Effect of Coconut Milk Supplementation to Nutritional Status Parameters in Liver Cirrhosis Patients

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ABSTRACT

Background: *Liver cirrhosis is on of health problems in Indonesia. Decreasing number of liver cells in cirrhosis cause some complications, one of which is malnutrition. In Indonesia, coconut milk is one of nutrients sources which quite popular. Coconut milk is thought to have hepatoprotective effect and be able to be eliminated by cirrhosis patients. A study about effect of coconut milk supplementation to nutritional status parameters in liver cirrhosis patients is really needed.*

Method: *This study was a randomized controlled trial with parallel design. This study was conducted in Cipto Mangunkusumo Hospital Jakarta from February to March 2014. Patients were given late night snack (LNS) in form of agar that contained 25 grams of sugar and additional 50 cc coconut milk in group I (experimental group) and additional drink that contained 25 grams of sugar in group II (control group). Variables that measured to look changes in nutritional status between the two groups were triceps skinfold thickness (TSF), mid arm muscle circumference (MAMC), body mass index (BMI), body fat mass (BFM), prealbumin levels and serum albumin levels.*

Results: *A total of 35 patients with liver cirrhosis in this study to the completion. There were three parameters of nutritional status that increasing better in the group receiving a LNS from combination of carbohydrates and coconut milk, compared to group receiving carbohydrates alone. Those three parameters were mean (SD) MAMC with amount of 9.41 (6.43) mm in group I and 4.68 (5.76) mm in group II, p = 0.028. Median (range) BFM changes 0.67 (-2.47-3.80) kg in group I and 0.21 (-4.96-1.99) kg in group II, p=0,373. Mean (SD) serum albumin level change 0.17 (0.31) g/dL in group I and 0.07 (0.41) g/dL in group II, p = 0,426. There was an increase in the TSF measurement in all subjects after one month of LNS supplementation, but not found any significant differences of TSF changes between the two groups. While the measurement of BMI and serum prealbumin did not show any significant changes after treatment in all subjects research.*

Conclusion: *One month LNS 200 kkal supplementation with combination of carbohydrates and coconut milk have a better effect on the improvement of nutritional status in patients with liver cirrhosis, compared to carbohydrates alone. This shown by the better parameters of MAMC, BFM and increased serum albumin in group I, compared to group II.*

Keywords: *liver cirrhosis, malnutrition, coconut milk, triceps skinfold thickness (TSF), mid arm muscle circumference (MAMC), body fat mass (BFM), body mass index (BMI)*

ABSTRAK

Latar belakang: *Sirosis hati merupakan salah satu masalah kesehatan di Indonesia. Berkurangnya jumlah sel hati pada sirosis menyebabkan berbagai komplikasi, salah satunya adalah malnutrisi. Di Indonesia, santan menjadi salah satu sumber nutrisi yang cukup popular. Santan diduga memiliki efek hepatoprotektif serta mampu dieliminasi dengan baik oleh pasien sirosis. Diperlukan sebuah penelitian mengenai efek santan terhadap berbagai parameter malnutrisi pada pasien sirosis hati.*

Metode: *Penelitian ini adalah uji klinik acak terkontrol dengan desain paralel. Penelitian dilakukan di Rumah Sakit Cipto Mangunkusumo Jakarta pada Februari hingga Maret 2014. Pasien diberikan makanan ringan tengah malam berupa agar yang mengandung 25 gram gula beserta tambahan santan 50 cc pada kelompok I (perlakuan) dan tambahan minuman yang mengandung 25 gram gula pada kelompok II (kontrol). Variabel yang diukur untuk melihat beda perubahan status gizi antara kedua kelompok adalah ketebalan lipatan kulit trisep, lingkar otot lengan tengah, indeks massa tubuh (IMT), masa lemak tubuh (MLT), kadar prealbumin serta kadar albumin serum.*

