รูปแบบการได้รับสารอาหารของผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม ณ โรงพยาบาลมหาราช นครเชียงใหม่

Nutrient Intake Characteristics of End Stage Renal Disease with Hemodialysis Patients at Maharaj Nakorn Chiang Mai Hospital

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Abstract: End-stage renal disease (ESRD) is one of the most important common chronic diseases. The morbidity and mortality rate in ESRD patients are unacceptably high. Malnutrition occurs at high prevalence in conjunction with ESRD patients who undergo maintenance hemodialysis (HD) treatment, which may be a risk factor for increased morbidity and mortality in these patients. The aim of the present study was to investigate the nutrients intake characteristics of ESRD patients on HD at Maharaj Nakorn Chiang Mai Hospital in reference to the recommendation of Nephrology Society of Thailand. The research sample size used in this study was 120 samples calculated using the Krejcie and Morgan tables. They were selected from population of 173 HD patients at Maharaj Nakorn Chiang Mai hospital during October – December 2015 using purposive random sampling. There were 54 males and 66 females whose average age was 67.6 years old. Food intake was collected using Easy Dietary Assessment (EDA) tools. The result showed that the average protein, energy, fat distribution, cholesterol and dietary fiber intake of samples were 0.89 ± 0.68 g/kg/day, 21.23 ± 10.11 kcal/kg/day, 39.15 ± 10.21%/day, 220.50 ± 21.04 mg/day and 12.85 ± 3.66 g/day, respectively. Nutrient intake characteristics of the samples was below the recommendation of Nephrology Society of Thailand. The finding can be used as a guide for appropriate food

consumption counseling to prevent malnutrition. The nutritional knowledge education can contribute to achieving better clinical outcomes as well as the patient's better quality of life.

Keywords: Food intake characteristics, end stage renal disease, hemodialysis

บทคัดย่อ: โรคไตวายเรื้อรังระยะสุดท้ายเป็นโรคเรื้อรังที่มีความสำคัญมากโรคหนึ่ง เนื่องจากอัตราการป่วยและตายของโรคนี้อยู่ในระดับที่สูงมาก ผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียมมักจะเกิดภาวะทุพโภชนาการ ซึ่งถือเป็นปัจจัยเสี่ยงที่จะทำให้อัตราการป่วยและตายสูงขึ้น การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษารูปแบบการได้รับสารอาหารของผู้ป่วยโรคไตวายเรื้องรังระยะสุดท้ายที่เข้ารับการฟอกเลือดด้วยเครื่องไตเทียม ณ โรงพยาบาลมหาราชนครเชียงใหม่ เปรียบเทียบกับข้อเสนอแนะของสมาคมโรคไตแห่งประเทศไทย ทำการศึกษาในกลุ่มตัวอย่างจำนวน 120 คน ซึ่งคัดเลือกจากผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม ณ โรงพยาบาลมหาราชนครเชียงใหม่ ระหว่างเดือนตุลาคม – ธันวาคม 2558 จำนวน 173 คน โดยตารางกำหนดขนาดตัวอย่างของเครจซีและมอร์แกน ใช้วิธีการสุ่มแบบเจาะจง เป็นเพศชาย 54 คนและเพศหญิง 66 คน อายุเฉลี่ย 67.6 ปี ทำการเก็บรวบรวมข้อมูลรูปแบบการบริโภคอาหารโดยใช้แบบประเมินการบริโภคอาหารอย่างง่าย (EDA) ผลการวิจัยพบว่า กลุ่มตัวอย่างได้รับโปรตีน พลังงาน ไขมัน โคเลสเตอรอลและไยอาหาร เฉลี่ยเท่ากับ 0.89 ± 0.68 กรัม/กิโลกรัม/วัน 21.23 ± 10.11 กิโลแคลอรี่/กิโลกรัม/วัน 39.15 ± 10.21%/วัน 220.50 ± 21.04 มิลลิกรัม/วัน และ 12.85 ± 3.66 กรัม/วัน ตามลำดับ ซึ่งต่ำกว่าปริมาณที่แนะนำโดยสมาคมโรคไตแห่งประเทศไทย ผลจากการศึกษาครั้งนี้สามารถนำข้อมูลที่ได้ไปใช้เพื่อเป็นแนวทางในการส่งเสริมและให้คำปรึกษาการบริโภคอาหารที่เหมาะสมของผู้ป่วยโรคไตวายเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียมเพื่อป้องกันภาวะทุพโภชนาการ โดยใช้กระบวนการให้ความรู้ทางโภชนาการจะมีผลทำให้ผู้ป่วยมีผลลัพธ์ในการรักษารวมถึงคุณภาพชีวิตที่ดีขึ้นต่อไป

