ORIGINAL ARTICLE

The effect of a nutrition education program on nutritional status and dietary intake among the end-stage renal disease patients on hemodialysis at Phayao Hospital, Thailand

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Abstract

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High range of patients who have the end-stage renal disease (ESRD) and have been through maintenance hemodialysis (HD) treatment are in the situation of malnutrition. This study aimed to examine the effects of nutrition education on the nutritional status, and dietary intake characteristic of HD patients at Phayao Hospital. The quasi-experimental study was used as the research design (n=60). The nutrition educational program is divided into 16 sessions in the total duration of 4 months. The status of nutrition will be measured on body mass index (BMI) and nutrition triage (NT) while the laboratory markers will be evaluated before and after the program.

The mean participant age was 56.62 with standard deviation (SD) of 3.95 years, 52% were females. Mean BMI was 20.29 with SD of 0.85 kg/m^2 (normal). 83% have their dry body weight decreased significantly at the end of the study ($p<0.01$) and were classified as mild malnutrition risk. No statistically significance change in BMI and laboratory markers while mean normalized protein equivalent of total nitrogen appearance (nPNA) was increased to 0.99 g/kg/day from 0.88 g/kg/day. Furthermore, there was a significant increase in dairy energy, protein, carbohydrate, and fat intake comparing between the baseline and the end of the study ($p<0.01$).

The results of this study suggest that a nutrition education program has improved the nutrition status, dietary intake, and biochemical markers in hemodialysis patients. Therefore, well-designed, frequent, and multifaceted educational programs may enhance knowledge, self-management, and clinical outcomes of the patients.

Keywords: nutrition education program, nutritional status, dietary intake, end-stage renal disease, hemodialysis

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ผลของโปรแกรมการให้ความรู้ด้านโภชนาการต่อภาวะโภชนาการและการรับประทานอาหารในผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม ณ โรงพยาบาลพะเยา ประเทศไทย

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บทคัดย่อ

ยุพา ชาญวิกรัย และ จักรกฤษณ์ วังราษฎร์ ผลของโปรแกรมการให้ความรู้ด้านโภชนาการต่อภาวะโภชนาการและการรับประทานอาหารในผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม ณ โรงพยาบาลพะเยา ประเทศไทย ว. สาธารณสุขและการพัฒนา 2561;16(3):29-40

ผู้ป่วยโรคไตเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม มีจำนวนเพิ่มขึ้นทุกปี และพบผู้ป่วยฟอกเลือดด้วยเครื่องไตเทียมมักมีความเสี่ยงสูงต่อภาวะทุพโภชนาการ การศึกษาครั้งนี้มีจุดประสงค์เพื่อศึกษาผลของโปรแกรมการให้ความรู้ด้านโภชนาการต่อภาวะโภชนาการและการรับประทานอาหารในผู้ป่วยที่ได้รับการฟอกเลือด ณ โรงพยาบาลพะเยา การศึกษาวิจัยแบบมีส่วนร่วมในผู้ป่วยได้รับการฟอกเลือดด้วยเครื่องไตเทียม 60 คน ผู้ร่วมโครงการทุกคนจะได้เข้าร่วมโปรแกรมการให้ความรู้ด้านโภชนาการ แบ่งเป็น 16 ครั้ง ในระยะเวลา 4 เดือน ตัวชี้วัดผลการศึกษา ได้แก่ การประเมินภาวะทุพโภชนาการด้วยแบบประเมิน nutrition triage (NT) ค่าดัชนีมวลกาย ผลตรวจทางห้องปฏิบัติการที่เกี่ยวข้องกับภาวะโภชนาการ ประเมินผลก่อนและหลังการให้โปรแกรม