Hasil: *Sebanyak 35 pasien sirosis hati terlibat dalam penelitian ini sampai selesai. Terdapat tiga parameter status gizi yang meningkat lebih baik pada kelompok yang mendapatkan makanan ringan tengah malam dengan kombinasi karbohidrat dengan santan, dibandingkan pemberian karbohidrat saja. Ketiga parameter itu ialah rerata (SB) lingkar otot lengan tengah sebesar 9,41 (6,43) mm pada kelompok I dan 4,68 (5,76) mm pada kelompok II, p = 0,028. Median (rentang) perubahan MLT 0,67 (-2,47-3,80) kg pada kelompok 1 dan 0,21 (-4,96-1,99) kg pada kelompok II, p=0,373. Rerata (SB) perubahan kadar albumin serum 0,17 (0,31) g/dL pada kelompok 1 dan 0,07 (0,41) g/dL pada kelompok II, p = 0,426. Terdapat peningkatan ukuran ketebalan lipatan kulit trisep pada semua subjek setelah 1 bulan mendapatkan makanan ringan tengah malam namun tidak didapatkan perbedaan bermakna perubahan ketebalan lipatan kulit trisep antara kedua kelompok. Sementara itu pengukuran IMT dan prealbumin serum tidak menunjukkan adanya perubahan yang bermakna setelah perlakuan pada semua subjek penelitian.*

Simpulan: *Suplementasi makanan ringan tengah malam 200 kkal selama satu bulan dengan dengan kombinasi karbohidrat dan santan mempunyai pengaruh lebih baik terhadap perbaikan status gizi pasien sirosis hati, dibandingkan pemberian karbohidrat saja. Hal ini ditunjukkan oleh ukuran lingkar otot lengan tengah, MLT dan kadar albumin serum yang meningkat lebih baik pada kelompok I, dibandingkan kelompok II.*

Kata kunci: *sirosis hati, malnutrisi, santan, ketebalan lipatan kulit trisep, lingkar otot lengan tengah, massa lemak tubuh (MLT), indeks massa tubuh (IMT)*

INTRODUCTION

Liver cirrhosis is still a health problem in Indonesia. Reports from several state public hospitals indicate liver cirrhosis prevalence ranged from 3.6 to 8.4%, or an average of 3.5%, with the largest age group between 40-50 years.[1] In cirrhosis, it was happened fibrosis and greatly reduced number of liver cells, then these situation will lead to various problems in the body, such as portal hypertension, splenomegaly, hypersplenism, ascites, spontaneous bacterial peritonitis, hepatorenal syndrome, hepatic encephalopathy, coagulation disorders, osteoporosis, anemia and malnutrition.[2] Italian Multicentre Cooperative on Nutrition in Liver Cirrhosis reported the decline in nutritional status in line with cirrhosis severity.[3] This study also showed correlation between nutritional status and Child Pugh (CP) score, reported that 75.3% cirrhosis patients malnourished, even 38.35% of them have severe protein-calorie deficiency malnutrition, moderate-severe malnutrition found more in patients with CP C than in CP A.[4] Total cholesterol level, high density lipoprotein (HDL), low density lipoprotein (LDL), and serum triglicyride in cirrhosis patients are found lower and total cholesterol level, HDL, and LDL inversely correlated with the cirrhosis severity.[5] Malnutrition in cirrhosis closely related with high morbidity and mortality.[6] Futhermore, nutritional status also a independent predictor which determine the quality of life of liver cirrhosis patients.[7]

Several factors that cause malnutrition in cirrhosis patients are low dietary intake, changes of nutrition absorption in intestine, decreasing synthesis ability of the liver, and increased catabolism of muscle protein in the body of cirrhosis patients.[1] Furthermore, in liver cirrhosis occured increased energy expenditure (EE) and endogen fat oxidation which used as source of basal

energy.[8-9] Dietary supplementation in cirrhosis patients helpful to prevent patients undergo hypercatabolism.[2] To meet the nutritional needs in cirrhosis patients, it is recommended to give provision of late night snack (LNS) which are additional food at night with as much as 50 grams carbohydrates (equal to 200 kkal).[10]

In Indonesia, coconuts are very easy to be found. Coconut meat and its processed products have long been used as food and medicine in various parts of the world.[11] Emulsions of coconut meat extract known as coconut milk.[12] Coconut milk contains many saturated fatty acids from the class of middle-chain triacylglycerol (MCT), consisting of caprylic acid (5-9%), capric acid (6-10%), and lauric acid (44-52%).[13,14] MCTs are more easily absorbed than LCT, and absorbed mainly in the form of free fatty acids so that they are good to be consumed in healthy patients and cirrhosis patients.[15,16] Additionally MCT is more easily oxidized so it acts as a high energy source that can be quickly used.[15] MCT administration in cirrhotic patients reportedly able to raise significantly the albumin levels of patients with alcoholic cirrhosis and has a hepatoprotective effect.[17,18] MCT administration in cirrhotic patients seems to have a good degree of safety, because cirrhotic patients with CP A, B, and C is able to eliminate these fats well.[19]