คำสำคัญ: รูปแบบการบริโภคอาหาร โรคไตวายเรื้อรังระยะสุดท้าย ฟอกเลือดด้วยเครื่องไตเทียม

Introduction

End-stage renal disease (ESRD), the untreatable disease, is known as one of the most severe health condition which has been spreading throughout the world continuously. Rate of death and patient suffered from chronicle kidney disease is intolerably high (Supasyndh *et al*., 2009). From many factors which might be the cause of the symptoms, poor diet is the main factor involved with the increasing number of the patients and the death caused by ESRD (Ikizler and Hakim, 1996). Among patients who require to hemodialysis treatment (HD), poor diet is the major factor; it could also be a risk factor of increasing number of death and patients cause by the disease (Kalantar-Zadeh *et al*., 2002). Extent number of studies regarding ESRD confirms that many people who suffer from this disease do not live on healthy diet (Dwyer *et al*., 1998). There are many causes of malnutrition among ESRD patients such as consumption behaviors changes, chewing problems, and digestive and gastric problems which exposed in form of vomiting or diarrhea problems. Also, protein and energy metabolism system disorder, changes of hormone and other infectious or other disease tends to get

involve with ESRD problems (Cianciaruso *et al*., 1995; Supasyndh *et al*., 2009). However, it is important to note that most of these factors overlap between the various stages and therapies of renal disease and whereas some of these may resolve with appropriate measures, others may persist through all stages of ESRD (Ikizler and Hakim, 1996).

ESRD is highly related to less food consumption or loss of appetite. The symptom tends to be more severe in case that detoxification by hemodialysis is not complete. It is difficult to identify the nutrition requirements of patients due to less amount of food consumption. So, the evaluation could not be initiated since the amount of food intake is not enough (Cupisti *et al*., 2010). The number of ESRD patients with poor diet is increasing extensively (Martins *et al*., 2017) and may lead to complications of other diseases, for example cardiovascular (Kalantar-Zadeh *et al*., 2002). Patients who undergo dialysis are weak, so they should be taken care of very carefully to avoid encounter other health problem (Johansson *et al*., 2016; Martins *et al*., 2017). Accordingly, the diet behaviors of the patient and food consumption amount are crucial. This research aimed to examine food consumption amount patients who undergo hemodialysis. This study was conducted at Maharaj Nakorn Chiang Mai Hospital, Thailand. Research tool applied to the study was Easy Dietary Assessment (EDA) . The researcher investigated hypothesis that HD patients lack necessary food nutrients compared to the amount of nutrient requirement based on Nephrology Society of Thailand suggestion (Nephrology Society of Thailand, 2014).

Materials and Methods

Case subjects

The observational study was used as the research design. The research sample size used in this study was 120 samples was calculated using the Krejcie and Morgan tables, which selected from a total population of 173 HD patients at Maharaj Nakorn Chiang Mai hospital during October – December 2015 using purposive random sampling. Inclusion criteria were age range between 18- 80 years old, have undergone hemodialysis for not less than 6 months, knowledge of Thai language to respond to the questions regarding food consumption. Furthermore, other criteria included in this study were patients' ability to take 3 meals daily on their own. Patients with other severe or fatal complications such as immunodeficiency syndrome, congestive heart failure, terminal malignancies, patients who admitted in in last 3 months; however, the exclusion criteria were patients taking only liquid food, patients with psychiatric problems or dementia, gastrointestinal or neurologic diseases in severe condition which affect food consumption.

Ethical considerations

This study was approved by the Ethics in Human Research Committee of

Faculty of Medicine, Chiang Mai University (NONE-2558-03443).

Nutrients intake measurements

The easy dietary assessment (EDA) which was developed by Nephrology Society of Thailand was applied to this study, it is also known as the food intake questionnaire. After the patients completed their questionnaires, the documents were returned for revision. If the blank spaces were found in the document, the research assistants would contact the patients to make inquiries to make it complete.

