ECRONICON OPEN ACCESS

EC NUTRITION
Research Article

Nutritional Intervention of Adequate Calorie and Protein Intake Improve Malnutrition Among Hemodialysis Patients

Suhair Abdalla Khalil Abdallah[1]* and Yousif Babiker Yousif[2]

[1]Clinical dietitian, clinical nutrition department, King Faisal Specialist Hospital & Research Center Jeddah, Kingdom of Saudi Arabia
[2]Professor of Clinical Nutrition, Ahfad University for Women, Khartoum Sudan

***Corresponding Author**: Suhair Abdalla Khalil Abdallah, Clinical dietitian, clinical nutrition department, King Faisal Specialist Hospital & Research Center Jeddah, Kingdom of Saudi Arabia.

Received: August 29, 2016; **Published:** September 26, 2016

Abstract

Introduction: Protein energy malnutrition (PEM) is common among end stage renal disease patients (ESRD) on hemodialysis (HD) with an estimated prevalence of 10 - 70% and it undoubtedly contributes to increased risks of morbidity and mortality. It is compounded by the fact that these patients loose large amounts of protein in the dialysate fluid and do not consistently take the recommended amounts of energy and protein for ESRD patients on HD. They are in need of individualized meal plans but they rarely consult a dietitian.

Purpose: This was a prospective, clinical trial hospital based (intervention) study to evaluate the effect of Nutritional intervention of adequate calorie and protein intake on malnutrition among HD patients.

Methods: The study was conducted on HD patients, in one of the biggest dialysis centers in Khartoum. 134 adult patients (males & females) were divided into a test group (n = 77) and a control group (n = 57). The test group after nutritional counseling consumed individualized diets for a period of 6 months that provided adequate amounts of energy and protein according to the recommendations of the National Kidney Foundation (NKF) while the control group continued consuming their usual diets. Malnutrition status was determined by using subjective global assessment (SGA) tool (which used by health specialists to score malnutrition status) at baseline and after 6 months of intervention. Data were analyzed using SPSS.

Results: The SGA scores of the study patients was similar at baseline in both groups, the majority 88.1% were severely malnourished (92.2 test and 82.5 control), 11.9% moderate malnourished (7.8% test and 17.5% control), and there was no well-nourished score in both groups. After intervention the result showed significant differences in SGA scores between the two study groups (P = 0.000); 46.8% of test group had well-nourished scores (A), and still no participants from control group reached the well-nourished score. 33.6% participants were moderately malnourished (B) (44.2% test and 19.3% control). The control group showed 80.7% as severely malnourished (C), and only 9.7% were severely malnourished from test group. Therefore, the result after intervention shows highly significant differences in SGA score between the two groups during intervention period (P = 0.000).

Conclusion: The study concluded that nutritional intervention in the form of adequate calorie and protein intake was help in improving nutritional status and malnutrition among HD patients. Therefore, nutritional counseling by qualified dietitians should be mandatory in renal dialysis units as part of the medical therapy management to reduce the incidence of malnutrition among HD patients.

Keywords: *Protein Energy Malnutrition (PEM); Malnutrition; Hemodialysis (HD); Subjective Global Assessment (SGA)*

Introduction

Protein-energy malnutrition (PEM) refers to a form of malnutrition where there is inadequate calorie or protein intake. It is currently the most widespread and serious health problem worldwide [1,2].

(PEM) is common among end-stage renal disease (ESRD) patients on hemodialysis (HD) [3-5] with an estimated prevalence of 10 - 70% [6,7] and it undoubtedly contributes to increased risks of morbidity and mortality [5,7,8] It is compounded by the fact that these patients loose large amounts of protein in the dialysate fluid and do not consistently take the recommended amounts of energy and protein for ESRD patients on HD [4,9-12]. They are in need of individualized meal plans but they rarely consult a dietitian.

