Original Article

Nutritional status of Korean male patients with alcoholic and viral liver cirrhosis

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This descriptive cross-sectional study aimed to investigate whether malnutrition occurs in outpatients with liver cirrhosis, and to compare the nutritional status of patients with alcoholic and viral liver cirrhosis using a variety of objective measures. This study also aimed to provide useful information about nutritional education and nutritional therapies for medical teams and patients with liver cirrhosis. Sixty-six Korean men between the ages of 30 and 69 with liver cirrhosis (24 alcohol-related and 42 virus-related) were recruited from the Internal Medicine Centres, Hanyang University Hospital, Seoul, Korea. The results showed that patients with alcoholic liver cirrhosis (ALC) were significantly lower in socio-economic status than patients with viral liver cirrhosis (VLC) (P<0.05). The energy intakes (excluding alcohol-derived energy) were 1448kcal and 1769kcal in the ALC and the VLC groups, respectively (P<0.05). As well, vitamin C intake was found to be higher in the VLC group than the ALC group, yet still more than 125% of the RDA for both groups (P<0.05). Among nutritional indices, only the TSF thickness showed interaction with the aetiology and the severity of the cirrhosis (P<0.05). Thus, these findings indicate that outpatients with liver cirrhosis in this study, particularly those with alcoholic liver cirrhosis, consumed a lower energy intake than suggested, but may not have been in a status of malnutrition. Body fat is more affected than other nutritional parameters in patients with liver cirrhosis.

Key Words: alcoholic liver cirrhosis, viral liver cirrhosis, Korean, nutritional status

Introduction

Liver cirrhosis is the fourth leading cause of mortality among middle-aged Koreans.[1] Males with liver cirrhosis have a mortality rate 9 times higher than females with liver cirrhosis.[1] Often, liver cirrhosis results from excessive alcohol intake and/or viral infection. Alcoholic liver cirrhosis is more common in western countries than eastern countries,[2-4] whereas viral liver cirrhosis caused by the Hepatitis B virus (HBV) is more common in eastern countries than western countries.[5,6]

Many studies from the west indicate that a well-designed nutritional therapy, intervention and education can decrease the mortality and the incidence of liver cirrhosis because alcoholic and viral liver cirrhoses are known to be closely associated with malnutrition.[2-4,7,8] Accordingly, many studies in western countries have investigated the nutritional status of patients with liver cirrhosis.[2-4,7,9,10] Although the liver plays a fundamental role in our body and influences nutritional status, in Korea, the focus has been on a pharmacological approach to treating liver cirrhosis caused by HBV.[11-13] In addition, when the liver injury, particularly cirrhosis, is due to alcohol intake, malnutrition may be exacerbated by factors associated with alcoholism compared to a situation where the disease is virally induced.[7,14] The Korean dietary pattern differs from the western dietary pattern in many respects. Typical Korean meals include rice, soup, and Kimchi (pickled and fermented Chinese cabbage with red pepper). Drinking patterns among Koreans are also different. Koreans consume alcohol with side dishes such as barbecued meats (Samgeubsal), fried chicken, and spicy soups (Tang).[15] Accordingly, many patients with alcoholic fatty liver are also obese.[15] Thus, we suggest that there are differences in nutritional status of Caucasian and Asian patients with liver cirrhosis.

Therefore, this study was conducted to investigate whether malnutrition occurs in outpatients with liver cirrhosis, and to compare the nutritional status of patients with alcoholic and viral liver cirrhosis using a variety of objective measures. This study also aimed to provide useful information about nutritional education and nutritional therapies for medical teams and patients with liver cirrhosis.