Research on the effect of coconut milk on the nutritional status of patients with liver cirrhosis have never done so many colleagues physicians which are hesitant, even not rarely prohibit cirrhotic patients to consume foods that contain coconut milk. This study was done to see the benefits of coconut milk supplementation (as late night snack) to improve nutritional status in malnourished cirrhosis patients, and expected to be able to answer these doubts.

METHOD

This study is a randomized controlled trial with parallel design, which aim to know the benefits of milk supplementation in improving the nutritional status of patients with liver cirrhosis. The study was conducted by comparing the change in nutritional status of cirrhosis patients after LNS supplementation which contained of carbohydrates and coconut milk with LNS supplementation which contained carbohydrates alone. This study conducted in Rumah Sakit Cipto Mangunkusumo (RSCM), Jakarta from February to May 2014.

Research subjects were liver cirrhosis patients in Hepatology Clinic RSCM Jakarta from February to May 2014 who are willing to participate in this study after receiving an explanation by signing an informed consent. Inclusion criteria for this study are patients with liver cirrhosis CP A and B who malnourished when screening using BMI criteria modified by Campillo (BMI < 22 kg/m^2 for cirrhotic patients without ascites, less than 23 kg/m^2 for cirrhotic patients with mild ascites, and less than 25 kg/m^2 for patients with cirrhosis with severe ascites) and or unintentional weight loss (weight loss over 5% of weight in a period of 6-12 months or less). Patients with a pacemaker, diabetes mellitus, renal failure, and infections except hepatitis B and C were excluded from this study. Patients who undergo hepatic encephalopathy, gastrointestinal bleeding, spontaneous bacterial peritonitis, or other complications during the study were excluded from the study (drop out).

Subjects were divided into 2 groups randomly using randomization techniques, which is consecutive sampling. Liver cirrhosis patients who malnourished be distinguished first by its cirrhosis degree of severity based on the Child Pugh criteria, after which each put in group I or II based on the order of participation in the study. Group I get LNS in form of agar that contains 25 grams of sugar with 50 cc coconut milk. Group II get agar that contain 25 grams of sugar which added by drink with 25 grams of sugar.

The independent variable is coconut milk supplemention, while the dependent variables are TSF, MAMC, BMI, BFM, prealbumin levels and serum albumin levels. All the data which are normally distributed are presented in mean (SD), and if not normal are presented in median. The bivariate analysis is used to see changes in nutritional status at the beginning and end of the treatment. When the data are normally distributed paired t-test was used, and if the data are not normally distributed Mann-Whitney test was used. This study was approved by the Ethics Committee for Health Research, Faculty of Medicine University of Indonesia.

RESULTS

During the period of study, 40 liver cirrhosis patients with CP A and B, who are willing to participate in the study, collected from cirrhotic patients who seek treatment at the clinic and the hepatology procedure room. After being grouped according to the degree of cirrhosis based on Child Pugh criteria, patients were randomly put into groups I or II according to the order of its participation, so that there are 20 patients in

Table 1. Characteristics of research subjects.