Statistical analysis

The descriptive statistics (frequencies, percentage, mean, SD) were used to analyze the characteristics of the samples.

Results

According to Table 1, participants' information regarding demographic features and clinical data are described: age (yrs), body mass index (kg/m^2), systolic blood pressure (mmHg), diastolic blood pressure (mmHg), BUN (mg/dL) normalized protein nitrogen appearance (k/kg/d), serum albumin (g/dL) and serum TIBC (mg/dL) of the participants was 67.62 ± 5.95 year, 19.68 ± 4.85 kg/m^2, 132.80 ± 26.42 mmHg, 70.51 ± 11.97 mmHg, 65.76 ± 18.58 mg/dL, 1.03±2.21 g/kg/d, 4.0±0.48 g/dL and 228.5±46 mg/dL, respectively

Table 1 Demographic and clinical data of the samples

Variable described	Mean±SD
Age, year	67.60 ± 6.25
body weight, kg	46.17 ± 6.46
Height, cm	154.12 ± 2.79
Body mass index, kg/m^2	19.68 ± 4.85
Systolic blood pressure, mmHg	132.80 ± 26.42
Diastolic blood pressure, mmHg	70.51 ± 11.97
BUN, mg/dL	65.76 ± 18.58
nPNA, g/kg/d	1.03±2.21
Serum albumin, g/dL	4.0±0.48
Serum TIBC, mg/dL	228.5±46

Abbreviation: BUN, Blood Urea Nitrogen; nPNA, normalized protein nitrogen appearance; TIBC, total iron binding capacity.

According to Table 2, food intakes are illustrated. To obtain the data, EDA data were analyzed. The appropriate consumption amount of protein, energy, fat distribution, cholesterol and dietary fiber that HD patients should take were 1.0-1.5 g/kg/day, 30-35 kilocalories (kcal)/kg/day. 25-35% /day, <200 mg/day and 20-30 g/day. The

average consumption amount of HD patients participated were 0.89 ± 0.68 g/kg/day, 21.23±10.11 kcal/kg/day, 39.15±10.21/day, 220.50±21.04 mg/day and 12.85±3.66 g/day respectively. The results indicated that the amount of energy, protein and dietary fiber consumption of the samples were lower than appropriate level whereas the amount of fat and cholesterol consumption was higher than the recommended level.

The amount of mineral consumption per day reported by samples were as follow: calcium 463.11 ± 170.60 mg/d, potassium 3,165.24 ± 58.08 mg/d, phosphorus 1,854.64 ± 37.13 mg/d and sodium 2,531.44 ± 272.13 mg/d. However, the appropriate amount of daily mineral 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. The results indicated that samples had taken lower amount of calcium, however, potassium, phosphorus and sodium amount was higher than the recommendation.

Table 2 Nutrients intake comparison with recommendation in HD patients

Nutritional component	Nutrients intake	Recommendation
Energy, kcal/kg/d	21.23 ± 10.11	30-35
Protein, g/kg/d	0.89 ± 0.68	1.1-1.4
Carbohydrate distribution, %/d	47.81 ± 12.44	50-60
fat distribution, %/d	39.15 ± 10.21	25-35
Cholesterol, mg/d	220.50 ± 21.04	<200
Fiber, g/d	12.85 ± 3.66	20-30
Potassium, mg/d	3,165.24 ± 58.08	2,000-3,000
Phosphorus, mg/d	1,854.64 ± 37.13	800-1,000
Sodium, mg/d	2,531.44 ± 272.13	2,000-2,400

Discussion

The research indicated that HD patient's consumption amount of energy, protein and dietary fiber are lower than the recommendation. The patients, however, replied the higher consumption of fat, cholesterol, potassium, phosphorus and sodium than the level suggested. It is necessary to suggest that HD patients should give priority to energy and protein consumption. The decreasing food consumption per day led to lower than the minimum level of consumption that a person should take daily.