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Methods

Subjects

One hundred and nine outpatients with either alcoholic or viral liver cirrhosis were recruited from the Liver Clinic of the Internal Medicine Centre, Hanyang University Hospital, between September 1998 and May 1999, based on their willingness to participate and their informed consent. The diagnosis of liver cirrhosis was based on a number of liver function tests, ultrasonography, and liver biopsies. Based on the clinical examinations, the patients were divided into two groups: those with alcoholic liver cirrhosis (ALC) and those with viral liver cirrhosis (VLC). Patients with alcoholic liver cirrhosis were chronic alcohol-drinkers (minimum 120g/day for more than 10yrs) and the patients with viral liver cirrhosis caused by the Hepatitis B virus were all strict non-drinkers. Of the 109 patients, 8 patients were excluded from the study due to liver cirrhosis with additional complications such as diabetes or gastrointestinal hemorrhages. Liver function was assessed by the Child-Pugh classification, which attributes an arbitrary score to serum albumin and bilirubin concentration, prothrombin time, and the presence of ascites and hepatic encephalopathy.[16] Patients were classified as being in a well-compensated status or in a decompensated status according to the aetiology and the severity of the liver cirrhosis.

All patients had this study explained to them individually and their voluntary participation was made clear. During the course of this study 35 out of 109 patients withdrew from the study. These patients were not re-contacted after their withdrawal from the study. Sixty-six male patients (24 with ALC, 42 with VLC) of the 109 patients originally recruited, completed the study. This study was approved by the Hospital Committee for Clinical Investigations.

Anthropometric measurements

Anthropometric measurements were performed on all the patients at the beginning of the study. The patient's height and body weight were measured and body mass index (BMI) was calculated. Triceps skinfold thickness (TSF) and mid-arm circumference (MAC) on the left side of the body were measured as indices of body fat and muscle protein compartment. Each patient's TSF thickness and MAC was measured three times by an experienced dietitian, and the mean values were recorded. The TSF thickness was evaluated using triceps skinfold thickness norms from NHANES II.[17]

Dietary intake assessment

The patient's dietary intake was determined using 24-hr recall in a one on one interview with a trained dietitian, and by having the patients keep three-day food records. All patients were individually educated about how to keep a food record and how to use the measuring tools before the three-day food records were recorded. Nutrients from dietary intake were calculated using the computerized nutrient analysis program, CAN.[18] Nutrient intakes were compared as a percent of the recommended daily allowance (RDA) for Koreans[19] and to the Guidelines of Medical Nutritional Therapy for Koreans.[20]

Statistical analysis

Statistical analysis was performed using SPSS for Windows (version 9.5; SPSS Inc., Chicago). All results are given as mean ± SD. Differences between variables in both groups were compared using the Student's t-test for continuous variables and the chi-square test or Fisher's exact test for categorized factors. The interaction effect between the aetiology and the severity of liver cirrhosis was assessed by two-way ANOVA. Probability levels of $P<0.05$ were considered to be statistically significant.

Results

General characteristics and anthropometric measurements

As shown in Table 1, of the sixty-six male patients in this study, 24 patients suffered from alcoholic liver cirrhosis (ALC) and 42 patients suffered from viral liver cirrhosis (VLC). The average ages were 54.8 ± 9.2 years old for the ALC group and 49.3 ± 7.6 years old

Fifty-six percent (56.5%) of the ALC group had less than a complete middle school education, while 55% of the VLC group had a high school education, showing that the education levels of the VLC group were significantly higher than that of the ALC group.

Comparing socio-economic level based on occupation and income,[21] 56.5% of the ALC group were unemployed and a further 17.4% of the ALC group were classified as lower-middle class, whereas only 10.3% of the VLC group were unemployed and a further 38.5% of the VLC group were lower-middle class. No patients in the ALC group had a high socio-economic level, whereas 7.7% of the VLC group had a high socio-economic level. The socio-economic level of the VLC group was significantly higher than that of the ALC group. Height, weight, BMI, TSF, and MAC did not significantly differ between the two groups. The TSF values for the ALC group were in the 25-50th percentile (11.4 ± 1.89mm) and in the 50-75th percentile (14.4 ± 6.75mm) for the VLC group when compared to NHANES II values. However, compared with the norms for Koreans, the TSF values of both groups were more than the 50th percentile.