Characteristics	Group I	Group II	p
Number of subjects	18	17	
Mean of age (SD)	50.67(8.80)	58.06(11.40)	0.039 (*)
Gender			0.691(#)
Male, n (%)	15(83.33)	13(76.47)	
Female, n (%)	3(16.67)	4(23.53)	
Child Pugh			0.903 (£)
Child Pugh A, n (%)	12(66.67)	11(64.71)	
Child Pugh B, n (%)	6(33.33)	6(35.29)	
Cirrhosis cause			0.257 (¥)
Hepatitis B, n (%)	10(55.56)	8(47.06)	
Hepatitis C, n (%)	7(38.89)	8(47.06)	
Fatty liver, n(%)	1(5.55)	1(5.88)	
Early nutritional status parameters			
Triceps skinfold thickness, mean (SD) mm	11.56 (4.56)	12.50 (3.67)	0.506 (*)
Mid arm muscle circumferences, mean (SD) mm	220.44(30.17)	214.10 (25.67)	0.509 (*)
Body mass index, mean (SD) kg/m^2	21.43 (3.36)	21.40 (2.57)	0.974 (*)
Body fat mass, mean (SD) kg	13.48 (5.06)	14.74 (4.02)	0.422 (*)
Serum prealbumin, median (range) mg/dl	8.50 (2.8-20)	9.80 (3.00-24.50)	0.575 (Ω)
Serum albumin, mean (SD) g/dl	3.44 (0.59)	3.53 (0.31)	0.631 (*)

* independent t-test, #Fisher exact, £Chi-square, ¥marginal homogeinity test, ΩMann-Whitney test

each group (Figure 1). From group I, two patients are unable to continue the research, one patient due to his work, one patient because of his unability to follow the study protocol to completion. From group II, 3 patients are unable to continue the research, one of them had to be hospitalized because of spontaneous bacterial peritonitis, two patients due to their work unable to follow the study protocol to completion. Therefore, the number of patients that complete the study in group I are as many as 18 patients and group II are as many as 17 patients.

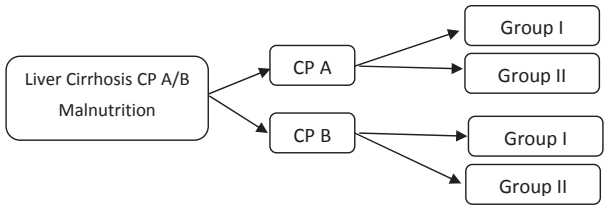

Figure 1. Research subjects recruitment and randomization flow.

In this study, there are 35 patients which able to complete the study protocol. The mean age of patients was 54.26 ± 10.67 years old, with an age range of 35 to 80 years. As much as 27 patients (80%) are male. According to the CP score, there are as many as 23 patients (65.71%) with CP A and as many as 12 patients (34.29%) with CP B. In group I, subjects with CP A and CP B are as much as 12 patients (66,67%) dan 6 patients (33,33%) consecutively, whereas in group II there are 11 patients (64.71%) and 6 patients (35.29%) consecutively. The most common cause of liver cirrhosis in patients are hepatitis B with 18 patients (51.43%), hepatitis C with 15 patients (42.86%), and fatty liver with 2 patients (5.71%). Detailed characteristics between the two study groups are shown in Table 1. Group I received supplementation with sugar and coconut milk, while group II receive sugar supplementation only.

In group I, it was found mean (SD) are 11.56 (4.56) mm for TSF, 220.44 (30.17) mm for MAMC, 21.43 (3.36) kg/m^2 for BMI, 13.48 (5.06) kg for BFM, 3.44 (0.59) g/dL for serum albumin levels, and median (range) for serum prealbumin levels is 8.50 (2.8-20) mg/dL. In group it was found mean (SD) are 12.50 (3.67) mm for TSF, 214.10 (25.67) mm for MAMC, 21.40 (2.57) kg/m^2 for BMI, 14.74 (4.02) kg for BFM, 3.53 (0.31) g/dL for serum albumin levels, and median (range) for serum prealbumin level is 9,80 (3,00-24,50) mg/dL. There were no significant differences in mean or median parameters of nutritional status of the two groups of subjects in the beginning of the study.

Because there are differences in mean age between groups I and group II, then do the correlation analysis was done between age and measured parameters of nutritional to observe the effect of age on nutritional status changes. The analysis shows there is no correlation between age and nutritional status changes in all measured parameters (Table 2).

Table 2. Correlation between age and parameter changes in nutritional status.

Parameter changes	Age		
	Correlation coefficient	p	Correlation
Triceps skinfold thickness	0,216	0,212	Spearman
Mid arm muscle circumferences	-0,128	0,465	Pearson
Body mass index	0,058	0,741	Pearson
Body fat mass	0,004	0,983	Spearman
Serum prealbumin level	0,149	0,392	Spearman
Serum albumin level	0,032	0,854	Pearson

In group I, there is change in mean (SD) of TSF from 11.56 (4.56) mm to 12.17 (4.62) mm (p = 0.045).

