

Free Papers—oral presentation

FO1

EFFECT OF A NUTRITIONAL APPROACH WITH K-17.22 ON ENDOGENOUS HEPATIC ANTIOXIDANT SYSTEM.

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Aim: In this study we tested a natural compound, i.e. K-17.22, which is endowed by transaminases-lowering effect in HCV patients, on free radicals-related liver damage by ischemia/reperfusion injury.

Methods: Wistar rats were fed for 2 weeks with either A) standard diet or B) standard diet added with 30mg of K-17.22 (Yojyo-Henshiko: K-17.22, Kyotsu Inc., Tokyo, Japan). A classical ischemia/reperfusion liver model was prepared and after 60min of reperfusion, hepatic tissue blood flow was measured and the rats sacrificed. A separate survival study was done too. The checked parameters were: liver tissue peroxides, SOD, Catalase, GSH metabolism, hepatic tissue blood flow and radicals-trapping ability of K-17.22 by ESR.

Results: After 60 min of reperfusion, B group showed a significantly lower MDA level ($p < 0.05$ vs controls) and an overall improvement of liver antioxidant system ($p < 0.001$). In particular, GSH and GSH-Px reverted to normal with a significantly lower GPT level ($p < 0.05$). K-17.22 didn't show any free radicals-trapping ability either on superoxide nor on hydroxyl radical systems. Ischemia-reperfusion phenomenon caused a nearly 40% drop of the liver blood flow in A group ($p < 0.001$ vs sham-op.). Pre-treatment with K-17.22 enabled a recovery of such haemodynamic parameter ($p < 0.05$ vs untreated group). Only 20% of rats survived after liver ischemia while B group yielded a 45% survival rate ($p < 0.05$).

Conclusions: The present nutritional approach seems to offer a noteworthy boosting ability on endogenous free radicals scavengers array which is unrelated to its direct in vitro action.

FO3

THE EFFECT OF DIFFERENT DOSAGES OF PALM VITAMIN E IN ENHANCING WOUND HEALING IN DIABETIC RATS.

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Wound healing is a normal process of regenerating injured cells with new ones involving biochemical and physical pathways of the body. However, in diabetes mellitus, wound healing becomes much slower or and this has been attributed to microangiopathy, neuropathy and recently, free radical damage. Palm vitamin E in palm oil contains a higher percentage of tocotrienol (60%) than any other vitamin E sources. In recent years, research has shown that tocotrienol can help prevent carcinogenesis and atherosclerosis by reducing the oxidant levels of the body. This study evaluates the effect of different dosages of palm vitamin E in enhancing wound healing in diabetic rats as compared to normal and healthy rats.

Normal and diabetic (STZ-induced) male Sprague-Dawley rats, weighing around 200-300g were divided into 4 groups, each consisting of 6 rats. Palm vitamin E (200mg/kg, 50mg/kg and 5mg/kg bw) was diluted in olive oil that is also given to control groups for normal and diabetic rats. Treatments were given orally, starting on the same day these rats received 4 wounds on the dorsal area using punch biopsy (6mm) and continued until day 10. Wounds were traced on days 1, 6 and 10 before being analyzed using image analyzer.

The results show that diabetic rats receiving supplementary palm vitamin E (200 mg/kg bw) healed significantly faster than the control group and that the rate of wound healing is dose dependent. In contrast, supplementation of palm vitamin E did not improve the rate of wound repair, even at the highest dose (200 mg/kg bw) for normal rats. In conclusion, supplementation of palm vitamin E enhances wound healing in diabetic rats in a dose-dependent response.

FO2

Relationship between Antioxidative Enzymes Activity with Wound Healing and Effects of Palm Oil Vitamin E Supplementation During Aging

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Antioxidant defence such as vitamin E and antioxidative enzymes such as catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx) should in principle retard aging process with a concomitant increase in maximum life span. Reports had shown that antioxidative enzymes activity varied with age and aging process has been suggested to impair the process of wound healing. The aim of this study is to determine the effect of palm oil vitamin E supplementation on antioxidative enzymes activity and wound healing during aging in rats. Sixteen male Wistar rats aged three months, weighing 200-250grams were divided into two groups. Group A being the control group, were given basal diet, while group B were supplemented with palm oil vitamin E at 5mg/kg body weight. The erythrocyte antioxidant enzyme activities were measured every three months and the wounds were created after six months of treatment. The preliminary results showed that in the control group, GPx activity increased significantly ($p < 0.05$) after three months, while the activity of CAT showed a significant decrease ($p < 0.05$). However there was no significant changes in SOD activity over the six months period. Supplementation with palm oil vitamin E caused a significant reduction ($p < 0.05$) in GPx activity at six months and SOD at three months compared to the control group, meanwhile there is no significant difference in CAT activity. The wound created at the end of the six months showed a slightly higher percentage of healing in the group supplemented with palm oil vitamin E as compared to the control though the increase is not significant. However, the relationship of wound healing and level of antioxidative enzymes activity had not been clearly shown in this preliminary report and that the study is still ongoing.

FO4

HAEMORRHOLOGICAL ABNORMALITIES IN CHRONIC LIVER DISEASE: EVIDENCE OF A FREE RADICALS ROLE AND IMPROVEMENT BY AN ORAL ANTIOXIDANT

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Aim: The aim of this study was to test a novel acid-resistant antioxidant on the haemorrhological parameters in alcoholics.

Methods. 30 alcoholics (150g ethanol/day for 3 to 5 years) were randomly, double-blindly allocated into 2 groups which were given for 2 weeks 18g/day of fermented papaya antioxidant preparation (FPAP, Osato Research Institute, Gifu, Japan) or placebo. Blood samples were taken for: routine tests, alcohol, acetaldehyde, plasma GSH and erythrocyte (RBC)-malonidialdehyde (MDA). Haemorrhological studies were as follows: blood and plasma viscosity, whole blood filterability (WBF), RBC-membrane, RBC-aggregation index and RBC-deformability.

Results: As compared to controls, alcoholics on placebo showed no change of plasma viscosity but a significantly higher RBC-MDA, blood viscosity ($p < 0.05$) and lower plasma GSH, WBF and RBC membrane fluidity ($p < 0.01$). FPAP group yielded a significant recover to control values of either blood viscosity and WBF ($p < 0.01$) and an improvement of RBC-membrane fluidity ($p < 0.05$), RBC-MDA and plasma GSH. RBC aggregation decreased in alcoholics ($p < 0.05$ vs control) and was not affected by FPAP. FPAP significantly improved the reduced RBC deformability ($p < 0.05$ vs control) and which correlated to RBC-MDA ($r: 0.62, P < 0.05$).