Dietary intake

As shown in Table 2, total energy intake averaged 1682kcal for the ALC group and 1769kcal for the VLC group. However, energy intake (excluding alcohol-derived energy) for the ALC group was 1448kcal, and thus there was a significant difference in energy intake (excluding alcohol-derived energy) between the two groups. Carbohydrate intake in the VLC group was significantly higher than that in the ALC group. In terms of micronutrients, only vitamin C intake of the VLC group was significantly higher than that of the ALC group. However, compared with the recommended dietary allowances (RDA) for Koreans, energy intake (excluding alcohol-derived energy) for both groups was less than 75% of the RDA, while the vitamin C intake for both groups was over 125% of the RDA.

Table 1. General characteristics and anthropometric measurements of the patients (mean ± SD)

Characteristics	ALC	VLC	Significance*
Age (yr)	54.8 ± 9.20	49.3 ± 7.62	0.014
30-39	-	5 (11.9)	NS†
40-49	8 (33.3)	16 (38.1)	
50-59	9 (37.5)	15 (35.7)	
60-69	7 (29.2)	6 (14.3)	
Education level			0.006†
≤ middle school	13 (56.5)	8 (20.0)	
high school	9 (39.1)	22 (55.0)	
≥ college	1 (4.3)	10 (25.0)	
Socioeconomic status			0.004†
high	-	3 (7.7)	
middle class	3 (13.0)	11 (28.2)	
middle-lower	4 (17.4)	15 (38.5)	
farmer	2 (8.7)	2 (5.1)	
unemployed	13 (56.5)	4 (10.3)	
others	1 (4.3)	4 (10.3)	
Height (cm)	165.3 ± 7.40	166.7 ± 6.34	NS
Weight (kg)	65.0 ± 10.76	65.3 ± 9.68	NS
BMI	23.7 ± 3.22	23.4 ± 2.84	NS
TSF (mm)	11.4 ± 1.89	14.4 ± 6.75	NS
MAC (cm)	26.8 ± 2.07	28.7 ± 3.31	NS
Child-Pugh classification			NS
A	20 (83.3)	39 (92.9)	
B	4 (16.7)	3 (7.1)	

Data are expressed as mean ± SD (No. %); *These were analyzed by Student's t-test (no symbol) and †chi-square test. NS, not significant; ALC, alcoholic liver cirrhosis ; VLC, viral liver cirrhosis; BMI, body mass index; TSF, triceps skinfold thickness; MAC, mid-arm circumference.

Interaction of Nutritional Indices

The interaction of the nutritional indices according to the etiology and the severity of liver cirrhosis is reported in Table 3. Among the nutritional indices, only the TSF thickness showed an interaction between the etiology and the severity of cirrhosis in this study.

Discussion

This study was conducted to investigated that whether malnutrition occurs in outpatients with liver cirrhosis, and to compare the differences in the nutritional status of patients with alcoholic and viral liver cirrhosis using a variety of objective measures including clinical examinations, anthropometric measurements, and dietary intake. This is the first known study in Korea to report on outpatients, not hospitalised patients, with alcoholic and viral liver cirrhosis using various nutritional assessment methods. In Korea, a number of studies have reported[22] on the dietary intakes of patients with liver cirrhosis, however, the present study further classified outpatients as being in a well-compensated status or decompensated status and as suffering from alcoholic liver cirrhosis or viral liver cirrhosis. Although the sample size of this study was small, the patients were carefully screened by liver biopsies.

The patients with alcoholic liver cirrhosis were found to be significantly lower in socioeconomic status than patients with viral liver cirrhosis (P <0.05). This result reflects the overall low socio-economic levels of patients with alcoholic liver cirrhosis, as reported by several studies.[22-24] However, it was found that the socio-economic status of some patients had changed due to the treatment of the liver cirrhosis or due to excessive alcohol intake in patients with alcoholic liver cirrhosis.