Apparently, the amounts of protein and energy consumption among HD patients were much lower than recommendation. This is in line with the research of Kalantar-Zadeh *et al*. (2002) and Cupisti *et al*. (2010) who studied food intake characteristics and nutritional status of hemodialysis patients

and found that HD patient have low protein and energy intake and below the recommendation. For patients with ESRD, problem of protein- energy wasting (PEW) could generally be found. Fouque *et al*. (2008) reported that factors contributed to PEW among patients with chronic kidney disease are varied. According to Jadeja and Kher (2012) PEW might cause by many factors, including factors related to nutrients and non -nutrients mechanism as well as the diseases which influence on uremic toxins retention like anorexia. Other diseases like acidosis and anemia are also taken into this account (Anderstam *et al*., 1996). The changes in responding to anabolic hormones, vitamin D deficiency, increasing number of inflammatory cytokines production, lack good nutrients consumption, suggested food restriction by doctors, loss of some types of nutrients which contribute to dialysate, for example, amino acids, peptides, blood, vitamins, trace element and glucose which possibly increases more risk of PEW among patients as well as dialysis treatment and comorbid conditions (Ikizler *et al*., 1994). The higher rates of death and patients with cardiovascular problems may cause by PEW (Cooper *et al*., 2004).

The study also indicated small amount of fiber consumption among HD patients. This is in line with Kalantar-Zadeh *et al*. (2002) denoting that dialysis patients consume less amounts of fiber in their diet, 47% of the HD patients in their research consumed less than 15 g of dietary fiber per day. In the same way, the research of Khoueiry *et al*. (2011) found that daily fiber intake of HD patient is lower than that recommended. The mean fiber intake was 10.77±5.87g/day, and only 2 of 71 (2.9%) were in compliance with the recommended daily intake of >25 g/day. Park *et al*. (2011) reported that more dietary fiber consumption can potentially decrease risk of death and death caused by CVD, other infectious diseases and diseases associated with respiratory organs in both male and female population. Todd *et al*. (1999) implied that there is relationship between dietary fiber consumption and the number of deaths. Streppel *et al*. (2008) also reported that fiber consumption in greater amount can help decreasing tendency of coronary heart disease and other cause of death. Fiber consumption in long term can help decreasing risk of death as a person grows older. Nevertheless, there are not many studies regarding fiber consumption of HD patients and relationship with case- specific death. Function of dietary fiber in decreasing number of patients and death rate among HD patients has not yet reached conclusion.

According to the research findings, amount of fat and cholesterol consumption of HD patients are high. This supports the findings of Chaiprateep (2017) who explained that patients with non-communicable disease (NCD) often consume high fat diet.

The research of Chen *et al*. (2008) indicated that the rising level of plasma total cholesterol and the low-density lipoprotein cholesterol (LDL) over 240 mg/dL concentration are major cause of coronary vascular disease (CVD). Many studies indicated that risk factor for CVD disease is hypercholesterolemia. The higher level of serum cholesterol, especially LDL, could lead to greater number of deaths of HD patients caused by cardiovascular of patients with dialysis (Seliger *et al*., 2002). The hypothesis indicates that the risk factor for all-cause and CVD death found in ESRD patients is hypercholesterolemia (Liu *et al*., 2004).

From the findings, it indicates high phosphorus consumption among HD patients may be due to the consumption of foods with phosphorus additives i.e., phosphorus salt or phosphoric acid which present in industrialized products preserve these foods colors, maintain their moisture, improve their flavor, homogenize their ingredients, and stabilize their proteins for example instant noodle, salad dressing, breads, cakes, biscuits, soda and dark cola (Winger *et al*., 2012). A serum phosphorus above 6.5 mg/dL in large percentage contributes to hyperphosphatemia (Block *et al*., 1998). Hyperphosphatemia is frequent in HD patients. Many factors could be explained as cause of hyperphosphatemia, including poor diet practice and prescribed phosphate binders, or even both of them (Sherman, 2016).

Hyperphosphatemia is known as independent cardiovascular risk of death among the dialysis patients because the kidney has limited ability to get rid of phosphorus load as glomerular filtration is decreased (Block *et al*., 1998, Stró**ż**ecki *et al*., 2001). Most ESRD patients can be predicted to have high level of serum phosphorus contained (Block *et al*., 1998). It is difficult to control serum phosphorus by dialysis because of low level of intradialytic blood. Also, all the way through the dialyzer, phosphorus is eliminated and separated from plasma. To increase phosphorus removal ability, more dialysis time is required even though dialysis efficiency should be watched out carefully (Daugirdas, 2015). Cupisti *et al*. (2010) conducted a research on controlling phosphate during dialysis treatment. The optimal dialysis is suggested to be removed. The use of phosphate binder and dietary phosphate control are required to observe how phosphate balance could be controlled among patients with good nourishment who attend dialysis 3 times weekly.