Conclusions: These preliminary data suggest that an effective antioxidant supplementation is able to improve the haemorrhology in alcoholics either by directly affecting the ethanol-related lipoperoxidation and xanthine oxidase system activation and/or by modifying RBC membrane characteristics.

FO5

Spermine alleviates hydrogen peroxide induced oxidative damage in IEC-6 cells.

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Aim: Human milk contains a number of bioactive substances, some of which are known as antioxidant. We have shown that defatted human colostrum alleviated hydrogen peroxide induced oxidative damage in rat intestinal epithelial IEC-6 cells (presented at ESPGHAN 2001). Polyamines (putrescine, spermidine, spermine), deeply involved in cell proliferation and differentiation in mammalian cells systems including the gastrointestinal tract, is found in human milk, and they may contribute antioxidative capacities of human milk. In this study, antioxidative properties of spermine were examined in IEC-6 cell system.

Methods: Confluent IEC-6 cells were preincubated for 24 hours either with 100 times diluted defatted human milk or increasing concentrations of spermine, followed by 0.25mM hydrogen peroxide challenge for 30minutes. Survived cells were evaluated 24 hours later by neutral-red uptake assay.

Results: Survived cell rates of non-preincubated cell, human milk or 0.5, 1, 5 μ M spermine-preincubated cells were 7.0(3.6)%, 44.0(3.4)%, 12.6(2.9)%, 13.1(2.6)%, 22.2(3.8)%, respectively. [Mean (SD)] Significantly higher survival rates were observed in the cells preincubated with human milk and spermine in comparison with non-preincubated cells.

Conclusions: The results of this study demonstrated that spermine alleviated hydrogen peroxide induced oxidative damage in IEC-6 cells. In conclusion, spermine in human milk may exhibit antioxidative properties in gastrointestinal tract of infants.

FO7

Serum Antioxidative Vitamin Level on Patients with Chronic Obstructive Pulmonary Disease (COPD).

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Introduction: Malnutrition is commonly observed in patients with COPD and body weight loss has been reported to be correlated with decrease in diffusion capacity due to destruction and enlargement of alveoli. Massaro et al. found that all-trans retinoic acid (ATRA) increased the number of alveoli in rats with experimental emphysema (Nat Med 3,675-677,1997).

Objective: We aim to determine the human serum levels of antioxidative vitamins including retinol, β -carotene and vitamin E and to investigate the relation between antioxidative vitamins and pulmonary function or smoking habit.

Methods: Thirty male patients with COPD and age-matched healthy control subjects participated in this study. HPLC method was used to measure retinol, β -carotene and vitamin E. Pulmonary function test and nutritional assessment were performed in patients group.

Results: No significant differences were seen in serum antioxidative vitamins between patients and control subjects. In patients group retinol and β -carotene significantly correlated with smoking index and forced expiratory volume in 1 second (FEV1), respectively ($p < 0.05$).

Conclusion: Decrease in serum antioxidative vitamins may be associated with exacerbation of airflow limitation in patients with COPD.

FO6

CYANOCOBALAMIN ABSORPTION FAILURE IN ALCOHOLIC LIVER DISEASE CAN BE PREVENTED BY A NOVEL FERMENTED PAPAYA PREPARATION

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Aim: Chronic alcoholics may have a reduced serum level of cyanocobalamin and there are scanty reports suggesting a role of ethanol-generated free radicals. Thus, the aim of this study was to test novel fermented papaya antioxidant preparation (FPAP, Osato Res. Institute, Gifu, Japan) on cyanocobalamin absorption in alcoholic chronic liver disease (CLD) patients.

Methods: 30 patients with alcoholic CLD (>150g ethanol/day for at least 5 years) and 24 teetotallers underwent baseline chemistry and Dual Isotope Schilling test (DIST). During endoscopy, biopsy samples were taken from gastric antrum and body to assay: routine histology, malonyldialdehyde (MDA), vitamin E, GSH concentration and vitamin B₁₂-Intrinsic Factor (IF) binding. Examinations were repeated after one week supplementation with FPAP 9g/day.

Results: Plasma MDA level, lipid hydroperoxides, MDA and xanthine oxidase concentration in the gastric mucosa were higher in CLD than in healthy subjects ($p < 0.01$) and significantly decreased after FPAP ($p < 0.05$). Gastric mucosal GSH was depleted in CLD patients and partly recovered with FPAP ($p < 0.05$ vs baseline). Although the CLD patients showed normal IF secretion in the gastric juice, they exhibited an impaired IF-cobalamin binding on the *in vivo* study ($p < 0.001$). Moreover, nearly 23% of them had an abnormal DIST. Both these failures reverted to normal after FPAP treatment ($p < 0.01$ vs baseline).

Conclusions: It can be postulated that the antioxidative action played by FPAP possibly due to its availability of substrates for GSH synthesis as well as its effect on local oxidative burst from neutrophils, is able to recover a normal cobalamin absorption.

FO8

VTAMIN B1 NUTRITIONAL STATUS IN MIDDLE AGE MEN AND WOMEN LIVED IN JAPAN AND CHINA

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Aim: Recently, with variation of life style including food intake nutritional status is changing in Japanese and also Chinese. On the other hand, it was reported that vitamin B1 intake of Japanese in average were enough (1.18 mg/day, 0.6 mg/1000 kcal), 153% for Japan recommended allowance, by the national nutritional survey of Japanese. But in some paper it was reported that vitamin B1 concentrations in blood of Japanese young women were very low, 20-35 ng/ml.

Methods: To clarify vitamin B1 nutritional status and health status of inhabitant in Japan and China, 559 men (47.8 \pm 8.4 years) and 355 women (47.3 \pm 9.1 years), total 914 inhabitant lived in Kyoto and Shiga prefectures in Japan, and 100 men (44.6 \pm 5.0 years), and 100 women (41.0 \pm 2.8 years), total 200 inhabitant lived in Nanjing prefecture were selected for volunteers with informed consent. All subjects were undergone physical and biochemical examinations including medical examination by interview, blood test including vitamin B1 concentration in blood and plasma biochemical test in June and July 2000. Blood vitamin B1 concentration was determined by post-column HPLC method.