Excessive and chronic alcohol intake is associated with negative dietary habits such as the irregularity of meals and unbalanced nutrient intake. The ALC group showed a lower energy intake (excluding alcohol-derived energy), a lower carbohydrate intake, and a lower vitamin C intake than the VLC group (P <0.05). Energy intake (excluding alcohol-derived energy) and some nutrients intakes in the ALC group were low because some patients in the ALC group were still consuming alcoholic beverages. The daily energy intake (excluding alcohol-derived energy) in both the ALC (1448 kcal) and the VLC (1769kcal) groups was found to be less than 75% of the RDA for Koreans (2500 kcal for 30-49 year olds, 2400 kcal for 2400kcal for 50-64 year olds). Sarin *et al* reported[10] that the mean energy intake of patients with alcoholic liver disease was 1547kcal and for those with non-alcoholic liver cirrhosis it was 1495kcal.

The National Nutrition Survey of Korea reported that the average energy intake per day in male adults was 1839kcal.[25] Furthermore, a study of dietary intakes of different age groups living in Seoul and the surrounding

Table 2. Mean daily nutrient intakes of the patients (mean ± SD)

Nutrients	ALC	VLC	RDA[2]	Significance*
Total energy (kcal)	1682 ± 410	1769 ± 341		NS
Energy (kcal) (excluding alcohol)	1448 ± 483 (63 ± 5%)[1]	1769 ± 341 (72 ± 2%)	2500† 2400‡	0.002
Carbohydrate (g)	256 ± 64	292±56		0.017
Protein (g)	58 ± 20 (78 ± 26%)	65 ± 18 (87 ± 23%)	75† 70‡	NS
Fat (g)	31 ± 13	37 ± 15		NS
Cholesterol (mg)	138 ± 102	194 ± 136		NS
Vitamin A (RE)	499 ± 359 (71 ± 51%)	513 ± 287 (73 ± 41%)	700	NS
Vitamin C (mg)	73 ± 40 (133 ± 73%)	114 ± 78 (207 ± 142%)	55	0.017
Thiamin (mg)	1.0 ± 0.43 (83.3 ± 43.30%)	1.1 ± 0.43 (90.4 ± 32.16%)	1.3† 1.2‡	NS
Riboflavin (mg)	0.8 ± 0.39 (56.8 ± 31.4%)	0.9 ± 0.39 (63.8 ± 26.7%)	1.5† 1.4‡	NS
Niacin (mg)	13 ± 5 (82 ± 32%)	14 ± 5 (88 ± 27%)	17† 16‡	NS
Calcium (mg)	354 ± 213 (51 ± 31%)	450 ± 258 (65 ± 37%)	250	NS
Iron (mg)	8.8 ± 3.71 (73 ± 31%)	10.3 ± 3.07 (86±26%)	12	NS

Data are expressed as mean ± SD; [1]calculated as % of the RDA ; [2] Recommended dietary allowances; †RDA values for Koreans aged 30-49year olds; ‡RDA values for Koreans aged 50-64year olds. * These were analyzed by Student's t-test (no symbol). NS, not significant; ALC, alcoholic liver cirrhosis; VLC, viral liver cirrhosis

Table 3. Nutritional indices of the patients classification according to the aetiology and the severity of the cirrhosis (mean ± SD)

Aetiology	Severity	TSF (mm)	MAC (cm)	Alb (g)	TP (g)	Energy (kcal) (excluding alcohol)	Carbohydrate (g)	Protein (g)	Fat (g)
ALC	Well-compensated status	11.8 ± 1.9	27.4 ± 1.9	4.5 ± 0.5	7.5 ± 0.6	1487 ± 524	254 ± 71	61 ± 21	33 ± 14
	Decompensated status	10.5 ± 2.1	26.2 ± 2.5	3.0 ± 0.7	6.8 ± 0.8	1294 ± 242	261 ± 21	47 ± 5	23 ± 7
VLC	Well-compensated status	14.7 ± 6.9	29.0 ± 0.6	4.3 ± 0.5	7.4 ± 0.6	1790 ± 342	293 ± 57	66 ± 17	38 ± 15
	Decompensated status	14.0 ± 1.3	25.2 ± 5.2	2.9 ± 0.0	5.9 ± 1.1	1501 ± 211	286 ± 27	46 ± 8	20 ± 7
	Aetiology	0.008	NS	NS	NS	0.006	0.020	NS	NS
	Severity	0.018	NS	0.001	0.001	0.039	NS	0.011	0.015
	Aetiology × Severity	0.043	NS	NS	NS	NS	NS	NS	NS