From the study, HD patients had relatively higher potassium consumption. HD Patients are advised to follow a sodium-restricted diet. These patients are often educated about various ways to reduce sodium intake, which include choosing low-sodium food alternatives. Potassium additives, such as potassium chloride, confer a salty taste and are often used for sodium replacement in sodium-reduced foods for example fermented meat and

poultry product. Furthermore, when consumed along with usual amount of potassium from other food sources. Moreover, many types of Thai fruit and vegetable contain high potassium compound such as banana, orange, durian, mango, papaya, tamarind, carrot, potato, and broccoli etc. High-potassium foods intake may lead to hyperkalemia (Parpia *et al*., 2018). ESRD patients have high tendency to suffer from hyperkalemia syndrome. Among ESRD patients who take hemodialysis, hyperkalemia related to malnutrition compliance the most, such as too much consumption of potassium and dialysis time is inadequate because of problems accessing vascular. Death caused by hyperkalemia are approximately 3.1/1,000 persons per year. Noori *et al*. (2010) researched on dietary potassium consumption and number of deaths from long-term hemodialysis (HD) patients, 224 HD patients who have the disease in long term were selected from 8 dialysis clinics in 2001-2006. The cohort study was applied with the use of Cox proportional hazards regression. They reported that HD patients with higher potassium consumption had more dietary energy, protein, and phosphorus consumption and higher pre-dialysis serum potassium and phosphorus amount. More consumption of dietary potassium had relationship with extensively increasing number of death in unadjusted models after incremental adjustments for case-mix, nutritional factors including 3-month averaged pre-dialysis serum creatinine, potassium, and phosphorus levels; body mass index; normalized protein nitrogen appearance; and energy, protein, and phosphorus intake and inflammatory marker amount.

Moreover, the results of our research indicated that HD patients consumed too much sodium. There is some evidence showing limited patient knowledge about sodium content in food (Wright and Cavanaugh, 2010). HD patients who are less knowledgeable about sodium are more likely to have a higher weekly consumption of high-sodium foods and also increased readmission after hospitalization, less knowledge may be a contributing factor in this population (Wright and Cavanaugh, 2010; Kollipara *et al*., 2008). Patients commonly indicate that their healthcare provider counsels them to adhere to a low sodium diet, but usually does not offer the detailed advice needed to execute this important recommendation (Sheahan and Fields, 2008). Furthermore, many types of Thai food especially fermented food added salt aimed to preserve and maintain shelf life for example pickle vegetable, pickle garlic, pickle bamboo shoot, dried salty meat and fish, dried shrimp, salty egg, salty fruit, shrimp paste, fish sauce, soy bean sauce and oyster oil. Most patients usually intake of processed, canned, and fast foods. The natural sodium content of food is estimated at 10%, whereas more than 75% is added during the manufacturing of processed foods (Wright and Cavanaugh, 2010).

In the line with research of Nerbass *et al*. (2013) the evaluation salt intake and food sources found in 109 HD patients (66% women, age = 49.0 ± 12.6 years) from five dialysis centers, the study implied that the amount of salt intake was high. The evidence to supports that greater dietary sodium intake is associated with higher blood pressure, a greater number of interdialytic weight gain (IDWG) and greater all-cause mortality on a population-wide based on chronic hemodialysis patients (Mc Causland *et al*., 2012). Meneton *et al*. (2005) reported high volume of salt intake is related to the inability of the kidneys to eliminate salt. Independent high blood pressure, dietary salt also increases cardiac left ventricular mass, arterial thickness and stiffness that lead to strokes, and the severe disease cardiac failure.

Conclusion

In the conclusion, this study showed that patients who need hemodialysis treatment had higher tendency of poor diets. Nutritional status development is reachable if their illness is treated with medical care. The result indicate requirement of dietetic and education of consumption behavior and advise in HD patients for a detailed assessment of food consumption. The nutritional knowledge and skills education can contribute to achieving better clinical outcomes as well as patient's better quality of life.

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