Results: The subjects had not especially diseases. Blood vitamin B1 concentration in average was 35.8 \pm 10.0 ng/ml in men and 31.4 \pm 8.2 ng/ml in women. By national nutritional survey, average vitamin B1 intake in middle aged Japanese was 1.28 mg/day (total average 1.30 mg/day) in men and 1.10 mg/day (total average 1.15 mg/day) in women. That are enough value compared to Japan recommended allowance. In inhabitant lived in Nanjing China blood vitamin B1 concentration was 49.19 \pm 10.15 ng/ml in men and 47.80 \pm 11.21 ng/ml in women, and vitamin B1 intake was 1.30 \pm 0.32 mg/day in men and 0.88 \pm 0.29 mg/day in women in average.

Aim: This discrepancy between blood concentration and intake of vitamin B1 in Japanese and Chinese is important problem to consider vitamin B1 nutritional status.

FO9

Thiamine Deficiency in the Critically Ill Patient under Peripheral Parenteral Nutrition.

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Aim: Thiamine deficiency in hospital may not be as rare as was thought, particularly in the critically ill patient whose requirement is high. The purpose of this study was to determine the frequency and significance of thiamine deficiency in the critically ill patient under peripheral parenteral nutrition (PPN).

Methods: We performed a prospective study on 17 patients admitted to our center. The patients received PPN without any vitamins for 3-5 days. Data were collected before and after PPN, and 2 or 3 days after enteral nutrition (EN). Whole blood thiamine concentrations were measured by post-column HPLC. Twenty-six ng/ml is the lower limit of normal for whole blood thiamine in the Japanese population. Comparisons for significant differences were performed by ANOVA.

Results: Seventeen patients (9 male, 8 female) were studied: 9 were hospitalized in disease, and 8 in trauma. Mean age was 56 (16-85). Mean glucose intake was 126 g/day, and mean nitrogen intake was 7.91 g/day.

Thiamine concentration were 38 ± 14 ng/ml before PPN, 31 ± 10 ng/ml after PPN, and 35 ± 16 ng/ml after EN. Differences between measured thiamine concentrations were statistically significant before and after PPN ($p < 0.05$). But, the thiamine concentrations had no change between after PPN and after EN.

Conclusions: In the critically ill patient, whole blood thiamine concentrations were decreased under PPN, and the data suggest the importance of thiamine supplementation.

FO11

Cause of anorexia during viral infection is different from during bacterial infection in rats

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Aim: Mechanisms of anorexia during acute diseases such as infection are not fully understood. Food intake (FI) is a product of meal size (MZ) and meal number (MN: $FI = MZ \times MN$). MZ and MN are regulated independently by different systems. Thus, measuring MZ and MN, not only FI alone, provides insights into the etiology of the pathogenesis of the anorexia. A decrease in FI during bacterial infections occurs via a decrease in MN, linked to tumor-necrosis factor (TNF)- α . Pattern of a decrease in FI during viral infection has not been previously reported.

Methods: FI, MZ and MN were measured via a rat eater meter in male Fischer rats ($n=7$) during opportunistic sialodacryoadenitis (SDA) viral infection, a common short-lived infection in rats akin to mumps in humans. Data were analyzed via ANOVA and t-test.

Results: After infection, FI decreased by 68% only via a decrease in MZ by 69%. MN did not decrease significantly. During recovery, MN slightly increased.

Conclusion: The difference between the pattern of a decrease in FI during SDA viral infection and a bacterial infection suggests that factors other than TNF- α play a significant role in the mechanism of anorexia during viral infection. An increase in MN may nutritionally accelerate prompt recovery in patients with acute viral infection.

FO10

The Effect of folic Acid on development of stomach and other gastrointestinal cancers

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Aim: To evaluate the roles for folic acid and β -carotene in chemoprevention of gastric and other gastrointestinal cancers. **Methods:** 216 patients with atrophic gastritis were randomly assigned to one of four groups—folate, natural β -carotene (N- β C), synthetic β -carotene (S- β C), and placebo. Follow-up continued from 1994 to 2001.

Results: 7 new cases of gastrointestinal cancers were diagnosed with 3 stomach, 1 colon and 1 esophageal cancers in placebo; 1 each stomach cancer in N- β C and S- β C and none in folate group. For GI cancers development, there was a significant reduction in folate, compared with placebo ($P=0.04$), and a similar trend in both N- β C and S- β C ($P=0.07 \sim 0.08$). For development of gastric cancer, any alone of the three active-treated groups did not reach the statistically significant reduction, but the combined almost did ($P=0.06$). Folate group showed obvious improvement of the gastric mucosal lesions with more reversed dysplasia (at 12 months, $P=0.017$), and atrophy and intestinal metaplasia (at the end of follow-up, $P=0.04$, $P=0.06$). No side-effect was found in folate.

Conclusions: This trial revealed the intervention effect of folic acid on development of GI cancers. Also, folic acid could be used to treat atrophic gastritis with improvement of the precancerous lesions.

FO12

Nutrition Management Record and Problem Oriented System

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Aim: The present study aimed to find out the status of entries in nutrition management records and examine the ideal method of nutrition management recording.

Methods: The first survey was conducted in June 1999 targeting a total of 72 medical institutions. The second survey was conducted in August 2000, on 42 institutions that responded in the previous survey as "adopting the problem oriented system (POS)" in nutrition management recording.

Results: In the first survey, 56.9% of the institutions adopted POS in nutrition management recording. Among them, 54.8% entered the records during working hours. As entry method, 67.2% used the description method and 27.6% used the checklist method. Concerning the required ability of the recording person and appropriateness of the entries, many institutions responded that there are "problems in medical knowledge and understanding of the main points". In the second survey, the contents of POS records were analyzed for 29 institutions that have compiled a checklist. Almost all the institutions used the POS recording method of SOAP. The contents included medical data and information of dietary habit, treatment problem, nutrition assessment, and nutrition guidance method. Only 41.4% of the institutions have compiled criteria for objective judgement by "evaluation".

Conclusions: The surveys show that facilities adopting the POS in nutrition management recording are actively engaged in patients' nutrition management. However, the appropriateness and simplification of entries as well as POS application methods need to be reexamined.

FO13

Dual forms of malnutrition: Why it happens in the same household?

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Aim: This study was aimed to investigate determinant factors affecting dual forms of malnutrition happening in the same household and to compare them with their normal counterparts.

Methods: The study was designed in a cross-sectional manner employing purposive sampling method where households with dual forms of malnutrition are those with overweight (BMI>25) mothers and underweight (WAZ<-2SD) underfives; and normal households are those with normal nutritional status of both mothers and underfives. Structured questionnaire on possible determinant factors, anthropometric and physical activity level (PAL) measurements, and dietary assessment were performed.