Data are expressed as mean ± SD; Significant differences between ALC and VLC, $P<0.05$ by two way ANOVA; ALC, alcoholic liver cirrhosis; VLC, viral liver cirrhosis; Well-compensated status, Child A class; Decompensated status, Child B class; TSF, triceps skinfold thickness ; MAC, mid-arm circumference; Alb, serum albumin; TP, serum total protein

areas reported that the total energy intakes were 1860kcal for 30-49year olds and 1715kcal for 50-69year olds.[26] However, according to the Korean Guidelines for Medical Nutritional Therapies, the patients in this study should have consumed around 1950kcal per day.[20] Thus, it cannot be concluded that the energy intakes (excluding alcohol-derived energy) of patients with liver cirrhosis in this study, in particular the VLC group, may be inadequate, because considering the patient's activity, their average energy intakes are 1824 ± 222kcal a day. Patients in this study, particularly those with alcoholic liver cirrhosis, consumed less energy than recommended, but may not have been in a status of malnutrition. Continued monitoring of alcohol intake and a nutritious dietary intake are encouraged in patients with liver cirrhosis.

Interestingly, although energy intake (excluding alcohol-derived energy) was less than 75% of the RDA in both the ALC and the VLC groups, protein intake did not fall below 75% of the RDA in both groups. Also, protein intakes in both groups were not lower than those recommended by the Guidelines of Medical Nutritional Therapies for Koreans (65g).[20] Protein intake in patients with liver cirrhosis is important to maintain an adequate nutritional status and for liver function, such as the synthesis and degradation of proteins.[14] Several studies from western countries have reported[10,22,27,28] that protein deficiency from a poor diet is common and marked in patients with alcoholic and viral liver cirrhosis. However, Simko *et al*[3] and Thuluvath and Triger [29] reported that the protein intake of patients with alcoholic and nonalcoholic liver disease in western countries was also not insufficient. Our study observed no differences in the protein intake between the ALC and the VLC groups (P <0.05). We suggest that a greater proportion of patients consume protein derived from tofu. Also, half of the patients in this study take folk remedies, which are rich in protein sources - one such example being Goombangyi. Some patients in this study have experienced changes in their mental status, resulting from hepatic encephalopathy due to excessive protein intake. Nutritional education is recommended for patients with liver cirrhosis to assist them in the selection and balance of protein foods. This study concludes that protein deficiency is not a great concern for patients with liver cirrhosis.

Among micronutrients, vitamin C intake was more than 125% of the RDA in both the ALC and the VLC groups (P<0.05). This suggests that the Korean diet provides adequate amounts of vitamin C from foods such as Kimchi and cooked or uncooked vegetables. Moreover, some patients with liver cirrhosis have been consuming special foods rich in vitamin C, such as Nokjoup (vegetable juice).

Anthropometry is useful in assessing the nutritional status of patients with liver cirrhosis.[2,30] However, the relationship between the severity and the aetiology of liver damage using anthropometric measurements has not been well documented in Korea. Regardless of cause, liver cirrhosis is likely to cause patients to have abnormal anthropometric measurements.[14,30] Several studies have reported that the TSF thickness was lower in patients with non-alcoholic liver disease than patients with alcoholic liver disease[10,31] and MAC was also found to be lower in patients with alcoholic liver cirrhosis than in those with non-alcoholic liver cirrhosis.[31] In contrast, Thuluvath and Triger reported[29] TSF thickness and AFA (arm fat area) showed no significant differences between patients with alcoholic and non-alcoholic liver disease. In this study, the TSF thickness and MAC values were higher in the VLC group than in the ALC group, but this difference was not found to be statistically significant. Only the TSF thickness showed an interaction among the nutritional indices with the aetiology and the severity of liver cirrhosis (P<0.05). This suggests that body fat is more affected than other nutritional parameters in patients with liver cirrhosis. Accordingly, if the well compensated patients do not maintain an adequate dietary intake and if they do not have their nutritional status monitored continuously, they will become malnourished. These results also indicate that the TSF thickness is a reliable method of nutritional assessment in a clinical setting for patients with liver cirrhosis.

