

A Randomized Trial Comparing The Effect of Soy Protein Diet Supplement Versus Hospital Standard Supplement on Clinical and Laboratory Parameters in Malnutrition Patients

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ABSTRACT

Background: Studies have shown that soy protein diet may improve clinical nutrition status of malnutrition patients. Soybeans itself are unique foods because of their rich nutrient content. The complete nutrient in soybean is important and also offers many health benefits especially in malnutrition patient during hospitalization.

Objective: The objective of this study was to assess the effect of soy protein supplement and hospital standard supplement (animal protein) on anthropometries and laboratory findings in malnutrition patients during hospitalization.

Method: Forty-eight patients with malnutrition (confirmed by Body Mass Index < 20 kg/m²) aged 14-70 years old were recruited from Internal Medicine wards in Cipto Mangunkusumo hospital, Jakarta, Indonesia. The study design was randomized controlled trial. The subjects were randomly divided into 2 groups were fed supplement diet contained soy protein supplement diet (40 g/d) or hospital standard supplement (40 g/d) for 2 weeks. Body weight was measured in the first day (base line data), 7-day and 14-day after intervention. Blood and urine was collected at baseline, 7-day and 14-day for measuring transferin, prealbumin and nitrogen balance. The intake of supplement, gastrointestinal symptoms and others adverse event were noted every day.

Result: From 48 subjects, there were only 32 patients that completed the study during 2 weeks. In the base line data there were no significant different for intake diet calculation, anthropometrics and laboratory parameters in study group and control group. A total of patients 32 consist of 20 (62,5 %) female and 12 (37,5%) male with a mean age 31,8 ± 12,9 years old. Anthropometrics evaluation after 1 week and 2 weeks intervention in soy protein supplement showed significantly increased every week in 2 weeks. In control group, significantly increased showed only after two weeks intervention. But there was no significantly increased of BMI of two groups. Serum transferin concentration increased from 1,489 ± 0,502 at base line to be 1,600 ± 0,502 at week 1 and to be, 695 ± 0,402 in study group. But this increasing was no significantly between two groups. No significant differences were found between two groups for prealbumin level after 1 week and 2 weeks intervention. Nitrogen balance improved significantly (p<0,05) more with soy protein supplement than hospital standard supplement (animal protein). In this study, there was no side effect in soy protein supplement diet and 1 case with diarrhea and nausea in hospital standard supplement (animal protein)

Conclusion: Soy protein supplement diet improved both of nutrition parameter: anthropometrics and laboratory parameter. There were no significantly different in anthropometrics and laboratory parameter between soy protein supplements than hospital standar supplement (animal protein). But nitrogen balance improved significantly in study group than control group. Substitution of soy protein for animal protein has the potential role for the patient with malnutrition

Keywords: Soy protein diet, Malnutrition

INTRODUCTION

Healthy people need food, not to mention sick people. This concept should be up hold tightly in treating patients. Therefore nutrition intake must be the main focus in treating the patients. Adequate nutrition intake for health and treatment is essential.

Our body needs thousands of molecules for metabolic processes. If we are sick, requirements of those substrates will also increase. Most of the requirements will come from daily food in the form of energy, water and minerals. Lack or excess of nutrition will create an effect to health. Malnutrition or deficiency of protein and energy is a condition which is common in everyday practice. Malnutrition in a sick patient will become a risk factor of deterioration of sickness and will increase the mortality. Therefore, malnutrition should be detected on the first day of admission, thus, optimal treatment, pharmacology or nutritional therapy could be started from the very beginning.

Many studies had reported that administration of soy formula could improve nutritional status especially one's with malnutrition. Soy itself contains complete nutrition. It has a good protein source and low fat, complex carbohydrate, fiber, micronutrients and isoflavone, a nutrition substance that has biological effect and also lowering risk of chronic diseases.

Soy formula has been reported able in lowering cholesterol level in human, protection against cancer, lowering risk of cardiovascular disease, improving post menopause symptoms, prevent osteoporosis, and improve kidney function.

MATERIALS AND METHODS

Patients

Study was conducted on pulmonary tuberculosis patients with malnutrition in internal medicine ward, Cipto Mangunkusumo hospital from January 2002 until December 2002. Patients eligible for study should fulfill the inclusion criterions: malnutrition, age 14-70, cooperative, and no history of allergy to soy. Patients

with severe disease could not eat and drink orally should be excluded. All patients have to sign an informed-consent before entering the study. Patients were divided into two groups, the treatment group shall receive soy protein and the control group will receive a hospital-based formula. Randomization was done with computer-based program. Dieticians would supervise the intake of both formulas.

Methods

Patients in the treatment group should have a screening on day-1 and basic data would be collected including history of sickness, cause of malnutrition, nutritional status, physical examinations such as anthropometric measurement (body weight, height, mid arm circumference). Blood sample should be collected as well for laboratory evaluation. Laboratory measurements include complete blood counts, urinalysis, ureum-creatinine, protein status (albumin, prealbumin, and transferrin), cholesterol, and nitrogen balance.