Causes of PEM

There are many causes of PEM in patients with ESRD. These include : Inadequate food intake secondary to: (anorexia caused by the uremic state, altered taste sensation, inter-current illnesses, emotional distress or illness, impaired ability to procure, prepare, or mechanically ingest foods and/or unpalatable prescribed diets) [12-15], another causes are: The catabolic response to superimposed illnesses, the dialysis procedure itself, which may promote wasting by removing such nutrients as amino acids, peptides, protein, glucose, water-soluble vitamins, and other bioactive compounds, and may promote protein catabolism, due to bio-incompatibility [16]. Conditions associated with chronic renal failure that may induce a chronic inflammatory state and may promote hyper-catabolism and anorexia [17-18]. Loss of blood due to: gastrointestinal bleeding, frequent blood sampling, blood sequestered in the hemodialyzer and tubing. Endocrine disorders of uremia (resistance to the actions of insulin and IGF-I, hyperglucagonemia, and hyperparathyroidism). The possible accumulation of endogenously formed uremic toxins or the ingestion of exogenous toxins [19-21].

Thus, ESRD patients are prone to suffer from PEM due to inadequate intake of dietary energy and protein as a result of insufficient food intake [22-25]. In addition, the patients lose protein with each dialysis session leading to low levels of protein and other nutrients in blood.

PEM is one of the strongest predictors of morbidity and mortality [26-30]. The mortality and morbidity rates in (ESRD) patients are unacceptably high [13]. It is important to adequately assess patients who are at risk. Nutrition therapy should be individualized based on various factors such as residual renal function laboratory analysis, and overall nutritional status [29, 31-35]. Numerous studies reported the prevalence of PEM among ESRD patients on HD. Patients who have been on HD for several years may be at greater risk for becoming malnourished [23].

Provision of adequate nutrition is a key component in the prevention of PEM among ESRD adults on HD. The K/DOQI Nutrition Clinical Practice Guidelines provide recommendations regarding the desirable dietary energy and protein intakes for adults undergoing HD [36].

Assessment of PEM among ESRD patients on HD

Several tools are recommended to Assess, diagnose and manager of PEM among HD patients, including the Subjective Global Assessment (SGA), Malnutrition Inflammation Score (MIS), Geriatric Nutritional Risk Index (GNRI), and PEW diagnostic criteria. These tools are reliable, and useful to determine predictors of outcomes in CKD patients. Among these tools, the widely used is (SGA), and this was support by many studies to assess malnutrition in HD patients. [24, 26, 28, 30, 34, 37-38].

Subjective Global Assessment (SGA)

SGA tool was developed by Detsky., *et al*. in 1984 that comprises subjective and objective aspects of nutritional status [39,40]. (SGA) is a tool used by health care providers to assess nutritional status and evaluate malnutrition with HD patients [41]. The tool has much strength in the clinical and research setting: it is inexpensive, rapid to conduct, reproducible, valid, and reliable in all studies. It can be used effectively by providers from different disciplines (nephrologist, nurse or dietitians). SGA has been recommended by The Kidney Disease Outcomes Quality Initiative (KDOQI) for use in nutritional assessment in the adult dialysis population to be performed every 6 months in the HD population [36]. It requires no additional capital outlay and correlates strongly with other subjective and objective measures of nutrition [13].

Clinicians place the patient into one of these categories (A, B, or C, reflecting well-nourished, moderately malnourished and severely malnourished categories respectively) based upon their subjective rating of the patient in two broad areas: medical history and physical examination, which are combined subjectively to form a global rating of A, B, or C [42].

Medical history

The medical history focus on 7 variables, namely: weight change in preceding 6 months and 2 weeks, change in dietary intake, presence of GI symptoms (anorexia, nausea, vomiting, diarrhea), change in functional capacity, disease state/comorbidities and their relationship to nutritional status. Each of these features is scored separately in terms of A, B, or C. The patient is then rated as either nourished, mildly too moderately malnourished, or severely malnourished for each of the seven parameters [36].

Physical examination

Physical examination focuses on the subcutaneous loss of fat, muscle wasting, edema and ascities. Loss of subcutaneous fat is assessed over triceps, biceps, chest and the pads below the eyes. Muscle wasting is assessed by examination of temples, clavicle, scapula, ribs, quadriceps, calf, knee, and interosseous. There are several body locations to examine for each parameter. The data are weighted, and the patients are then classified in terms of three major SGA scores [36].