Results: Dual-form group tend to be less favorable as compared with their normal counterparts in terms of practices on intra-familial food distribution; caring practices; child's health; mother's knowledge on feeding practices, underweight and overweight condition. No difference in the underfives' PAL was observed between dual-form and normal groups, but mothers' PAL tend to be lower in dual-form group. Number of underfives who was below 2/3 of RDA for energy and protein intake was higher in dual-form group.

Conclusions: The energy balance of the underfives in dual-form group was lower than in normal group and influenced by energy intake and BMR, but not by physical activity level. Neither physical activity level nor energy intake influenced the energy balance of mother which was no difference between two groups. However, BMR influenced the energy balance of mother.

FO15

EFFECT OF HYPOALBUMINEMIA ON THE TREATMENT OUTCOME OF PAKISTANI CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIA

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AIMS: To assess the effects of Hypoalbuminemia on the treatment outcome.

METHODS: 163 patients with Acute Lymphoblastic Leukemia (ALL) below the age of 14 years with L1 & L2 FAB morphology were included in this study. All the sample were of newly diagnosed & untreated patients. Treatment protocol used was FBM. Serum Albumin were also recorded before treatment & Malnutrition classification was done (See Rodwell 1985) as Well-nourished (G-0), Mildly Malnourished (G-1), Moderately Malnourished (G-2) & Severely Malnourished (G-3). Statistical analysis was performed by using one-way ANOVA.

RESULTS:

Mean Age was 6.8± years, Mean Height was 108.90± cm & Mean weight was 19.63± kg. Of 163 patients Well-Nourished (WN) were 56% & 44% were Under-Nourished (UN). Out of these 163 patients mildly malnourished were 21%, moderately malnourished 15% & severely malnourished were 8%. Overall Treatment outcome show that the patients who completed their treatment & alive were 51%. Relapsed were 8% & expired were 41%. 56% completed treatment & alive, 8% relapsed & 36% expiries were observed in WN (Grade-0). 50% completed treatment & alive, 7% relapsed & 43% expiries were observed in Grade-I. 43% completed treatment & alive, 14% relapsed & 43% expiries were observed in Grade-II. 18% completed treatment & alive, 9% relapsed & 73% expiries were observed in Grade-III.

CONCLUSION:

Our data were not significant (P=0.35) to prove the hypothesis that the hypoalbuminemia adversely effects the treatment outcome in Pakistani children with Acute Lymphoblastic Leukemia (ALL).

FO14

Tempe Powder Improves Nutritional Status of Malnourished Children In Indonesia

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Aim: Tempe, one of traditional food in Indonesia has been recognized to have higher nutrition values. To provide complementary feeding locally available for children, Tempe Powder was developed with higher bioavailability and micronutrients content. Does Tempe Powder supplementation for 3 months increase nutritional status of malnourished children?

Methods: Forty malnourished children (6-35 mo) were chosen for this study. Each child received 500g Tempe Powder every week. Cadres were first trained to make Tempe Powder and then distributed it to each child. Weight was measure at the beginning and each month. Weight for age (WA z-scores) of International standard was used as a nutritional status indicator. Changes of WA z-score were assessed using paired t-test.

Results: The study showed that most children accepted the Tempe Powder well (83%). Accordingly, nutritional status of children improved significantly from baseline to the end (p<0.0001). Average of WA z-scores each months were -2.13 ± 0.8, -1.84 ± 0.8, -1.61 ± 0.9, and -1.50 ± 0.8, respectively for exam I-IV. At the beginning there were 8 severe malnourished children (<-3 z-score). However at second month until the end, there was only 1 severe malnourished child. In addition, most children (80%) become well nourished (>-2 z-score) at the end of this study.

Conclusion: Tempe powder could be effectively used for treatment of severe malnourished children in areas that Tempe is commonly consumed.

FO16

Supplementary Feeding Program for Underweight Children Under Five Years at Tebet Health Center, South Jakarta

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Aim: To determine the characteristics of the underweight children under five years old, and to evaluate the effectiveness of the supplementary program.

Methods: A descriptive, analytic and cross-sectional design. The instrument used was closed-ended questionnaire consisting of 56 variables. Seventy-eight parents of underweight children and 52 nutrition cadres were proportionally random sampled from 7 villages under the jurisdiction of Tebet reference health center.

Results: Parents had mostly lower education level, with average of family income was below US.40.00 per-month and worked as laborer. Underweight children were mostly female (65%) and eighty percent of the underweight only ate "3 healthy" out of 4 and 5 excellent (Purwo Soedarmo slogan on balance diet in the community), and 51% had improper eating pattern above two years. Forty-percent cadres were for more than ten years with moderate average knowledge on nutrition. Most of the cadres experienced financial difficulties for attending monthly weighing program due to economic problem in the family. Among those underweight, seventy percent of underweight had increased the Nutritional status.

Conclusions: The supplementary feeding program was effective to increase the body weight as shown by comparing pre and post program body weight where paired T test was p<.001 but was not sufficient to enhance the nutritional status significantly.

The management issues address promotion should be more intensively to the parents who had under 5 year children, socialization supplementary diet program to the community and improving knowledge of the cadres as a field manager.

FO17

Effects of medium-chain triglyceride in parenteral nutrition on rats undergoing gastrectomy

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Abstract

This study was designed to investigate the effects of preinfusion with total parenteral nutrition (TPN) using medium-chain triglyceride (MCT) versus long-chain triglyceride (LCT) emulsion as fat sources on hepatic lipids, inflammatory mediators and antioxidant capacity in rats undergoing gastrectomy. Rats with internal jugular catheter, were divided into two groups and received TPN. TPN supplied 300 kcal/kg/d with 39% of the energy provided as fat. All TPN solutions were isonitrogenous and identical in nutrient composition except for the fat emulsion, which was composed of MCT/LCT (1:1) or LCT. After receiving TPN for 5 days, the rats underwent partial gastrectomy and were sacrificed 24 h after surgery. The results of the study demonstrated that the MCT/LCT group had lower hepatic lipids than did the LCT group. No differences in interleukin-1 β , interleukin-6 and tumor necrosis factor- α in peritoneal lavage fluid were observed between the two groups. Erythrocyte glutathione peroxidase activity was significantly higher in the LCT group than the MCT/LCT group, although erythrocyte superoxide dismutase activity did not differ significantly between the two groups. These results suggest that infusion with MCT/LCT before an abdominal operation did not have an effect on modulating the production of inflammatory mediators in the location of the injurious stimulus. However, preinfusion with MCT/LCT have beneficial effect in improving liver lipid metabolism and reducing oxidative stress in rats with gastrectomy.

