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NUTRITIONAL ASSESSMENT OF DIALYSIS PATIENT WITH A WEB-BASED TOOL ALLOWS MORE ACCURATE TREATMENT OF MALNUTRITION

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ABSTRACT

Background/Aims: Regular assessment of nutritional status of dialysis patients is vital for preventing malnutrition and protein energy wasting. The aim of this clinical study was to analyze dietary intake of dialysis patients and to determine if it meets their nutritional needs.

Methods: Clinical study was conducted on 30 randomly selected dialysis patients in the dialysis department of the University Medical Centre Ljubljana. Nutritional interview was conducted unannounced five times over a period of three months with the 24-hour recall method. Results were analyzed with Prodi 6.6 Expert software. Body composition was measured with bioimpedance spectroscopy.

Results: Average caloric intake of 30 patients is 14.1 ± 4.7 kcal/kg body weight per day, average protein intake is 0.61 ± 0.19 g/kg body weight per day. The average BMI (body mass index) is 27.9 ± 4.4 kg/m2, the average LTI (lean tissue index) is 12.5 ± 3.1 kg/m2, the average FTI (fat tissue index) is 14.2 ± 5.7 kg/m2 and the average phase angle is 4.2 ± 1.0. Average calorie intake and protein intake are inadequate according to the dietary recommendations for dialysis patients. Anthropometric measurements indicate sarcopenic obesity.

Conclusion: According to the aim of the study, we confirmed that caloric and protein intake of dialysis patients were inadequate according to their needs. Depending on the results of nutritional analysis and bioimpedance measurements, we have confirmed the presence of protein energy wasting among observed patients.

Keywords: haemodialysis, nutrient intake, 24-hour recall, malnutrition

INTRODUCTION

Dialysis patients have increased protein needs and increased catabolism as a result of the treatment. Therefore, it is harder for them to consume recommended daily protein requirements [Bovio, 2016]. Despite the fact that nutritional support in renal diseases is equivalent to other treatments, patients still do not have regular assessments of dietary intake and an individual optimal nutritional regime. Poor nutritional status is quite common among dialysis patients with occurrence

rate of more than 20% of dialysis patients. In addition to weak general nutritional status, dialysis patients often experience protein-energy wasting (PEW), which can be caused by many factors including inadequate protein and caloric intake [De Mutsert, 2009]. The concept of PEW is defined as state of nutritional and metabolic disorders in patients with chronic kidney disease, which is characterized by the loss of systemic body proteins and energy stores. This is reflected in the loss of muscle mass and adipose tissue, leading to cachexia [Fouque, et al., 2008]. PEW is associated with severe clinical outcomes, especially in dialysis patients. PEW is closely linked to major adverse clinical outcomes and causes hospitalization and death [Kalantar-Zadeh, 2004]. Several factors can affect nutritional and metabolic status of dialysis patients, therefore various therapeutic approaches are needed to reduce and prevent PEW. This includes the optimization of dietary intake, appropriate treatment for metabolic disorders and systemic inflammation, and prescribing appropriate dialysis regimens [Ikizler, 2013]. PEW often occurs to patients transitioning to dialysis treatment. Patients who are already malnourished when starting dialysis treatment are most likely to stay malnourished for one to two years after. On the other hand good nutritional status at the start of dialysis treatment is most likely to continue [Laville, 2000]. Inadequate protein and energy intake is an important cause for PEW in chronic kidney disease patients, especially for those receiving dialysis treatment. An additional factor for muscle loss in patients with chronic kidney disease is also dialysis treatment [Ikizler, 2013]. PEW can be determined by the malnutrition-inflammation score, anthropometry, subjective global assessment and by levels of biochemical parameters of albumin, C-reactive protein and cholesterol [Bovio, 2016]. Despite the importance of adequate nutrition in patients with chronic kidney disease, it can be difficult to investigate their exact nutritional intake. The aim of our study was to assess nutritional intake of 30 randomly chosen haemodialysis patients with 24 hour recall method. We compared our data with dietary guidelines for dialysis patients. In particular we were interested whether dietary protein intake was sufficient for their needs. Our working hypothesis was that dialysis patients had insufficient daily protein intake due to other dietary restrictions and increased needs.