ค่าเฉลี่ยอายุของผู้เข้าร่วมโครงการ 56.62 ปี (SD = 3.95) เป็นผู้หญิงร้อยละ 52 และค่าเฉลี่ยดัชนีมวลกาย 20.29 กก./ตร.ม. (SD = 0.85) ซึ่งอยู่ในเกณฑ์ปกติ เมื่อจบการศึกษาพบว่าผู้ร่วมโครงการร้อยละ 83 มีน้ำหนักแห้งลดลงอย่างมีนัยสำคัญทางสถิติ ($p < 0.01$) มีความเสี่ยงต่อภาวะทุพโภชนาการเพียงเล็กน้อย ไม่พบการเปลี่ยนแปลงอย่างมีนัยสำคัญทางสถิติของค่าดัชนีมวลกาย และผลตรวจทางห้องปฏิบัติการ แต่ค่าเฉลี่ย normalized protein equivalent of total nitrogen appearance (nPNA) เพิ่มขึ้นเป็น 0.99 จาก 0.88 ก./ น้ำหนักตัว กก./ วัน และมีแนวโน้มจะเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ พบการเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติของพลังงาน และสารอาหารที่บริโภคประจำวัน ได้แก่ โปรตีน คาร์โบไฮเดรต ไขมัน ($p < 0.01$)

ผลการศึกษาครั้งนี้ชี้ให้เห็นว่าโปรแกรมการให้ความรู้ด้านโภชนาการมีส่วนช่วยให้ผู้ป่วยที่ได้รับการฟอกเลือดมีภาวะโภชนาการ การรับประทานอาหารและค่าทางชีวเคมีที่ดีขึ้น ดังนั้นการออกแบบโปรแกรมที่ดี มีความเหมาะสมทั้งด้านความถี่ของการเข้าร่วมโปรแกรม ความหลากหลายและครบถ้วนของเนื้อหา จะส่งผลทำให้ผู้ป่วยมีความรู้ด้านโภชนาการ ความสามารถในการจัดการตนเองได้ และผลลัพธ์ทางคลินิกที่เพิ่มขึ้น

คำสำคัญ: โปรแกรมการให้ความรู้ทางโภชนาการ ภาวะโภชนาการ การรับประทานอาหาร ผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้าย การฟอกเลือดด้วยเครื่องไตเทียม

Introduction

End-stage renal disease (ESRD) is a worldwide major public health problem as it is one of the incurable common chronic diseases. The mortality and morbidity in ESRD patients are unacceptably high[1]. According to the Thailand Renal Replacement Therapy database in 2011-2015 the total yearly prevalence of hemodialysis patients were 34,895 40,505 47,410, 49,719 and 54,104 per 100,000 population, respectively. In Phayao province the numbers of hemodialysis patients in 2011-2015 showed modestly increased which were 216, 239, 408, 317 and 413, respectively[1]. The main factor that affected the increase of mortality and morbidity of the ESRD patients[2] is malnutrition, which has a high rate of occurrence on the patients who have undergone the maintenance hemodialysis (HD) treatment[3] as recorded in numerous study documents indicating that 20-60% of them are malnutrition[4]. Many factors incline to the event of malnutrition in patients with ESRD such as changes in craving, dental problems, vomiting, and diarrhea. This also includes the abnormality disturbances in protein and energy metabolism, hormonal derangement, infections, and other superimposed illnesses[1,5-7]. However, it should be noted that these factors are overlapping each other in each stages and appropriate measures may be used to resolve, and others may persist through all stages of ESRD[2].

Malnutrition occurs from the poor food consumption habits of the ESRD patients, experience with nutritional education is limited. They usually have received the nutrition information in a single session from a physician and through documentations such as handouts, brochures, or guidelines, leading to many doubts. Moreover, the outcome of interest in educational intervention of the previous related studies were compliance with medication, preparation for hemodialysis therapy and quality of life, but not mention in the improvement of nutritional status and dietary intake. Therefore, the ESRD patients desire to have a specific nutritional education[8]. The purpose of this study was to conduct both of individual and group nutritional education program for 4 months and evaluate its effectiveness in the nutritional status, and dietary intake characteristic of HD patients at Phayao Hospital, Thailand.