FO19

Effects of fish oil concentrate on the circulating Interleukin-6 in Thai Rheumatoid Arthritis on low n-6 fatty acid diet

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Objectives: To examine the changes of IL-6 in active Rheumatoid Arthritis (RA) consuming low n-6 fatty acid (FA) diet and fish oil concentrate supplementation.

Method: 22 patients (4 M, 18 F) with active RA according to American College of Rheumatology criteria entered the study after given consent. The study lasted 24 wks. The patient's medications had been kept constant at least 3 month before enrollment. At wk 0, All were advised to consume low n-6 FA and maintain throughout the study. They were assigned to receive n-3 FA (Omacor®: 47% EPA and 37% DHA) from wk 6 to wk 18 as adjunctive therapy. The total n-3 FA was 3.36 gm/day. 3-day dietary records were assessed every 6 wk. Patients' compliance were monitored with capsule count and total serum FA analysis. Serum IL-6 were analysed in a serial fashion by ELISA.

Results: 10 patients completed the study. (5 violated the protocol, 2 admitted due to other illnesses, 5 unstable medications) At wk 0, IL-6 was 133.74 \pm 36.26 pg/ml (mean \pm SEM) and declined to 112.32 \pm 21.72, 123.06 \pm 29.08 and 41.18 \pm 6.79 pg/ml at wk 6, 18 and 24, respectively. IL-6 significantly decreased from wk 6 to wk 24. (P=0.002). **Conclusion:** Serum IL-6 gradually declined and reached a significant difference at wk 24.

FO18

Dietary Medium-chain Triacylglycerols Suppress Accumulation of Body Fat Compared in a Double-blind Controlled Trial.

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Aim: We investigated the effect of long-term ingestion of dietary medium-chain triacylglycerols (MCT) on body weight and fat in humans.

Methods: Using a double-blind, controlled protocol, we assessed the potential health benefits of MCT in comparison with long-chain triacylglycerols (LCT) using 78 healthy volunteers. Changes in anthropometric variables, body weight and body fat profiles during the 12 wk treatment period were compared with those in subjects consuming the LCT diet. The subjects were asked to consume 9218 kJ/d energy and 60 g/d total fat.

Results: The energy, fat, protein and carbohydrate intakes did not differ significantly between the groups. Body weight and body fat in both groups were decreased at 4, 8, and 12 wk into the study period. However, in the subjects with BMI>23kg/m², the extent of the decrease in body weight was significantly greater in the MCT group than in the LCT group. In subjects with BMI>23kg/m², the change in body fat in the MCT group was significantly lower than that in the LCT group.

Conclusions: These results suggest that the MCT diet may reduce body weight and fat in individuals (BMI>23kg/m²) to a greater extent than the LCT diet.

FO20

Effects of long-term high-monounsaturated-fat diet on glucose and fat metabolism in patients under total enteral nutrition through percutaneous endoscopic gastrostomy

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Aim: Effects of long-term enteral diet with different fat content on nutritional status, glucose and fat metabolism were examined in patients under total enteral nutrition through percutaneous endoscopic gastrostomy (PEG) route.

Methods: These patients were subjected to be randomly assigned into 3 experimental groups of enteral nutrition with different fat content: Group A received high-unsaturated fat diet (calorie % of fat was 50%), Group B received medium fat diet (calorie % of fat was 40%), Group C received low fat diet (calorie % of fat was 25%). The patients received 100-120% calories of energy expenditure of this EN for 3 months based on Harris-Benedict equation. Nutritional status, albumin, glucose, insulin, glucagon, total cholesterol (TC), triglyceride (TG), and HDL cholesterol (HDL-C) 30 min after enteral feeding were examined at 3 months to see whether there is difference in nutritional status and substrate metabolism between each group.

Results: While there are no difference of glucagon, TC, and HDL-C, Insulin in Group A, B, C 30 min after enteral feeding (Mean \pm SEM) was 83 \pm 23, 95 \pm 2, 118 \pm 27 μ U/ml, respectively. Blood glucose in Group A, B, C was 160 \pm 17, 154 \pm 17, 165 \pm 20 mg/dl, respectively. TG in Group A, B, C was 132 \pm 16, 124 \pm 35, 197 \pm 36 mg/dl, respectively and this value in Group A was significantly lower than the value before the start of enteral diet specific formula.

Conclusions: Long-term infusion of high-monounsaturated fat diet through enteral route may be beneficial for lowering TG for the long-term and for attenuating insulin response after enteral feeding.

FO21

Arginine prevents renal tubulointerstitium from fibrosis after massive small bowel resection.

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Aim : Our experiment was designed to clarify whether massive small bowel resection induces tubulointerstitial fibrosis (TIF) in the kidney and arginine (Arg) administration can prevent tubulointerstitium from it after massive small bowel resection.

Methods: Four-week-old male SD rats underwent 90% proximal small bowel resection (90% SBR). Thereafter, they were divided into 3 groups such as G-1, G-2 and G-3. They were kept by elemental diet (Elental-P, ED-P) with or without Arg supplementation in G-1 and G-2 for 6 weeks after surgery, respectively. In G-3, ED-P without Arg supplementation was given for 3 weeks. Thereafter, their food was changed to ED-P with Arg supplementation for 3 weeks. Pair-fed control rats underwent simple anastomosis, and ED-P with or without Arg supplementation was given for 6 weeks, respectively. They were sacrificed 6 weeks after surgery.

Results : In G-2, low plasma levels of Cit and Arg, increased urinary excretion of orotate, and TIF were observed 6 weeks after surgery. In G-1 and pair-fed control groups, renal histology showed normal glomeruli and tubulointerstitium. However, TIF was still observed in G-3.

Conclusion : Arg deficiency causes TIF in the kidney following massive small bowel resection.

FO23

Living-related Small Bowel Transplantation for a Patient with Intestinal Failure Associated with TPN-related Liver Dysfunction

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Background: Although intestinal failure can be well managed by total parenteral nutrition (TPN), long-term TPN sometimes causes life-threatening complications and small bowel transplantation (SBTx) is a final solution. We have performed a living-related SBTx in a 16-year-old boy with microvillus inclusion disease who developed liver dysfunction from a long-term TPN.