SUBJECTS AND METHODS

Out of 220 haemodialysis patients who were treated at the dialysis department of the University Clinical Medical Centre in Ljubljana, only 30 patients were selected for the study, because they were able to provide comprehensive and reliable answers in all five interviews with regards to the accuracy of the method. The first nutritional interview was initially conducted with more than 30 patients, but all were not able to provide clear and reliable answers to the questions about the foods they consumed the previous day. Therefore, we did not carry out further interviews with them. In the chosen group of 30 dialysis patients there were 15 women and 15 men. All patients agreed to participate in the study and we also obtained permission from Ethical Committee. All patients were older than 18 years of age. They all had chronic kidney disease with kidney failure and received dialysis treatment 2 to 3 times per week. 9 of chosen patients also had diabetes. 40% of chosen patients were in the age group between 70 and 80 years of age.

Assessment of nutrient intake

We estimated intake of energy, macro nutrients and some vital micro nutrients, using the 24 hour recall method. The 24 hour recall is a simple method to record persons' dietary intake of previous day. It is a retrospective method that requires an experienced interviewer, since it is based on the respondents' ability to remember all foods and drinks consumed the previous day. As a retrospective method, it relies on an accurate memory of intake, reliability of the respondent not to under/misreport, and an ability to estimate portion size. Domestic measurements (spoon, palm, cup), food models, or image material with portion displays can be used to assist the responder with more accurate estimation of portion sizes [Wrieden, 2009]. This method involves a five-step system of questioning. Each step involves obtaining various information on all the consumed foods and beverages during the previous day. Accurate tracking of the levels of questioning and the use of images with portion sizes reduces the under reporting of nutrient intake [Rumpler, 2008]. For more accurate results,

it is necessary to carry out 3 to five nutritional interviews with the 24 hour recall with each patient. The final results are the average of all five interviews conducted in person with all of the 30 chosen patients. The advantage of the 24-hour recall is its suitability for obtaining detailed and qualitative information on consumed foods during the previous day [Trabuls, 2001].

In a nutrition interview, we adjusted the stages of the 24 hour recall by focusing primarily on the main meals. We asked the patients to list all the foods they had for breakfast, lunch, dinner and snacks. During the conversation we made a list of all consumed foods. We then asked them to describe how the food was prepared (cooked, baked, fried, etc.). In this step, we also showed them images with measured portion sizes to help them determine the size of their portions. We also encouraged them to describe portions with domestic measurements. Some patients preferred describing the diet of the previous day chronologically from morning to evening, and at the same time giving information on how food was prepared and portion sizes. In the third step we asked them about the snacks that they might have forgotten to mention. In the last step, we read the list of foods and asked them if all the information was correct and if they might have forgotten to mention some foods consumed between meals, such as fruit, coffee, juice, biscuits, salty snacks, etc. To analyse daily energy and nutrient intake we used the Prodi 6.6 Expert program.

Anthropometric Assessments

We measured body weight and height in all patients. Body composition was measured with the BCM-body composition monitor manufactured by Fresenius Medical Care. Measurement of the body composition was carried out before patients were connected to the dialysis machine.

Laboratory Measurements

Routine laboratory biochemical tests were performed in University Medical Centre of Ljubljana.

Statistical Analyses

Nutritional intake of macro- and micronutrients, energy intake anthropo-metric data and laboratory examinations were expressed as means ± SDs. Statistical analyses were performed with Matlab software.

RESULTS

All 30 participants completed the study. The mean age was 64.8 ± 14 and the average dialysis duration was 6.5 ± 5.4 years and all patients were adequately dialyzed.