Meanwhile, in group II there is change in mean (SD) TSF from 12.50 (± 3.67) mm to 13.78 (± 4.19) mm (p = 0.001). Median of TSF changes in group I and group II respectively are 0 ([-1] - 4) mm dan 1 (0–3.5) mm (p = 0,064).

In group I, there is increased mean (SD) of MAMC from 220.44 (±30.17) mm to 229.68 (± 33.68) mm (p = 0.001). In group II, there is increased mean (SD) of MAMC from 214.10 (± 25.67) mm to 218.78 (± 27.21) mm (p = 0.004). Therefore, increased mean (SD) of MAMC in group I are 9.41 (± 6.43) mm greater than in group II (p = 0.028).

Body mass index (BMI) before treatment in group I is 21.43 (±3.36) kg/m^2. After received late night snack 25 gram of sugar and 50 cc of coconut milk for one month, mean of BMI is 21.75 (±3.70) kg/m^2 (p = 0.145). In group II, mean of BMI before treatment is 21.40 (±2.57) kg/m^2. After received late night snack 50 gram of sugar for one month, mean of BMI is 21.73 (± 2.99) kg/m^2 (p = 0.068). Changes between means in group I and group II respectively are 0.32 (± 0.89) kg/m^2 dan 0.33 (± 0.70) kg/m^2 (p = 0.96).

In group I, there is increased mean of BFM from 13.48 (5.06) kg to 14.30 (4.54) kg (p = 0.033). Meanwhile, in group II there is decreased mean of BFM from 14.74 (4.02) kg to 14.66 (4.57) kg (p = 0.873). Median of body fat mass changes between group I and group II is not statistically significant with p = 0.373.

In group II, median of serum prealbumin levels before and after treatment are 8.50 (2.8 – 20) mg/dL and 8.10 (3.60 – 18.70) mg/dL (p = 0.943). Meanwhile in group II, median of serum prealbumin levels before treatment is 9.80 (3.00 – 24.50) mg/dL, which change after treatment to 7.90 (3.20-33.4) mg/dL (p = 0.102). Median of serum prealbumin levels changes between group I and group II is not statistically significant (p = 0.198).

Table 3. Serum prealbumin levels before and after coconut milk suplementation in both groups.

	n	Median (range) mg/dL		p
		Before treatment	After treatment	
Group I	18	8.50 (2.8 – 20)	8.10 (3.60 – 18.70)	0.943
Group II	17	9.80 (3.00 – 24.50)	7.90 (3.20-33.4)	0.102

Mean (SD) of serum albumin levels in group I increased from 3.44 (0.59) g/dL to 3.61 (0.59) g/dL, this change is not statistically significant (p = 0.035). In group II mean (SD) of serum albumin levels before treatment is 3.53 (0.31) g/dL, while mean (SD) of serum albumin levels after the treatment is 3.60 (0.46) g/dL, which also not statistically signicifant (p = 0.459). Difference in changes between two groups is 0.17 (0.31) g/dL in group I and 0.07 (0.41) g/dL in group II, which are not statistically significant (p = 0.426).

DISCUSSION

This study followed by 35 subjects who completed the entire protocol. Despite the age difference, there is no correlation between the two groups indicates that the age factor does not affect the nutritional status parameters changes (Table 2). From six nutritional status parameters which measured, four of them showed increase value which indicated an improvement in the nutritional status of research subjects. The four nutritional status parameters are TSF, MAMC, BFM, dan serum albumin levels. The other two parameters of nutritional status, BMI and serum prealbumin did not show a significant change in nutritional status in this study.

Significant changes in MAMC showed coconut milk potential in improving the nutritional status of patients with cirrhosis. Means of BFM and serum albumin levels also found increased significantly in group I and not increased in group II showed that supplementation of food supplements containing coconut milk is superior to the food supplements containing carbohydrates only. Increased TSF measurement similar between the two treatment groups showed that administration of dietary supplements either carbohydrate alone or a combination of carbohydrates with coconut milk as LNS improve the nutritional status of patients with cirrhosis, but this parameter is not able to show the superiority of one food supplements given as LNS.