Case Report: The patient presented with vomiting and intractable diarrhea since the first day of life and had been managed by TPN thereafter. Around the age of 14 years, hepatosplenomegaly progressed with thrombocytopenia and coagulopathy. Liver biopsy showed remarkable steatosis and bridging fibrosis. The entire small bowel of the recipient was resected and was replaced by an ileal graft of 150 cm from his blood-type-identical grandmother. A double-barrel stoma was reconstructed using the distal ileum of the recipient and the donor for endoscopic surveillance and biopsy. Evident rejection was detected three times and was controlled. Oral feeding was started on the 14th day after SBTx with gradual development of tolerance. At fifth month, TPN was withdrawn. Hepatomegaly, coagulopathy disappeared. Liver biopsy showed complete disappearance of steatosis, while bridging portal fibrosis was still present. Because of persistent splenomegaly with pancytopenia, splenectomy was performed at 11th month. At 13rd month, stoma was closed. Currently (20th month), he tolerates regular diet without intravenous fluid supplement and is gaining body weight.

Conclusion: SBTx may establish the full supplement of oral feeding and withdrawal of TPN in a patient with intestinal failure, resulting in disappearance of TPN-related steatosis.

FO22

Benefit of Nucleosides and Nucleotide Mixture in Fetal Small Bowel Transplantation

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Aim : We aimed to estimate the effect of the nucleoside (NS) and nucleotide (NT) on the recipient's intestine and the graft in the model of syngenic small bowel transplantation using fetal rat intestine as a graft.

Methods : A segment of jejunum, 2 cm in length, of fetal Lewis rat at 19th day of gestation, was transplanted into the abdominal wall of the 5 weeks old Lewis rat by non-vascular anastomotic technique. After transplantation, the rats were separated into two groups, group 1 (NS and NT free) and group 2 (NS and NT supplemented). The grafts and the recipients were estimated morphologically on 14 days after the transplantation using conventional histological study and immunohistochemical study of neuron and smooth muscle.

Results : The small intestine of recipients in group 1 showed poor gain of body weight, although they received similar amount of food to those of group 2. The grafts of group 1 showed poor development of length, diameter and wet weights. They also showed the poor development of villi, abnormality of nerve distributions, and degeneration of muscle layer structure in histological and immunohistochemical studies.

Conclusions: NS and NT are considerable to be essential nutrients for intestinal growth and keeping of structures in the fetal small bowel transplantation.

FO24

Gastro-esophageal reflux and cow's milk intolerance in infants and children: a prospective clinical, physiological, and histological study

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Aim : To show the clinical, physiological and histological characteristics in GER with cow's milk intolerance

Methods : Nine children with GERD less than 6 years old who had at least recurrent vomiting as their symptom were studied. Endoscopic and histologic diagnosis, gastric scintigraphy and 24 h-pH monitoring, blood tests were done.

Results : All children had cow's milk intolerance clinically. Acid reflux in esophagus and delayed gastric emptying were shown. Duodenitis with histamine and substance P and mild esophagitis were present in these children.

Conclusions : Duodenitis with chemical mediators secondary to cow's milk intolerance may play an important role for the cause of GER in children.

FO25**Effects of Bifidobacterium breve (B breve) Administration on the Intestinal Flora in Low Birth Weight Infants**

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Aim: The flora of breast-fed infants differs from that of formula-fed infants. It is thought that this difference in flora is one of the important reasons why breast-fed infants suffer less from gastrointestinal diseases. However very little is known about faecal flora in neonates fed with *B breve* after their birth. The purpose of this study is to characterize the differences of the faecal flora of low birth weight infants given *B breve* within 24 hours or more than 72 hours after their birth and those without them.

Methods: This study was carried out on 15 low birth weight infants admitted to neonatal intensive care unit in Juntendo University Hospital. The neonates were divided into three groups fed with *B breve* within 24 hours (A group, n=5), more than 72 hours (B group, n=5) after their birth and without being given (C group, n=5). The mean gastrointestinal age, birth weight and the age of being fed were 33 weeks 6 days, 1523g, 4.4 days; 33 weeks 6 days, 1354g, 4.5 days and 32 weeks 6 days, 1480g, 3.4 days respectively in the 3 groups.

The fresh specimens were immediately cultured and analysed faecal flora basically using the method reported by Mitsuoka.

Results: There was not significant difference in microflora between A and B groups. But they were different from C group. The colonizations of the anaerobe, Bifidobacteria and Lactobacillus were detected in A and B groups but not in C group. The number of Enterobacteriaceae is higher in group C than in group A and B. Bifidobacteriaceae colonized more stably in group A than in group B.

Conclusion: In this study, administration of *B breve* induced changes in microflora in the 3 groups. Our results showed that the supplementation of *B breve* in very early period of life is useful in favorable the colonization of Bifidobacteria and the decrease of Enterobacteriaceae.

FO27

Cancelled

FO26**Glicentin Inhibits Internalization of Enteric Bacteria by Cultured INT-407 Enterocytes**

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Aim: Glicentin, the main component of enteroglucagon, has trophic effects on intestinal mucosa. It may also have an inhibitory effect on extraintestinal invasion of enteric bacteria. We have established an in vitro bioassay system for determining the effects of recombinant human glicentin on cell-cell junctions formation and bacterial internalization by confluent enterocytes.

Methods: INT-407 cell line was serum-deprived for 2 days, then was treated with a medium for 24 h containing one of the following: glicentin 1 μ g/ml, 10% fetal bovine serum (FCS) or without any growth factors. 1) Monolayers were confirmed using immunofluorescence technic and exposed to E-cadherin, ZO-1 and sIgA. 2) INT-407 cells were grown on transwell filters. Pure cultures of Salmonella typhimurium and Escherichia coli were introduced to the upper chamber of the filter units. Followed by 2 hr. incubation with bacteria, numbers of bacteria in the lower chamber were measured.

Results: 1) Confocal laser scanning microscopy showed that glicentin caused a marked induction of E-cadherin, ZO-1 and sIgA. E-cadherin level with glicentin treated group was approximately 150% of control group. 2) Pretreatment of enterocytes with glicentin inhibited bacterial internalization compared to untreated enterocytes.

Conclusion: Glicentin was associated with inhibition of enterocyte internalization of enteric bacteria by a mechanism that might be related to the integrity of the enterocyte adhesive junctions, tight junctions, and production of sIgA. Glicentin seems to have a function as a barrier-sustaining agent that inhibits extraintestinal invasion of enteric bacteria.

FO28**Comparison of Glycemic Index between Japanese NIDDM and the non-diabetic subjects**

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Aim: The GI values of two Japanese food products were compared between the NIDDM and the non-diabetic subjects based on rice as the reference food.