Table 1. *Mean ± SD of anthropometric and clinical features of the sample*

	Total (n=30)
Age ,years	64.8 ± 14
Dialysis duration, years	6.5 ± 5.4
Body mass, kg	79.3 ± 15.6
BMI, kg/m^2	27.9 ± 4.4
LTI, kg/m^2	12.5 ± 3.1
FTI, kg/m^2	14.2 ± 5.7
TBW	37.6 ± 9.2 l
ECW	19.0 ± 4.7 l
ICW	18.5 ± 4.8 l
E/I	1.0 ± 0.1
BCM, kg	19.6 ± 8.0
Phase Angle	4.2 ± 1.0
Albumin, g/l	38.2 ± 3.2
PTH , ng/l	502.9 ± 533.9
CRP, mg/l	12.9 ± 14.6
Ferritin, μmol/l	362.2 ± 239.9
Phosphate, mmol/l	1.6 ± 0.4
Glucose, mmol/l	5.7 ± 1.7
Calcium, mmol/l	2.2 ± 0.2
Chloride, mmol/l	102.3 ± 3. 7
Creatinine, μmol/l	726.7 ± 160.9
Magnesium, mmol/l	1.0 ± 0.2
Urea, mmol/l	26.2 ± 4.5
K-Hb, g/l	115.1 ± 9. 8
K-Ht , l	0.3 ± 0.03
Potassium, mmol/l	5.5 ± 0.7
A-Phosphatase, μkat/l	1.9 ± 1.9
Total holesterol, mmol/l	4.0 ± 1.3
HDL cholesterol, mmol/l	1.1 ± 0.3
Triglycerides mmol/l	2.1 ± 1.6
Folic acid, nmol/l	14.3 ± 9.5
vit. B12, nmol/l	304.6 ± 126.8

PTH - Parathyroid hormone; CRP – C-reactive protein

The main anthropometric and clinical characteristics of the patients are shown in Table 1. The average phase angle is quite low, which is an indication of cell membrane damage and cells' inability to store energy. A fairly high ITM, rather high FTI and low LTI indicate the presence of sarcopenic obesity [Lee, 2014]. The average E/I ratio is close to 1, which indicates issues with fluid retention.

Table 2. *Mean ± SD of daily energy and nutrient intake of the sample*

	Total (n=30)
Energy, kcal/kg BM/day	14.1 ± 4.7
Proteins, g/kg BM/day	0.61 ± 0.19
Total CHO, g/day	125.8 ± 49.4
CHO, g/kg BM/day	1.6 ± 0.6
Total Lipids, g/day	42.2 ± 16.9
Lipids, g/kg BM/day	0.5 ± 0.2
Sodium g/day	1.5 ± 0.6
Potassium g/day	1.5 ± 0.5
Phosphorus g/day	0.6 ± 0.2

BM-body mass, CHO-carbohydrates

Table 2 shows the average daily values of energy,and macro- and micronutrients (Na, K and P). Dietary recommendations for energy intake for active dialysis patients are 35 kcal/kg BM/day, for protein intake 1.2-1.4 g/kg BM/day. Recommendations for micronutrient intake: phosphate 0.8-1 g/day, potassium 2-2.5 g/day and sodium 1.8-2.5 g/day. Chronic haemodialysis causes increased needs for folic acid (1 mg/day), pyridoxine (10-20 mg/day), and vitamin C (30-60 mg/day) [Priporočila, 2008]. Figure 1 shows the average energy intake for each patient. Figure 2 shows average protein intake for each patient. The red line in both figures indicates the recommended intake according to patients' individual daily energy needs.