Scoring guidelines

The clinician rates each medical history and physical examination parameter as either A, B, or C on the SGA Scoring Sheet. On the basis of all of these parameters' ratings, the clinical observer assigns an overall SGA classification which corresponds to his or her subjective opinion of the patient's nutritional status.

SGA is not a numerical scoring system. Therefore, it is inappropriate just to add the number of A, B, and C ratings to arrive at the overall SGA classification. The clinician should examine the form to obtain a general feel for the patient's status. If there seem to be more checks on the right-hand side of the form (more B and C ratings), the patient is more likely to be malnourished. If the ratings seem to be on the left-hand side, the patient is likely to be nourished. The severely malnourished rating (C) is given whenever a patient has physical signs of malnutrition such as, severe loss of subcutaneous fat, severe muscle wasting, or edema, in the presence of a medical history suggestive of risk, such as continuing weight loss with a net loss of 10% or more, or a decline in dietary intake. GI symptoms and functional impairments usually exist in these patients. Severely malnourished patients will rank in the moderate to severe category in most sections of the SGA form.

When weight loss is 5-10% with no subsequent gain, in conjunction with mild subcutaneous fat or muscle loss and a reduction in dietary intake, the patient is assigned the mild/moderate malnourished rating (B). These patients may or may not exhibit functional impairments or GI symptoms. The B rating is expected to be the most ambiguous of all the SGA classifications. These patients may have a ranking in all three categories. In general, if the severely malnourished or well-nourished rating is not clearly indicated, the patient is assigned to the moderately malnourished classification.

If the patient has no physical signs of malnutrition, no significant weight loss, no dietary difficulties, no nutritionally related functional impairments, or no GI symptoms which might predispose to malnutrition, the patient should be assigned to the well-nourished category. If the patient has recently gained weight, and/or showed improvement in other indicators i.e. appetite, the patient may then be assigned the A rating, despite previous loss of fat and muscle which may still be physically apparent.

Obese patients can be moderately or severely malnourished based upon their poor medical history and signs of muscle loss. Even patients with a normal appearance could be classified as mildly or moderately malnourished because of a poor medical history.

SGA has been validated in a variety of CKD patient populations as a predictor of PEM and relative risk of death (36) and the current European Best Practice Guidelines on diagnosis and monitoring of malnutrition recommends the use of SGA to detect severe malnutrition in HD patients. The guidelines refer to a study that showed SGA ability to differentiate severe from normal nutrition status among dialysis patients [43-45].

Nutrient requirement for ESRD patients on HD

Inadequate nutrient intake is an important contributor for PEM among ESRD patients on HD [46]. Nutrient requirements must be individually assessed for patients by calculating energy, protein, potassium, phosphorus, sodium and fluid.

A specific diet is an essential part of the treatment process; it can also help to avoid complications of renal disease such as malnutrition, fluid overload, high blood potassium, bone disease, and weight loss. The nutrient needs of the adult on HD are an integral part of the treatment for kidney failure. [31, 47].

The dietary protein and energy intakes is very important to prevent and manage malnutrition with in this category of patients, they are in need of individualized meal plans but they rarely consult a dietitian. in other words, a special diet is needed for ESRD patients on HD. Recommended daily nutrients intake for an adult on HD are: protein 1.2 gm/kg body weight (50% of high biological value); energy for an adult < 60 years 35 kcal/kg and for an adult > 60 years or obese 30 kcal/kg; the minerals (mg/kg/day) - sodium 2-4, potassium 40 and phosphorous 17; fluids depends on fluids output + 500ml [31].

(KDOQI) recommend the use of standardized practices in renal nutrition as a central and integral part of the dietary management of ESRD patients on HD. A dietitian with renal experience should be responsible for the ongoing evaluation of patient's nutrition status and the development of plans for dietary care [48]. This ensures appropriate assessment of the nutrition status and timely identification of patients at risk [49].