Methods: Subjects consumed 50g glucose mass of white rice (reference food) at least two times, red glutinous rice and vinegar rice (sushi) once on separate days after an overnight fast. Capillary blood glucose measurement were conducted. Glycemic Index of each food was expressed as the ratio of incremental blood glucose areas of the test food and the reference food.

Result: A total of 18 NIDDM and 17 controls remained in the final analysis. Significant differences in blood glucose areas, age, HbA1c, and fasting plasma glucose were seen between NIDDM and the controls. The GI for the control and NIDDM were 94 and 96 (red glutinous rice) and 79 and 93 (sushi), respectively. The smaller vinegar effect in GI reduction seen among NIDDM was thought to be due to the poor metabolic control of diabetes. Patients having higher HbA1c (>9.8%) showed positive correlation ($r=0.7$, $p=0.04$) between HbA1c and GI of sushi. In addition, significant positive correlation was seen between GI sushi and diabetes ($r=0.973$, $p<0.005$, $n=7$).

Conclusion: The Glycemic Index of sushi was higher among the NIDDM when compared to the control. The effect of vinegar in reducing GI not seen could be due to the poor metabolic control of diabetes.

FO29

Diet and Lifestyle Intervention in Bone Accumulation of School Children to Prevent Osteoporosis: 5-Year Follow-up Study in a Small Village

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Aim: High dose of calcium supplementation was known to accelerate to increase bone mass in adolescent, however, the effect of changes in diet and lifestyle on bone mineral accrual is not known. We examined the effect of improving diet such as intake of calcium and other nutrients-rich foods on bone mass accumulation in adolescent.

Methods: All girls and boys aged 10 to 15 years (n=548) living in a small village were yearly measured by ultrasound densitometer (Achilles A1000) at calcaneus and were educated how to prevent osteoporosis for 5 years. Menstrual status, food intake, physical activity and other lifestyle factors were obtained by questionnaire and interview.

Results: The peak bone mass was accumulated by the age of 14 or 15 years in girls and later in boys. Their bone mass were associated with body weight, height, body mass index (kg/m²) and intake of dairy products and small fish in girls and boys, age at menarche and Japanese sitting-style on floor in girls. Yearly increase in bone mass was associated with increased intake in vegetable and fish in girls and boys and also associated with consciousness of their previous bone measurements in boys, who had increased in calcium-rich food.

Conclusions: Bone measurement and nutritional education to prevent osteoporosis in adolescent should enable to accumulate higher peak bone mass by their efforts of improving diet.

FO31

Renal ketogenesis during hepatic inflow occlusion with Ringer's acetate infusion in rabbits and dogs

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Aim: We have reported that administration of Ringer's acetate solution (AR) during hepatic inflow occlusion in rabbits merits in the following two points over Ringer's lactate (LR). First, sodium acetate can be metabolized in the extra-hepatic organs and yields alkalinizing agent. Second important finding is that the kidneys were able to yield ketone bodies during hepatic inflow occlusion with AR administration. In this study, we aimed to clarify whether the renal ketogenesis is the phenomenon exclusively observed in the rabbits or a common phenomena occurs also in other species.

Methods: Male mongrel dogs were infused with AR or LR during hepatic inflow occlusion for 40 min, and further studied for 30 min after the release of the occlusion without infusion. Acid-base balance, ketone body concentrations (KBC) in arterial and renal venous blood were examined.

Results: Blood KBC that markedly decreased with LR infusion were maintained with AR (p<0.01). Renal venous KBC was also maintained (p<0.01) and even slightly higher compared with arterial KBC.

Conclusion: Renal ketogenesis during hepatic inflow occlusion occurred in the dogs if AR was administered.

FO30

Nutrition and Isolation Stress in Stroke-Prone Spontaneously Hypertensive Rats

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Introduction: The effect of isolated caging on the development of hypertension and its complications in SHRSP (Okamoto, K., et al. 1974) was reported (Horie, et al. 1991). In this study, the effect of a high protein diet and high fat cholesterol (HFC) diet on such isolation stress was examined.

Materials&Methods: Fifty-three SHRSP were used. The first experiment; 13 rats were kept in isolation, and 7 rats were kept together in one cage (14 in total). These rats were fed on a high protein (50%) diet with 1% NaCl for drinking water. The second experiment; 12 rats were kept separately and 7 rats were kept in a group, i.e., preparing 2 cages for 14 animals in total. HFC diet containing 20% fat and 5% cholic acid was given with 1% NaCl for drinking water. During both experiments, BP and BW were checked, 24h urine analysis was performed, and food and water intakes were measured. They were all sacrificed for autopsy.

Results with Discussion: A high-protein diet prevented isolation stress as previously confirmed by decreases in urinary Ca and catecholamin excretion. Consequently, stroke did not occur. It has already been reported that a high protein diet, even with 1% NaCl for drinking water, prevents stroke. In the present study, additional isolation stress was also prevented. On the other hand, HFC diet reduced the incidence of stroke in both rats kept in isolation and kept in a group, by decreasing BP with reduced catecholamin response in attenuated vascular reactivity of resistant vessels caused by atherosclerosis.

FO32

A New Route for Enteral Nutrition with a Percutaneous Trans-Esophageal Gastric-tube

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Aim: We established a less invasive method of esophagostomy with a rupture-free balloon: RFB which we invented to be used in conjunction with Percutaneous Trans-Esophageal Gastro-tubing: PTEG. PTEG with RFB allows the surgeon to create an esophagostomy safely and simply even in cases with complications that would make it difficult to create a Percutaneous Endoscopic Gastrostomy: PEG.

Methods: The control group consisted of eleven patients who underwent an esophagostomy by PTEG with a normal balloon from October 1994 to May 1997. Thirteen cases were done with existing balloon catheter to dilate the gastrointestinal tract in place of an RFB for PTEG from June 1997 to December 1997 as the preliminary study. This prospective study is based on 59 patients for feeding, with informed consent for PTEG, who were performed PTEG with RFB invented in January 1998 and who needed an indwelling catheter for a long term, from January 1998 to November 2001.

First of all, insert an RFB through the nose into the esophagus and inflate it. Puncture the RFB percutaneously aided by ultrasonography. Insert a guide wire. Insert a dilator with a sheath. Insert an indwelling catheter into the digestive tract through the sheath.