On day-7, and 14, physical data, anthropometric and laboratory examinations would be repeated and collected.

Data analysis

Data collected on day-1, 7 and 14 will be processed using computer. Results of day-1, 7 and 14 was compared with paired t-test. Statistical analysis was performed using SPSS 11 for windows. Data were represented as mean \pm SD. The difference was considered significant at $p < 0.05$

RESULTS

Patients

During the period of January 2002-December 2002, a total of 48 patients were enrolled in the study. All of them have fulfilled the inclusion criterions. 32 out of 48 could complete the whole study; each group consisted of 16 patients. All of these patients suffered from pulmonary tuberculosis and malnutrition. Total of female patients was 20 (62.5%) and male, 12 (37.5%) with age between 16 to 65 years.

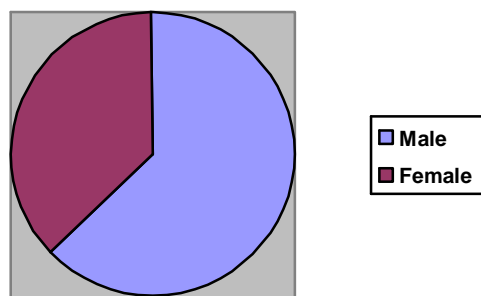


Figure 1. Composition of 48 patients

Day-1

There are no significant difference of body mass index ($14.1 \pm 2.6 \text{ kg/m}^2$ vs. $14.7 \pm 2.6 \text{ kg/m}^2$) between two groups and laboratory parameters: transferrin (1.71 ± 0.67 vs. 1.57 ± 0.52 ; $p = 0.589$); prealbumin (0.11 ± 0.058 vs. 0.115 ± 0.0888 ; $p = 0.862$)

Day-7 and 14

Anthropometric measurements after week-1 and week-2 of study were presented in table-1. In the treatment group, weight gain was reported on day-7, ($14.1 \pm 2.6 \text{ kg/m}^2$ to $14.6 \pm 2.6 \text{ kg/m}^2$) and continues to increase to day14 ($14.9 \pm 3.0 \text{ kg/m}^2$). This increase was significantly different ($p = 0.016$). In the control group, weight gain was noted in day-14 ($14.7 \pm 2.4 \text{ kg/m}^2$ to $14.8 \pm 1.5 \text{ kg/m}^2$; $p = 0.006$).

Table 1. Body Mass Index on day-1, 7, and 14

Body Mass Index (BMI)	Day-1	Day-7	<i>p</i>	<i>P</i> pre and post	Day-14	<i>p</i>	<i>P</i> pre and post
Treatment	14.1 ± 2.6	14.6 ± 2.6	0.759	0.010	14.9 ± 3.0	0.850	0.006
Control	14.7 ± 2.4	14.8 ± 2.6		0.010	14.8 ± 1.5		0.016

There are no significant difference of transferrin between treatment group and control group (table 2)

Table 2. Transferrin Level on Day-1, 7 and 14

Transferrin	Day-1	Day-7	<i>p</i>	<i>P</i> pre and post	Day-14	<i>p</i>	<i>P</i> pre and post
Treatment	1.489 ± 0.502	1.600 ± 0.502	0.802	0.766	1.516 ± 0.348	0.538	0.420
Control	1.489 ± 0.485	1.542 ± 0.474		0.204	1.695 ± 0.756		0.420

Prealbumin level was increased in day 7 in the treatment group (0.108 ± 0.057 to 0.150 ± 0.078 ; $p < 0.05$). While in the control group, prealbumin was decreased (0.138 ± 0.121 to 0.130 ± 0.078). There is no significant difference of the prealbumin result among the treatment and control group. (Table-3)

Table 3. Prealbumin Level on Day 1, 7 and 14 After Soy Protein Supplementation.

Prealbumin	Day-1	Day-7	<i>p</i>	<i>P</i> pre and post	Day-14	<i>p</i>	<i>P</i> pre and post
Treatment	0.108 ± 0.057	0.130 ± 0.078	0.519	0.019	0.121 ± 0.068	0.866	0.534
Control	14.7 ± 2.4	14.8 ± 2.6		0.077	0.133 ± 0.0662		0.854

Cholesterol was increased in both group, but the value was not significantly difference between the treatment group and the control group ($p = 0.068$) (table-4)

Table 4. Cholesterol Level on Day 1 and 14 After Soy Protein Supplementation

Cholesterol	Day 1	<i>p</i>	Day 14	<i>p</i> pre and post	<i>p</i>
Treatment	102.4 ± 40.0	0.931	121.7 ± 46.1	0.013	0.0698
Control	125.4 ± 74.9		142 ± 82.7	0.350	

In this study, the nitrogen balance was improved in the control group (-27.331 ± 66.436 vs. -1.081 ± 4.126), and also in the treatment group (-4.062 ± 8.371 vs. $+2.546 \pm 4.976$). The value of nitrogen balance among treatment and controlled group was significantly different ($p < 0.05$) (table-5).