Materials and Methods

Patients and study design

This was an intervention study to evaluate the effect of Nutritional intervention of adequate calorie and protein intake on malnutrition among HD patients. The study was carried out in the one of the largest HD Center in Khartoum. Complete coverage were done for all ESRD patients on HD who was dialyzed at this Center and fulfilled the following inclusion criteria: (ESRD patients on regular HD (three times weekly), dialyzed four hours per session, Patients, who dialyzed for at least 3 months, Both genders, More than 18 years of age, consent given for participation in the study, Absence of active underlying disease (e.g., collagen vascular disease), Absence of active infection (free from infections and inflammations)and Not hospitalized during the month preceding the study). Among the 156 ESRD patients who were on HD treatment and dialyzed at the Center, during the study period, 145 fulfilled the inclusion criteria and were enrolled in this study. The patients were divided into 2 groups: test group (n = 83) and control group (n = 62). After the intervention period, the sample decreased to 134 patients (77 test and 57 control). Some died; others opted for transplant and changed to peritoneal dialysis.

Method of data collection

Data was collected on day one for each patient (baseline), during study period and after intervention. The medical records of the patients were reviewed by the researcher for co-morbid conditions and medical history of the participants. This was examined to check the presence of chronic diseases such as DM, HTN, IHD, hepatitis profile, duration of the problem, treatment, duration on dialysis (per months), number of dialysis sessions per week and duration of dialysis in hours. The medical records were reviewed for all participants (test group and control group) at baseline study and at every 2 months for biochemical results.

A questionnaire was used to collect data (on baseline) through direct interviews by the researcher. Each subject was interviewed with a structured questionnaire during their dialysis session. It was used to collect the Demographic characteristic of the sample and some Medical characteristic of the sample.

Nutritional status assessment

Intervention: Eighty-three HD patients who were included in the study as test group received conventional nutritional counseling and individual meal plan to achieve adequate protein and calories intake. Monitoring was done during 6 months of follow up. The individual meal plan was designed and explained to patient and their families by the following ways:

Educational lecture: was given exclusively to the test group. It was presented by the researcher to the patients and their families during their dialysis session by using a data-show to educate the patients and their families on the nutritional needs to provide appropriate food with adequate calories and protein to the patients. Presentation included all the important information needed to be known by ESRD patient on HD. It was concentrated mainly on calorie and protein needed, additional to fluids limitation, intake of sodium, potassium and phosphorus in foods. Information was provided in a simple way and was explained by pictures for more understanding.

Pamphlets: were prepared and distributed to all intervention group participants after the lecture and all the summary information that was presented was found in the sheet.

Individualized meal plans: was designed individually to all intervention group participants after analysis of the full information that helped the researcher to conduct the meal plan. The meal plan was based on: patient's economic status, medical history, diet history, like and dislike, chewing and swallowing status, food allergies, blood investigation result, age, weight, height and sex.

After calculation of all nutrients needed by each participant, individual meal plan for the whole week was designed by researcher, typed, organized, color printed and given to participant with full explanation of uses. The meals planned were designed only for intervention patients, whereas control patients continued to receive their usual care.

Subjective global assessment (SGA): The SGA Form was completed by the researcher at both the base line and after intervention to determine nutrition status of the participants. Score was calculated based on the medical history and physical examination as described by Detsky., *et al*. in 1984. The medical history focused on 7 variables, namely: weight change in preceding 6 months, weight change in last 2 weeks, change in dietary intake, presence of GI symptoms, change in functional capacity, disease state/comorbidities relation to nutritional status. The physical examination focused on the subcutaneous loss of fat, muscle wasting, edema and ascites. Loss of subcutaneous fat was assessed over triceps, biceps, chest and the fat pads below the eyes. And muscle wasting was assessed on examination of temples, clavicle, scapula, ribs, quadriceps, calf, knee, and interosseous. The patients were classified into 3 groups according to the points scored as follows: well nourished (SGA-A), moderately malnourished (SGA-B) or severely malnourished (SGA-C).