Therefore, the results of this study indicate that outpatients with liver cirrhosis did not show marked malnutrition, but only mild nutritional abnormalities. Thus, we suggest that the selection and balance of foods of proper quantity and quality with respect to the typical Korean dietary patterns should be cautiously emphasized for patients with liver cirrhosis. Appropriate nutritional education relating to traditional folk remedies and continued monitoring are needed for outpatients with liver cirrhosis according to the aetiology and the severity of the liver cirrhosis.

Conclusions and recommendation

This study was performed to assess the nutritional status of outpatients with either alcoholic or viral liver cirrhosis, and to provide useful information about nutritional education and nutritional therapies for medical teams and patients with liver cirrhosis. The data indicates that marked malnutrition is not common in outpatients with liver cirrhosis, however, patients with alcoholic liver cirrhosis did have lower energy intakes than patients with viral liver cirrhosis. Body fat appears to be affected by the aetiology and the severity of the cirrhosis. Moreover, if patients with a well-compensated status do not maintain adequate nutritional intakes, they may become malnourished.

Therefore, the selection of foods of proper quantity and quality with respect to Korean dietary patterns should be cautiously emphasized for patients with liver cirrhosis according to the aetiology and the severity of the cirrhosis. Patients with liver cirrhosis also need to be given nutritional education relating to dietary supplementation, alcohol intake, and the benefits and drawbacks of traditional folk remedies. In addition, nutritional monitoring by various methods is necessary for patients with liver cirrhosis to predict and prevent further deterioration. Further long-term investigation into the nutritional status of Koreans with liver cirrhosis using larger study groups is needed.