Table 5. Nitrogen Balance on Day 1 and 14 After Soy Protein Supplementation

Nitrogen Balance	Day 1	<i>p</i>	Day 14	<i>p</i> pre and post	<i>p</i>
Treatment	- 4.062 ± 8.371	0.295	+ 2.546 ± 4.976	0.033	0.562
Control	- 27.331 ± 66.436		- 1.081 ± 4.126	0.351	

Side Effects

There was only 1 side effect reported in the study. One patient was noted to have mild diarrhea and nausea in the control group.

DISCUSSION

In this study, we compared the effect of soy-based formula (Proten) with hospital-based formula. We also evaluated the effect of each formula on day-7 and day-14. All selected patients were suffering from tuberculosis with low body mass index and based on laboratory values, patients also have malnutrition. Patient with malnutrition and chronic disease are at high risk of higher morbidity and mortality during their treatment. Therefore, nutrition should be focused.

Nutritional history after 7 and 14 days of treatment revealed no significant difference between the use of hospital-based formula and soy-based formula (Proten). This result showed that the quality of soy formula equals the hospital-based formula, which comes from animal. But, if we look at the values of total calories, carbohydrate, protein and fat intake, it showed that there was an increase in the intake. It confirmed that there was improvement of food intake of the patients. The explanation of this might be due to recovery of patients and administration of the supplement it self has made the nutritional intake better.

Body weight is one of anthropometric parameter in evaluating nutritional status. But, we have to notice that in the calculation of body weight, we need to exclude

edema that would interfere with the measurement. In this evaluation, body weight of the treatment group showed a significant increase on day-7 and 14. While the control group only showed increase on day-14. When we compared, among the treatment group and control group, we found no significant difference. This condition shows that supplementation of both formula showed no difference.

In this study we also evaluate the laboratory parameters, to see the effect of proten supplementation towards changes in those parameters. We used transferrin and prealbumin. Transferrin was produced in the liver and has a half life of 8 days, which is ideal for nutritional evaluation. Pre albumin has a better half life profile than transferrin, 2-3 days. Therefore, we used these 2 parameters for nutritional evaluation.

Transferrin level in the treatment group showed an increase on day 7 and day 14 compared to day 1, but these changes showed no significant difference compared to control group. Prealbumin also gave a change toward improvement on day 7 and day 14. But, only on day 7, the change showed significant difference compare to day 1. We conclude that numbers of patients recruited and short administration period might have influenced the result. Nevertheless, the result had given a message that administration of soy protein supplementation could improve the laboratory parameters.

Previous study had told us that the benefit of soy protein was the effect of lowering cholesterol in

normocholesterolemia and hypercholesterolemia patient.² A meta-analysis which involved data from 38 clinical studies showed that administration soy formula were effective in lowering cholesterol level only in patients with high cholesterol level (> 6.47 mmol/L).²

In this study we also reviewed the cholesterol level after 14 days of treatment. Patients submitted to this study was patients with malnutrition and average body mass index of 14 – 14.5 kg/m² with average cholesterol level of 125.4 mg/dl in the control group and 102.4 mg/dl in the treatment group. It was concluded that administration of supplement were given at a low cholesterol value. Evaluation of cholesterol level revealed that there were an increase of cholesterol level in both group but these increase was not significant. This condition is in accordance with references that there were no significant changes of cholesterol in normocholesterolemia patients.⁹

Another laboratory parameter used in this study was nitrogen balance evaluation. This examination was based on protein intake with 24-urine urea nitrogen. This examination was aimed to evaluate protein's catabolism and to evaluate whether protein intake was enough or not. This measurement is influenced by several conditions like activity, stress, infection, fever, and trauma. Measurement before the study showed that in both group, nitrogen balance were large. This was due to subject of study was patients with tuberculosis and usually with secondary infection. Evaluation on treatment group showed that a significant improvement of nitrogen balance occurred in the treatment group after 14 days of supplement administration. But, compare to control group, there was not a significant change. This result is also in accordance with previous study which concluded that soy formula improved nutritional status.

We also review if any side effect occurs during the study. There were no side effect occurred on treatment group but one patients in the control group had nausea and diarrhea.

CONCLUSION

Currently, supplementation with plant protein has been counted as a substitute of animal protein, due to biological effect of plant protein, fiber and phytochemicals. Biological effect of plant protein eventually may reduce risk of several chronic diseases.

In this study, it was proven that supplementation of soy-based formula (Proten) for 7-14 days improved nutritional parameters, anthropometric and laboratory. If the administration was given longer, obviously the result would be better and clearer. With improvement of nutritional status, generally clinical improvement should be expected as well.

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