum, 2015). Furthermore, according to the pathophysiology of fatigue (Gerber et al., 2019; Louati & Berenbaum, 2015; Swain & Jones, 2019) and the linkage between nutritional status and fatigue in patients with cirrhosis as mentioned before, nutritional status, therefore, is a significant factor related to fatigue in patients with cirrhosis.

The differences in fatigue among differing levels of nutritional statuses

In the current study, participants who had worse nutritional statuses were more likely to report a higher total FIS score. Generally, participants with moderate or serious mal-nutrition reported a relatively higher total FIS score than those who were in the normal nutritional status category (or those with mild malnutrition). The differences in fatigue were statistically significant among these four group-pairs of participants: a) normal nutrition and moderate malnutrition, b) normal nutrition and serious malnutrition, c) mild and moderate malnutrition and d) mild and serious mal-nutrition.

A relatively greater difference in nutritional status of participants reflects that they may have large differences in the severity of their cirrhosis. For example, Łapiński & Łapińska (2019) reported that malnutrition was found most

frequently in patients with cirrhosis in advanced stages due to the fact that the ability of the liver to regulate nutrient metabolism gradually degenerates with the aggravation of cirrhosis. At different levels of cirrhosis severity, participants may experience various types of physical and psychological distress, and their changes in lifestyle to adapt to this progressive illness (such as reducing workload and social activities) may also differ. Compared to patients in earlier stages of cirrhosis, patients in advanced stages of cirrhosis may have more underlying problems, such as anorexia, vomiting, poor absorption, and other gastrointestinal disorders, which can also contribute to fatigue. Actually, Rojas-Loureiro et al. (2017) found that those patients with malnutrition exhibited more severe troubles in their daily lives, such as a feeling of tiredness or fatigue, having trouble lifting or carrying objects, decreased levels of energy, and decreased strength, compared with well-nourished cirrhosis patients.

Participants may have different risks for complications based on their nutritional status. For instance, Pérez-Reyes et al. (2016) reported malnourished patients had a higher frequency of the development of ascites and infections due to the fact that malnutrition can lead to decreased liver function, which fosters the progression of the disease and facilitates the development to fcomplications. It also contributes to severe abnormalities in the immune system, which can leave patients with cirrhosis susceptible to infection (Pérez-Reyes et al., 2016). Moreover, complications of cirrhosis, such as hepatic encephalopathy, variceal bleeding, poor wound healing and poor hepatic function, are associated with nutritional status (Chinese Society of Hepatology, 2020). Considering complications of cirrhosis are the cause of many symptoms including fatigue, participants may experience different levels of fatigue when they have differing nutritional statuses and complications.

However, this study showed that there was no significant difference in fatigue between two pairs of groups of participants: a) normal nutrition and mild malnutrition, and b) moderate malnutrition and serious malnutrition. This might be due to the small difference in nutritional status (the interval value of serum albumin concentration was less than 5g/L), which is reflected in the difference in albumin concentration between the two groups of participants. Furthermore, only 3 participants reported serious malnutrition, and there may be some other reasons for this.

Conclusions and Recommendations

In conclusion, this study found that fatigue in patients with cirrhosis was significantly different when patients have differing nutritional statuses, as determined by serum albumin concentration. This current study was the first study in China examining fatigue among patients with cirrhosis and its differences within groups of nutritional status. However, because our participants were patients with cirrhosis in two in tertiary hospitals, Yunnan Province, the People's Republic of China our findings might not be generalizable to those living in other settings with different contexts.

Conclusions and Implications

Application of research findings

The gained knowledge about nutritional status and fatigue in patients with cirrhosis can enlighten nurses and health caregivers to the important concerns of these problems. Also, the difference of fatigue within groups of patients

with cirrhosis in different nutritional statuses indicate that nurses should consider the impact of fatigue on their patients, as well as the importance of assessing their patients' nutritional status. Serum albumin concentration could be a basic indicator to monitor nutritional status as well as fatigue. If patients have moderate or serious malnutrition, as determined by serum albumin concentration, a program including nursing education and corresponding intervention for protection should be provided to promote patients' nutritional status and decrease potential impacts caused by fatigue.

Suggestions for further research

It is possible that a larger population, or another method to test nutritional status, is needed to ascertain the difference of fatigue within groups of differing nutritional status in patients with cirrhosis. In addition, qualitative research should be considered to reveal the fatigue experience of patients with cirrhosis at different nutritional statuses. Furthermore, an interventional research design may be considered, to implement a program that can promote nutritional status and relieve fatigue in patients with cirrhosis.

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