Methods

Population and sample

The quasi-experimental study was used as the research design. The data was collected from January to June 2015. All patients with ESRD who were undergoing hemodialysis at the Dialysis Unit, Phayao Hospital, Thailand. From a total of 97 patients, 60 agreed to participate, while 37 either refused. Inclusion criteria included being 18 years old or older receiving hemodialysis for a period longer than 6 months, received dialysis dose at least of the sum of single pool Kt/V (spKt/V) more than 3.6 weeks and proved to have no residual renal function, which was determined by urine output less than 100 ml per active infection days, and the ability to ingest food independently at least 3 times daily.

The exclusion criteria were patients who had major debilitating diseases including acquired immunodeficiency syndrome (AIDS), severe (stage III or IV) congestive heart failure, severe lung disease, or terminal malignancies. This also includes patients who have hospitalization in the last 3 months except for dialysis access–related admissions, inability to

ingest regular solid food, major psychiatric diseases or severe dementia, and gastrointestinal or neurologic diseases that interfered with food ingestion. Minor criteria such as active inflammatory or infectious disease and pregnant are also excluded.

Nutrition education program

The nutrition educational programs were developed by the researcher and multidisciplinary team, aimed to increase the nutritional status, and dietary intake characteristic of the ESRD patients. The programs passed the inspection on content consistency, objective congruence and the consideration of the language suitability by three experts in nutrition and kidney disease.

The program was divided into 16 sessions that were conducted both individual and group in the total duration of 4 months. The individual sessions were conducted weekly, each session was conducted in 30 minutes while the patients are undergoing the HD treatment performed by the researcher team and registered dietitians. The format for each lesson was standardized and the topics were developed with the relevant issues such as daily food intake, nutritional requirement, recommended food and appropriated cooking. The group sessions were conducted monthly with the participants who have seated in the same areas on the same day as the individual session and are also performed by the researcher team and registered dietitians. The titles instructed on each session included renal function and renal failure, the function of food and nutrients, food sources of nutrients, and self-assessment. During the development of the briefings, the patients were encouraged to actively participate, thus increasing the patient-professional feedback.

Nutritional assessment

Nutrition screening

Initially, the risk of malnutrition for all participants was evaluated by Nutrition Triage (NT)[9]. The parameters needed for NT scoring were recorded including weight change, energy delivery, age, and disease severity. The evaluation was classified into 4 groups as NT I to IV; class I: no nutrition risk (0 – 4 scores), class II: mild nutrition risk (5 – 7 scores), class III: moderate nutrition risk (8 – 10 scores) and class IV: severe nutrition risk (>10 scores)[10].

Anthropometric evaluation

Anthropometric were collected by trained staff. Weight and height of each subject were measured using a standard instrument to an accuracy of 0.1 kg and 0.1 cm, respectively. Body Mass Index (BMI) was calculated using metric system of height (meter) and weight (kilogram) measurement. A standard mercury sphygmomanometer was used to assess blood pressure, twice with a 30-minute interval for any participant while seated and rested. The average of two measurements was taken as the blood pressure

Laboratory evaluation

The researchers collected the records of serum albumin, serum creatinine, serum potassium, serum phosphorus concentrations, total cholesterol and normalized protein equivalent of total nitrogen appearance (nPNA) before and after the end of the program from the hospital data record and average for the pre and post study.

Dietary intake measurements

The dietary intake was evaluated using the three-day dietary records which is a standard technique used widely in research as well as in empirically based clinical practice to evaluate recent dietary intake. Participants were instructed on how to complete the food record by trained dietitian, and included data for two weekdays and one weekend on the amount, type, preparation and time of food or beverage consumed by subjects. Nutrient intakes were calculated with the INMUCAL software version 3.0 developed by Mahidol University that contains a nutrient database from foods typically consumed in Thailand.

Statistical analysis

Data were analyzed by using descriptive statistics including frequencies, percentage, mean and standard deviation. Besides, significant differences between the beginning and the end of the nutritional education program were analyzed by using the Wilcoxon signed rank test, as the limited number of subjects.