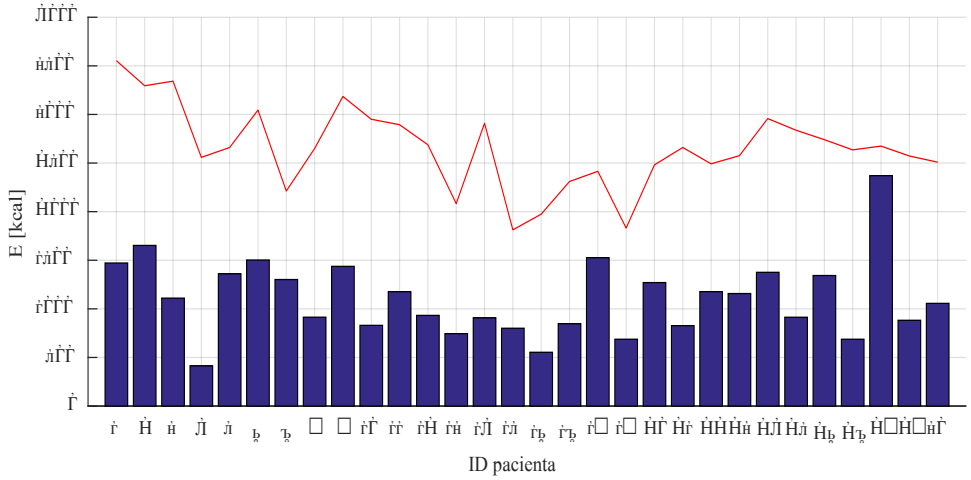

Figure 1. *Comparison of Daily Energy Intake (E) with recommended values*

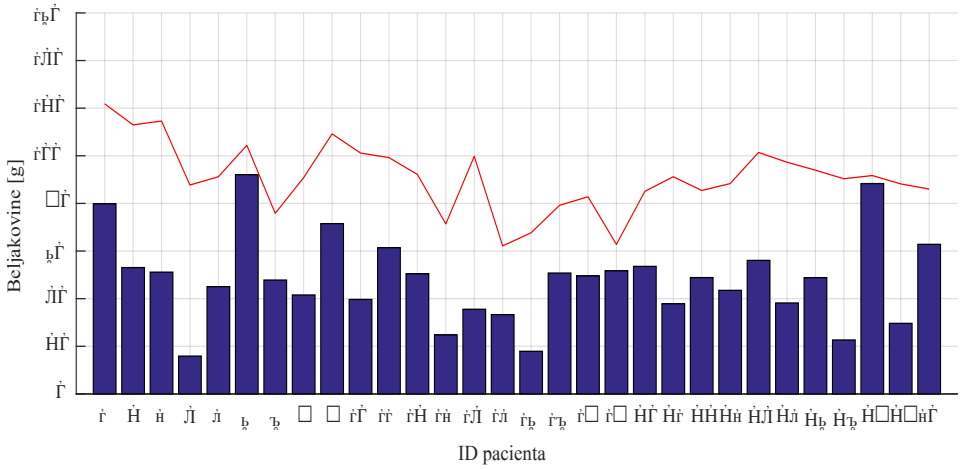

Figure 2. *Comparison of Daily protein Intake with recommended values*

DISCUSSION

Based on the recommendations for protein intake for dialysis patients, ranging from 1.2-1.4 g/kg body mass per day, the daily protein intake of our analysed patients is inadequate. Their daily energy intake is also inadequate, since does not meet the guidelines for energy intake of active patients, which is 35 kcal/kg body mass per day. The dietary intake of analysed micronutrients (K, Na, P) is appropriate according to the recommendations [Priporočila, 2008].

Martins et al. [2015] in their clinical study analysed the diet of elderly patients receiving dialysis treatment and found that their energy and protein intake was inadequate. Other studies that analysed nutritional intake of dialysis patients also found macronutrient and micronutrient intake to be largely inadequate compared to recommendations [Bovio, 2016].

Many dialysis patients experience PEW, due to inadequate daily protein intake. One of the therapeutic approaches for preventing PEW is the increase of protein intake [Kalantar-Zadeh, 2011]. Nevertheless, uncontrolled high daily protein intake may have adverse effects for dialysis patients as it is accompanied by higher phosphate intake. Therefore, nutritional interventions need to be tailored individually according to the needs of each patient [Kovesdy, 2016].