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References

1. Annual report on the cause of death statistics. National Statistical Office, Korea. 1997.
2. Italian Multicentre Cooperative projects on nutrition in liver cirrhosis: Nutritional status in cirrhosis. J Hepatol 1994; 21: 317-32.
3. Simko V, Cornell AM, Banks B. Nutritional status in alcoholics with without liver disease. Am J Clin Nutr 1982; 35: 197-203.
4. Lautz HU, Seberg O, Körber J, Bürger M, Müller MJ. Protein-calorie malnutrition in liver cirrhosis. Clin Investig 1992; 70: 478-486.
5. Lee MH. The story of liver. Seoul: SaeChang Press, 1997; 204-205.
6. Seo KS, Lee BS, Sung JK, Lee SO, Kim SH, Kim KT, Lee SH, Kim JH, Kim NJ, Lee HY. The cause and complication of liver cirrhosis during the recent 5 years. Korean J Hepatol 1997; 3: 202-209.
7. Mendenhall CL, Anderson S, Weesner RE, Goldberg SJ, Crolic KA. Protein-calorie malnutrition associated with alcoholic hepatitis: Veterans administration cooperative group on alcoholic hepatitis. Am J Gastro internal 1991; 86: 1200-1208.
8. Mendenhall C, Moritz TE, Roselle GA, Morgan TR, Nemchausky BA, Tamburro CH, Schiff ER, McClain CJ, Marsano LS, Allen JI, Samanta A, Weesner RE, Henderson W, Gartside P, Chen TS, French SW, Chedid A. A study of oral nutritional support with oxandrolone in malnourished patients with alcoholic hepatitis. Hepatol 1993; 17: 564-576.
9. Merli M, Riggio O, Dally L, PINC. Does malnutrition affect survival in cirrhosis? Hepatol 1996; 23: 1041-1046.
10. Sarin SK, Dhingra N, Bansal A, Malhotra S, Guptan RC. Dietary and nutritional abnormalities in alcoholic liver disease : A comparison with chronic alcoholics without liver disease. Am J Gastroenterol 1997; 92: 777-783.
11. Kim SH, Sung JK, Lee SO, Lee KT, Lee SM, Lee BS, Kim JH, Kim NJ, Lee HY. The comparison of adverse effect and short-term effect of different dosage of recombinant interferon alpha-2b treatment in patients with chronic active hepatitis type B. Kor J Hepatol 1998; 4: 12-22.
12. Kim BY, Ahn HJ, Oh SW, Jeoung EM, Choi YJ, Kook JH, Kim KC, Hong SP, Hwang SG, Park PW, Lim KS. The degree of TGF-β 1 and α-SMA expression in liver tissues with its prognostic value for the therapeutic efficacy of interferon in chronic hepatitis B. Kor J Hepatol 1998; 4: 317-329.
13. Park NH, Joo KR, Kim DH. The effect of Lamivudine therapy for chronic liver disease due to hepatitis B virus infection. Kor J Hepatol 2001; 7: 77-89.
14. Mark AK, Charles SL. Nutrition in Pancreatic and Liver Disorders. In: Shils ME, Olson JA, Shike M (eds). Modern nutrition in health and disease. 8th edition. Philadelphia: Lea & Febiger, 1994; 1067-1069.
15. Lee SH, Kee CS, Chang YK. The dietary intake and nutritional status of fatty liver patients. Kor J Community Nutr 1998; 3: 622-629.
16. Pugh RNH, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R. Transection of the oseophagus for bleeding oseophagus varices. Br J Surg 1973; 60: 646-649.
17. Vital and Health Statistics Series. Triceps skinfold norms form NHANES II. U.S Department of Health and Human Services: National Centre for Health Statistics, Centres for Disease Control, Public Health Service; 1987 (11): 238.
18. CAN PRO-Computer Aided Nutritional Analysis Program. The Korea Nutrition Centre, 1998.
19. Recommended Dietary Allowances for Koreans 6th revision. The Korean Nutrition Society. Kor J Nutr, 1995.
20. Korean Dietetic Association. Liver Diseases. In: Manual of Medical Nutrition Therapy, 2nd ed. Seoul, 1999: 317-334.
21. Hong DS. Stratified analysis of occupation. Social Science and Policy Committee, 1983; 5: 69-87.
22. Koo BK, Chung JM, Lee HS. A study on the alcohol consumption and nutrient intake in patients with alcoholic liver disease. Kor J Nutr 1997; 30: 48-60.
23. Patek AJ, Toth IG, Saunders M, Castro G, Engel JJ. Alcohol and dietary factors in cirrhosis. Arch Intern Med 1975; 135: 1053-1057.
24. Eghöje KN, Juhl E. Factors determining liver damage in chronic alcoholics. Scand J Gastroenterol 1973; 8: 505-512.
25. Kim SW, Moon SJ, Popkin BM. The nutrition transition in South Korea. Am J Clin Nutr 2000; 71: 44-53.
26. Shim JE, Paik HY, Moon HK, Kim YO. Comparative analysis and evaluation of dietary intakes of Koreans by age groups. Kor J Nutr 2001; 34: 554-567.
27. Caregaro L, Alberino F, Amodio P, Merkel C, Bolognesi M, Angeli P. Malnutrition in alcoholic and virus-related cirrhosis. Am J Clin Nutr 1996; 63: 602-609.
28. Bunout D, Gattas V, Iturriage H, Perez C, Pereda T, Ugarte G. Nutritional status of alcoholic patients: it's possible relationship to alcoholic liver damage. Am J Clin Nutr 1983; 38: 469-473.
29. Thuluvath PJ, Triger DR. Evaluation of nutritional status by using anthropometry in adults with alcoholic and nonalcoholic liver disease. Am J Clin Nutr 1994; 60: 269-273.
30. Loguercio C, Sava E, Marmo R, Vecchio blanco C, Coltorti M. Malnutrition in cirrhotic patients: Anthropometric measurements as method of assessing nutritional status. BJCP 1990; 44: 98-101.
31. Lakshmi Narayanan S, Chawila Y, Sharma M, Bhalla AK, Dilawari JB. Assessment of malnutrition in alcoholic and non-alcoholic cirrhotics. Trop Gstroenterol 1999; 20:1 20-122.