Ethical consideration

The study protocol was approved by the Ethics Committee of the Institute Review Board at University of Phayao, approval code: 57 02 04 0018. The participants were informed about the research design, purpose of the study, ethical sense explanation of the research, while guaranteeing confidentiality and anonymity in both orally and writing. The participants have to sign a written informed consent before treatment.

Results

The demographic characteristics

As shown in Table 1, the participants were 60 end-stage renal disease patients with hemodialysis at dialysis unit at Phayao Hospital, Phayao Province, Thailand. For baseline characteristics of the 60 participants, 31 participants (52%) were females and 29 participants (48%) were males. The mean age was 56.62 with standard deviation (SD) of 3.95 years. In the aspect of education, the most of them graduated from high school (68.3%). Most were married (80.0%). The majority (45.0%) of income was in the range of 5,001 – 10,000 baht/month. Most of them had been on hemodialysis 1-5 years (63.3%). The mean dry body weight was 52.17 (SD = 9.76) kg and height was 157.92 (SD = 6.79) cm, and body mass index was 20.29 (SD = 0.85) kg/m2. The participants usually were classified as mild nutrition risk in class II (83.33 %). Nearly 20% of the participants were classified as a combination of moderate and severe risk in class III (13.33 %) and IV (3.24%) according to NT.

Table 1 Distribution of respondents by the demographic characteristics

Characteristics	Number (%)
Gender	
Female	31 (52.0)
Male	29 (48.0)
Education	
Primary and lower	5 (8.3)
High school	41 (68.3)
Higher than high school	14 (23.4)
Marital status	
Single	4 (6.7)
Married	48 (80.0)
Widowed/Divorced/Separated	8 (13.3.0)
Income (baht/month)	
<5,000	12 (20.0)
5,001 – 10,000	27 (45.0)
10,001 – 15,000	16 (26.7)
> 15,001	5 (8.3)
Time on hemodialysis	
< 1 year	14 (23.3)
1-5 years	38 (63.3)
> 5 years	8 (13.4)
Nutrition Screening	
Mild nutrition risk	50 (83.3)
Moderate nutrition risk	8 (13.4)
Severe nutrition risk	2 (3.3)

The change of anthropometric and biochemical parameters

Table 2 represents the different of anthropometric and biochemical parameters in the participants. The observation has shown the decrease of body weight in participants during the study ($p<0.01$) and there is no statistically significant change in BMI, blood pressure, blood urea nitrogen (BUN), serum creatinine, serum albumin, serum potassium, phosphorus, and cholesterol while mean normalized protein nitrogen appearance (nPNA) slightly increased to 0.99 g/kg/day from 0.88 g/kg/day.

Table 2 The change of anthropometric and biochemical parameters of the sample

Variables	Pre-study		Post-study		p-value
	Mean	SD	Mean	SD	
Body weight, kg	52.81	9.8	51.28	9.6	0.001*
Body mass index, kg/m^2	20.72	4.3	20.60	4.0	0.410
Systolic blood pressure, mmHg	133.50	27.1	138.08	26.7	0.120
Diastolic blood pressure, mmHg	70.50	13.7	69.80	13.9	0.970
BUN, mg/dL	65.76	18.6	61.43	21.0	0.060
Serum creatinine, mg/dL	11.75	7.3	11.13	3.7	0.410
Serum albumin, g/dL	3.69	0.9	3.86	0.7	0.260
Serum potassium, mEq/L	4.49	1.0	4.42	0.8	0.450
Serum phosphorus, mg/dL	4.34	2.3	3.98	1.8	0.130
Serum cholesterol, mg/dL	147.48	58.7	151.85	36.9	0.950
nPNA, g/kg/day	0.88	0.4	0.99	0.3	0.180

*significant difference between pre and post study ($p<0.05$).

BUN= Blood urea nitrogen, nPNA = Normalized protein nitrogen appearance.