Since most high protein foods contain high levels of phosphorus, the limitations in phosphorus intake can be the main reason for low protein intake in dialysis patients' diets [Martins, 2015]. Therefore, the question arises whether recommendations for protein intake of 1.2g/kg body mass per day are even appropriate at all. Can the electrolyte balance of phosphorus be achieved with such protein intake?

In addition to haemodialysis treatment, optimal nutritional support is extremely important, as adequate diets prevents malnutrition. It also reduces the accumulation of uremic toxins and water retention in the body, while improving patient's quality of life and prolonging their life expectancy [Kazancioglu, 2014].

Compliance with Ethical Standards

Authors declare that they have no conflict of interest.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

CONCLUSION

The amount of nutrient intake was calculated with 5 unannounced nutritional interviews. 24 hour recall method was used for interviewing the patients. Our results indicated low nutrient intake, especially energy and protein intakes were inadequate. The intake of analyzed micro-nutrients corresponded to the recommendations. Although our research group was small and couldn't represent the entire dialysis population, our result indicated that inadequate diet in dialysis population caused malnutrition. This is why regular nutritional assessment is particularly important in preventing PEW and malnutrition in dialysis patients. Successful collaboration between patients and dietitian is essential for the objective results of the 24 hour recall method and the objective results of nutritional assessment. Early identification of protein malnutrition and successful nutritional intervention allows optimum protein intake in haemodialysis treatment, which results in improved nutrition, longer life expectancy and improved quality of life for dialysis patients.

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Резиме

НУТРИЦИСКА ОЦЕНА НА ПАЦИЕНТ НА ДИЈАЛИЗА ЗАСНОВАНА НА ИНТЕРНЕТ-АЛАТКА ШТО ОВОЗМОЖУВА ПОТОЧНО ЛЕКУВАЊЕ НА НЕИСХРАНЕТОСТА

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Историја/цели: Редовната проценка на нутритивниот статус на пациентите на дијализа е од витално значење за спречување на неисхранетоста и загубата на протеините. Целта на оваа клиничка студија беше да се анализира исхраната на пациентите на дијализа и да се утврди дали ги задоволува нивните нутритивни потреби.

Методи: Клиничка студија беше спроведена на 30 случајно избрани пациенти на дијализа во Одделот за дијализа на Универзитетскиот медицински центар Љубљана. Интервјуто за исхраната беше спроведено ненајавено, петпати во период од три месеци, со метод на 24-часовно повлекување. Резултатите беа анализирани со софтверот Prodi 6.6 Expert. Составот на телото беше мерен со биоимпедансна спектроскопија

Резултати: Просечниот калоричен внес на 30 пациенти е 14,1 ± 4,7 kcal / kg телесна тежина дневно, просечниот внес на протеини е 0,61 ± 0,19 g / kg телесна тежина дневно. Просечниот BMI (индекс на телесна маса) е 27,9 ± 4,4 kg / m^2, просечниот LTI (индекс на немасно ткиво) е 12,5 ± 3,1 kg / m^2, просечниот FTI (индекс на масно ткиво) е 14,2 ± 5,7 kg / m^2 и просечниот фазен агол е 4,2 ± 1,0. Просечниот внес на калории и внесот на протеини се несоодветни според препораките за исхрана за пациентите на дијализа. Антропометриските мерења укажуваат на саркопенска дебелина.

Заклучок: Според целта на студијата, потврдивме дека внесот на калории и протеини кај пациентите на дијализа е несоодветен според нивните потреби. Во зависност од резултатите од анализата на исхраната и мерењата на биоимпедансата, го потврдивме присуството на загуба на енергија од протеини кај набљудуваните пациенти.

Клучни зборови: хемодијализа, внес на хранливи материи, 24-часовно повлекување, неисхранетост