In both groups, there is significant changes to the TSF after treatment supports the notion that the provision of LNS in cirrhotic patients were able to improve the nutritional status in patients with cirrhosis.[20] In TSF parameter, there is no visible advantage of coconut milk compared to carbohydrates alone, this can be caused by larger arm muscle mass growth occurs in group I, which caused greater strain on the skin of the triceps skin fold areas which measured than in group II.

Decreased muscle mass in patients with cirrhosis caused by decreased protein synthesis in muscle cell, which caused by patients with cirrhosis are susceptible to hunger during long periods of fasting at night.

Along with that, there is increased degradation of proteins which used for gluconeogenesis.[21,22] Increased muscle mass after treatment in both groups proved that supplementation of 200 kcal LNS is able to improve the nutritional status of patients with liver cirrhosis. This occurs because the LNS can meet energy needs of patients in long periods of fasting at night, therefore protein synthesis is not impaired and gluconeogenesis does not occur.[23]

Increased mean of MAMC in group I that received supplementation of coconut milk exceeds the group I which only received sugar alone showed that the nutrients contained in coconut milk, especially MCT is a source of energy that is better in patients with liver cirrhosis. Futhermore, MCT is also said to improve absorption of amino acids.[24] Although both groups received LNS with the same number of calories, as many as 200 kcal every night, but the increase of muscle mass in the group that received supplementation of coconut milk has increased more mass muscle. The results are consistent with the argument of Merli et al and Greco et al that the fat is the main basal energy source in people with cirrhosis.[8,9]

In this study, there is no significant change in BMI before and after supplementation of LNS, both in group I and group II. If it was confirmed by other parameters of nutritional status such as MAC, TSF, TFM, it showed that there is improvement after supplementation of food with a late night snack, then it seems that nutritional status improvement is happened in patients both groups, but the parameters of BMI is less sensitive to be used as a measurement tool to monitor changes in the nutritional status of cirrhosis patients. This situation is caused partly because of the patients in this study experienced edema and ascites, in which the ascites over the study period can change rapidly due to the diuretic treatment, thus affecting the assessment of BMI. This is in accordance with recommendations on the ESPEN consensus which does not recommend BMI to monitor the nutritional status of cirrhosis patients, because many cirrhotic patients experienced edema or ascites.[25] Although Campillo et al stated that BMI with modifications can be used to assess the nutritional status of cirrhosis patients, but in practice it is difficult to use to view the changes in nutritional status. It might be that BMI with modifications by Campillo better only be used to screening patients with malnutrition in cirrhosis and not to monitor changes in nutritional status cirrhotic patients.[26]

Cirrhotic patients has experienced decreasing BFM significantly since the beginning of cirrhosis.[27] The study conducted by Pirlich concluded that BIA is a good technique for measuring the nutritional status of cirrhotic patients both cirrhotic patients with ascites and without ascites.[28] Increased BFM in cirrhosis patients in group I in this study indicated that there have been improvements in the nutritional status of the patient group. When the result are linked with the research results by Merli et al and Greco et al which showed that fat is a source of primary energy in patients with cirrhosis of the liver, it is likely that the better measurement results of BFM in group I is due to the contribution of fat content in the coconut milk which meet the fat needs as an energy source in cirrhotic patients.[8,9]

A study by Yovita et al also found that there is no association between serum prealbumin levels with anthropometric examination, including the TSF and MAMC. In her research, she get a negative correlation between serum prealbumin levels with CP score, thus prealbumin may be more related to the severity of liver function, rather than the nutritional status.[29] Prealbumin itself is a globular non-glycosylated protein with molecular mass of 54.98 kDa. This molecule is also called transthyretin because of its function in the transport of thyroxine and retinol. Most prealbumin produced by the liver parenchymal cells, while a small fractions generated by khoroideus plexus, pancreas and retina. Catabolism of prealbumin is mainly done in the liver, which then excreted through the kidneys and gastrointestinal tract. [30]

Prealbumin used as parameters for nutritional status because it has shorter half-life (about 2 days) than albumin which has half life of about 20 days. Experts expect that with shorter half-life, prealbumin can changes faster with changes in nutritional status, but the use of prealbumin as nutritional status parameter has several drawbacks, namely because its level in the blood is influenced by several other circumstances beside the nutritional status.[31] Reduced numbers of liver cells in cirrhosis appears to have a considerable influence on serum prealbumin levels. Some other conditions which can cause lower prealbumin levels are elderly age, increased vascular permeability such as ascites and pleural effusion, inflammation, trauma, malignancy, bleeding, and nephrotic syndrome.[30]