The change of dietary intake

On the end of the study, there was the significant increase of dairy energy, protein, carbohydrate, and fat intake comparing between the baseline and the end of the study ($p<0.01$) with Wilcoxon's signed-rank test as shown in Table 3. Within 6 months caloric distribution from protein and carbohydrate in the participants intake significantly increased, whereas a fall in fat 27.99% from 36.15%. The data indicated amounts of mineral consumption per day before the study reported by the sample were as follows: calcium, potassium, phosphorus and sodium were 797.97 mg/d, 1,795.78 mg/d, 404.84 mg/d and 2,640.99 mg/d and after the study were 1,313.22 mg/d, 2,062.53 mg/d, 877.47 mg/d and 2,248.54 mg/d, respectively. The calcium, potassium and phosphorus level after the study was higher than those before study, except sodium which lower than before study. However,

they were still in the recommended. The appropriate amount of daily calcium, potassium, phosphorus and sodium consumption were 1,000-1,500 mg/d, 2,000-3,000 mg/d, 800-1,000 mg/d, and 2,000-2,400 mg/d, respectively.

Table 3 The change of dietary intake of the sample

Variables	Pre-study		Post-study		p-value
	Mean	SD	Mean	SD	
Energy and nutrients intake					
Energy, kcal/kg/day	16.63	12.9	23.84	12.5	0.001*
Protein, g/kg/day	0.82	0.6	1.16	0.6	0.001*
Carbohydrate, g/day	102.41	96.0	148.71	87.1	0.001*
Fat, g/day	26.14	22.3	38.19	34.2	0.010*
Cholesterol, mg/day	194.73	186.9	281.00	243.5	0.001*
Fiber, g/day	3.48	2.6	5.13	2.7	0.001*
Calcium, mg/day	797.97	152.4	1,313.22	270.1	0.001*
Potassium, mg/day	1,795.78	635.4	2,062.53	639.1	0.010*
Phosphorus, mg/day	404.84	295.2	877.47	302.6	0.001*
Sodium, mg/day	2,640.99	400.5	2,248.54	534.5	0.001*
Caloric distribution (%/day)					
Carbohydrate	44.80	25.4	51.30	16.4	0.001*
Protein	19.05	10.2	20.71	6.9	0.001*
Fat	36.15	20.2	27.99	13.9	0.410

*significant difference between pre and post study ($p<0.05$)

Discussion

This study determined the effect of both individual and group nutrition education program on nutritional status and dietary intake characteristic of ESRD patients at Phayao Hospital, Thailand. The study utilized biochemical data and also dietary intake and malnutrition scoring tools to evaluate the participants' malnutrition. As an European agreement express that standard dietary evaluation ought to include various clinical information, including the weight reduction history, BMI, muscle mass, subcutaneous fat mass, the serum albumin, creatinine, and cholesterol levels[11].

The study resulted in the revelation of 83% of participants were mild nutrition risk. This is in line with the study of Cupisti *et al.*[12] illustrated that in stable dialysis patients, abnormalities of nutritional parameters are less prevalent than expected caused by multiple factors such as decreased food intake,

increased nutrient losses, and increased nutritional needs[13]. The study has estimated that 50-70% of malnutrition in ESRD patients related to insufficient consumption of protein and energy, which is being below the recommendation. Additionally, it has been shown that protein energy malnutrition (PEM) has negatively affected the evolution and prognosis of the disease and increase the risk of morbidity and mortality during the treatment[14-15]. A significance number of patients with HD have their quality of life decreased due to the high rate of malnutrition. However, the improvement of their nutrition status is achievable if medically treated appropriately and one of the effective methods is to make an education program for the fundamental knowledge of nutrition. While it is effective, more research still needed to be conducted to assess whether interventions help improves nutritional status and lower health risk in ESRD patients[16].