Results: We treated fifty patients by creating an esophagostomy by PTEG with an RFB without any major trouble which might be that of creating a PEG. This method only took about fifteen minutes. The average periods for the indwelling catheter are 147.1±107.1 days for feeding. The indwelling catheter may be used for the long term affording easy maintenance at the bedside and home care. The patients' complaints subsided, and the quality of life was improved for them all.

Conclusions: When it is difficult to create a PEG, PTEG with RFB is a safe, simple and less invasive method than PEG and just as effective.

FO33

Influence of Surgical Stress and Nutritional Support on Serum Leptin Concentration in Patients with Gastric Cancer.

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Aim: Adipocyte derived leptin is an obese gene product. A possible role of leptin in feedback mechanism that regulates food intake, energy expenditure and fat mass. The purpose of this study was to investigate the leptin metabolism under surgical stress and the effect of nutritional support on leptin levels in gastric cancer patients.

Methods: 1) The nutritional status and serum levels of leptin were measured perioperatively in patients with gastric cancer. 2) The influence of TPN on serum leptin levels were measured in pyloric stenosis (Group I) and cancerous cachexia (Group II) groups.

Result: Serum leptin levels in 50% of gastric cancer patients were below the normal range at admission. Serum leptin levels were decreased in malnourished cases with advanced stage. Serum leptin levels in the group with high concentration of total body fat were higher than in low group. Serum leptin levels were significantly increased after gastrectomy in comparison with the preoperative value (Pre. Op.: 4.2 ± 1.1 vs IPOD: 9.8 ± 5.3 ng/ml, $p < 0.01$).

Serum leptin levels on the IPOD were significantly higher in the group with high (≥ 2.5 ng/ml) levels of serum leptin, compared to the group with low (< 2.5 ng/ml) preoperative levels ($p < 0.01$). The body fat weights were higher in Group I than Group II. After 2 weeks of TPN significant increase of serum leptin levels was observed in Group I ($p < 0.05$) whereas not increased in Group II.

Conclusions: Surgical stress is associated to an increase of serum leptin levels in patients with gastric cancer. The body fat accumulation quantity greatly affected the serum leptin levels after gastrectomy and in short period of parenteral nutritional support.

FO35

Effect of Living-Related Liver Transplantation on Nutritional Status in Patients with Biliary Atresia.

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Aim: The purpose of this study is to assess the effect of LRLT on nutritional status in such patients.

Methods: We studied 11 pediatric patients receiving LRLT after Kasai's operation for biliary atresia. Nutritional parameters examined were serum levels of albumin, cholinesterase (ChE), prealbumin (PA), retinol binding protein (RBP), vitamin A, vitamin E, zinc and copper, plasma aminogram and bone mass density (BMD). These parameters were regularly evaluated pre- and post-operatively.

Results: Serum levels of albumin and ChE were depressed before LRLT and normalized in three months. Both rapid turnover protein levels such as PA or RBP and Fischer's ratios calculated from plasma aminogram were deeply depressed before LRLT and they were quickly elevated in one week after LRLT. However, they remained around the lower limit of the normal range thereafter. Serum levels of vitamin A and vitamin E and Zinc were depressed before LRLT and were normalized one month after LRLT. Copper levels, which were elevated in most of LRLT patients due to cholestasis, were quickly decreased in a few weeks after LRLT, and showed transient elevation in one month and were gradually decreased again. Z scores of BMD were deeply depressed before LRLT. Only the young patients (< 8 years old) showed remarkable improvement of BMD and could reach within ± 1.5 SD of z scores.

Conclusions: Each nutritional parameter was remarkably improved after LRLT, however it remained in relatively low levels.

FO34

Effects of Nocturnal Branched-Chain Amino Acid on Protein Metabolism in Patients with Liver Cirrhosis

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Aim: We have reported previously that oral administration of branched-chain amino acids (BCAA) is effective to improve serum albumin and patients' prognosis. We herein studied the effects of nocturnal BCAA on protein metabolism in patients with liver cirrhosis.

Methods: Twelve patients with liver cirrhosis participated in this study. All subjects ate isonitrogenous and isocaloric diets for a week prior to the study. On day 8, indirect calorimetry was carried out, and BCAA, Fischer's ratio and nitrogen balance were also examined. Patients were then administered either with regular BCAA (4g BCAA after each meal, n=6) or with nocturnal BCAA (4g after breakfast and 8g before bedtime, n=6) for one week. On day 14, the same examination was carried out. The cross-over study was performed for the third week in the same patients. Six patients were followed up with nocturnal BCAA supplementation for one month.

Results: After ordinary administration of BCAA, Fischer's ratio and nitrogen balance were improved. These two parameters were further improved after nocturnal BCAA. One-month nocturnal BCAA improved serum albumin in the patients.

Conclusions: Nocturnal BCAA could improve serum albumin in liver cirrhosis who did not respond to ordinary BCAA. This effect could be partly due to increased Fischer's ratio and its protein-sparing effect during the night time.

FO36

A NUTRITIONAL APPROACH WITH K-17.22 DELAYS THE ONSET OF GENETIC CHRONIC PANCREATITIS (CP)

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Aim: CP is a progressive disease without therapeutic options. A recent herbal formula (Yojyo-Henshiko: K-17.22, Kyotsu, Tokyo, Japan) has shown to significantly decrease chronic liver disease activity and we tested it on the progression of a genetic model of CP.

Methods: 4-week old WBN/Kob rats were fed a specific MB-3 diet to promote CP within 12-week. Rats were allocated into 4 groups: A) no treatment; B) K-17.22 50mg/kg-5% glucose; C) vit.E 200mg/kg. The same schedules were applied after the onset of CP. Rats were sacrificed at 12- and 20-week in the prophylactic and therapeutic groups, respectively. Blindly scored histology and PAP gene expression from total pancreatic RNA was done

Results: Unlike A and C groups, B pancreata didn't show any edema/haemorrhage in the prophylactic group, but not on the therapeutic one. B and C rats preserved pancreas weight and lessened serum amylase ($p < 0.05$ vs A). Microscopically, K-17.22 prevented CP damage ($p < 0.001$ vs A, C) when used prophylactically and decreased fibrosis, inflammatory infiltrate, oedema and ductal hyperplasia in the "therapeutic" group ($p < 0.05$). B rats showed a suppression of PAP mRNA in the prophylactic group ($p < 0.01$ vs A, C) and a significant decrease in the therapeutic one ($p < 0.05$).

Conclusions: These data suggest that K-17.22 yields powerful protection against the progression of CP by mechanisms to be elucidated such as: antioxidative, microcirculatory-enhancement, gastric and pancreatic secretion suppression and cytokine regulation.