Some of the circumstances that lead to higher levels of prealbumin are the use of steroids, non-steroidal anti-inflammatory and insulin-like growth factor. Prealbumin levels are also found to be higher in renal failure, renal tubular damage, acute alcohol intoxication and dehydration.[30,31] With this study, it seems that the ability of prealbumin in terms of

reflecting changes in nutritional status is not as good as MAMC, TSF, BFM, and albumin. Given there are many ways that may affect blood prealbumin levels in cirrhotic patients, then use of prealbumin as a nutritional status parameter for liver cirrhosis patients should be proceed with caution, and should considering other factors that can influence it.

In this study, albumin levels prior to treatment in both groups were relatively similar, which are 3.44 g/dL in group I and 3.53 g/dL in group II with p = 628, therefore it can be said that improvement of nutritional status of cirrhotic patients in form of increased albumin levels in group I caused by coconut milk supplementation advantages compared with carbohydrates alone. This conclusion is supported by the results of other parameters measurement such as MAMC and BFM which also showed superiority coconut milk supplementation when compared with carbohydrates alone in cirrhotic patients with malnutrition. In this research, there is increased level of albumin of 0.12 g/dL after coconut milk supplementation for a month. When compared with the research conducted by Nakaya et al which showed an increase of 0.2 g/dL after BCAA snack supplementation for 3 months, then the increased levels of albumin in the milk supplementation did not less than the BCAA supplementation which done by Nakaya et al.[20] It needed further research to prove it.

Albumin synthesis of the body is affected by several things, namely nutritional status, osmotic pressure, and systemic inflammation. In cirrhosis patients, serum albumin levels are also affected by the distribution volume of body fluids.[32] This study did not specifically correlate serum albumin with several things that can affected it such as inflammatory and dilutional conditions against the results of the examination, therefore the effects of both these circumstances the results of the albumin level still requires further research.

There are differences in MAMC and serum prealbumin levels and serum albumin levels measurement results for changes in the nutritional status of cirrhosis patients. MAMC measurement looked very well to reflect the change in nutritional status which occurred, it seems there are increased MAMC in both groups, in which group I seemed to have an increased MAMC better than group II. Prealbumin levels did not show significant changes after supplementation in both groups, whereas serum albumin level showed an increase in group I only.

The difference between the MAMC measurement with serum prealbumin and albumin measurement caused by the MAMC which measured in arm muscle, in which protein synthesis carried by muscle cells which have relatively unaffected function, whereas prealbumin and albumin produced mainly by the liver cells which numbera has greatly diminished in a state of cirrhosis, thus showed less response than MAMC. Serum albumin levels increased in group I, this situation does not appear to be caused by improved liver synthesis, but most likely caused by a reduction in the degradation of albumin that is used as a source of energy through gluconeogenesis. Liver synthesis which did not improved is demonstrated by prealbumin levels were not increased in both groups after food supplementation.

There are also differences in measurement results TSF with BFM which both describe the amount of body fat. Beside the TSF is influenced by increasing muscle mass, this condition can also be caused by each of these parameters describe the state of body fat in two different compartments, which are subcutaneous fat and total body fat. Therefore, the results of this study indicated that supplementation with carbohydrates and coconut milk able to add fat in all compartments of the body fat, whereas the supplementation with carbohydrates alone just adds to the subcutaneous fat.

CONCLUSION

One month LNS 200 kkal supplementation with combination of 25 gram (100 kkal) of carbohydrates and 50 cc (100 kkal) coconut milk have a better effect on the improvement of several nutritional status parameters in patients with liver cirrhosis, compared to supplementation of 50 gram (200 kkal) carbohydrates, as shown by parameters of MAMC, BFM and serum albumin levels. Parameters of TSF, BMI and prealbumin serum levels did not show any significant changes between two groups with different given treatments, maybe this caused by the limitation of measurement methods which used to assess nutritional status changes in liver cirrhosis patients.

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