This study proposed that the nutrition educational program have positive effects on the participants in their nutritional status, particularly in malnourished ESRD patients, as shown in the mean body weight that have significantly decreased ($p<0.01$) and biochemical parameters were also stable at normal level. This is consistent with the report of Morante *et al.*[17] that implemented a nutritional education program and evaluated and compared its effectiveness in the treatment and prevention of malnutrition in ESRD patients. They indicated that a nutritional education program was effective for preventing and even treating malnutrition in ESRD patients, improving their nutritional status, which may result in a long-term decrease in the mortality and morbidity of these patients. Raza *et al.*[18] suggested that active consultation and education on the subject of nutrition could improve biochemical parameters and fluid overload problems in ESRD patients. The randomized controlled study of self-efficiency training which Tsay[19] have been conducted on hemodialysis patients in northern Taiwan with the result of gradual decrease of weight gain and better fluid compliance. However, the effectiveness is slightly low as weight gain and fluid intake compliance only decrease slightly over time. These results were statistically significant when baseline differences controlled for ($p<0.05$).

Additionally, hyperphosphatemia in ESRD induced complications could be prevented by intensive nutritional intervention[20]. According to de Brito and Dobbie[21], they studied the effect of dietetic educational intervention on phosphorus and calcium of hemodialysis patients with hyperphosphatemia by conducting both individual and group educational intervention approximately 40 minutes in an attempt to improve patients' knowledge of phosphorus management and their dietary compliance and medications. Over a period of 3 months, there was a statistically significant decrease of serum phosphorus after the education session ($p<0.02$). Ford *et al.*[22] have evaluated the effectiveness of dietary education in improving serum phosphorus and other laboratory value in dialysis patients with hyperphosphatemia 20-30 minute/month for 6 months. The education tools included posters, handouts, puzzles and individualized phosphorus-racking tool. The dietitian have stressed the importance of all aspects of phosphorus control, prevention of renal bone disease, foods which are high in phosphorus, medications, and the importance of diet, dialysis, and drug therapy. The study resulted in statistically decrease in serum phosphorus ($p<0.05$)

and in calcium/phosphorus product ($p<0.01$).

This study illustrated that ESRD participants had poor intake of calories, protein, several vitamins and minerals, which was associated with study of Stark *et al.*[23] which reported the same line as this study. After the end of their study, dietary energy and protein intake were significantly increased but still not exactly meet the recommended level ($p<0.01$). While dietary fiber, calcium, and phosphorus are also significantly increased ($p<0.01$). However, the level is still within the targeted range[24]. Leon *et al.*[25] have indicated that in fact, hypoalbuminemia was frequently spotted among hemodialysis patients and strongly related to mortality and morbidity of the patients. Therefore, a study on the effect of a nutrition education intervention on albumin levels of hemodialysis patients was taken and resulted in the stratification of albumin with 29% of the patients have little to no changes in albumin, 44% had moderate improvement, and 27% have a significantly large improvement more than control patients.

The study was conducted in both individual and group nutrition education, which emphasized on positive action. As shown in several studies, there were difficulties in adhering to the complexity of the renal disease diet parameters[26]. The methods included creating active learning, coping strategies that were related to the food environment of the participants and focusing on a single goal rather than multiple goals. However, dialysis modality, dialysis adequacy, residual renal function, age, presence of diabetes, and psychosocial factors are considered to be influence protein intake and energy intake in hemodialysis patients[27].

However, there are some limitation for this study, such as some confounding variables including subjects' culture, and social background, economic diversity and different time on hemodialysis which could affect their learning. These confounding variables were not control by this study, but may be worthy of future research.

Recommendations

In conclusion, the participants who are ESRD patients and undergone HD treatment have their nutritional status improved with many interventions during the study and were confirmed to be effective. While the outcome has shown positive effect, it is recommended that multifaceted and interactive interventions should be included and a multidisciplinary team is also needed for lowering the risk of bias. We also suggest that ESRD patients should receive the knowledge attainment, self-efficacy in nutrition and lifestyle management, medication adherence, disease process, its complication and management, and exercise and weight management in the nutritional program outcomes.

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