Medications: All the participants from both groups (test and control group) took their medications, such as receiving antihypertensive, phosphate binders' erythropoietin, iron medications and supplementation of vitamins B, C, D during the study, which were recommended by their physicians.

Follow up: Each patient was monitored during three consecutive dialysis sessions during the study period (baseline 2 - 4 - 6 months).

Statistical Analysis: All analyses were performed using SPSS statistical software package program (version 17.0 for Windows; SPSS Inc., Chicago, IL, USA). The results are presented as frequencies and percentages for categorical variables and mean [+ or -] standard deviation (SD) were calculated for all continuous variables. For com¬parison and differences between means data were analyzed using the 't' test and ($\chi 2$) qui squire test. A 'p' value of less than (<) 0.05 was considered statistically significant.

Results

Demographic characteristic of the study sample: For The demographic characteristic of the study participants, test and control, Males represented a higher percentage than the females. The age group distribution of subject shows that most of the patients (46.3%) were in the active age group of 30 - 45yrs (49.4% test and 42.1% control). The majority (31.3%) had higher secondary school education (29.9% test and 33.3 % control), followed by 17.9% university graduates (23.4% test and 10.5% control), the rest were illiterate or with low educational level.

Medical profile of the participants: The medical characteristics of the study participants are shown that 53.7% of the participant had hypertension (61.0% test and 43.9% control), while only 3.0% had diabetes mellitus and hypertension (1.3% test and 5.3% control) and

the rest 43.3% did not have any co-morbid disease (37.7% test and 50.9% control). The mean durations of dialysis periods were 57.08 ± 36.16 months for both groups (61.77 ± 38.84 test and (50.75 ± 31.42 control group).

Nutritional evaluation of Subjective Global Assessment (SGA) scores of the study patients: The SGA scores of the study patients was similar at baseline in both groups, the majority 88.1% were severely malnourished (92.2 test and 82.5 control), 11.9% moderate malnourished (7.8% test and 17.5% control), and there was no well-nourished score in both groups. After intervention the result showed significant differences in SGA scores between the two study groups (P = 0.000); 46.8% of test group had well-nourished scores (A), and still no participants from control group reached the well-nourished score. 33.6% participants were moderately malnourished (B) (44.2% test and 19.3% control). The control group showed 80.7% as severely malnourished (C), and only 9.7% were severely malnourished from test group. Therefore, the result after intervention shows highly significant differences in SGA score between the two groups during intervention period (P = 0.000).

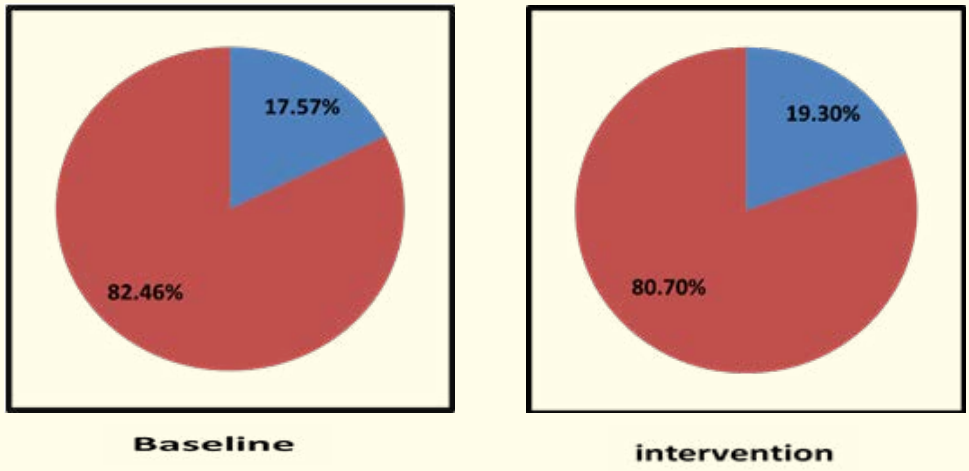

Figure 1: *Comparison of Nutritional status differences of control group according to changes in SGA score during the study (on baseline & after intervention) (n=57).*

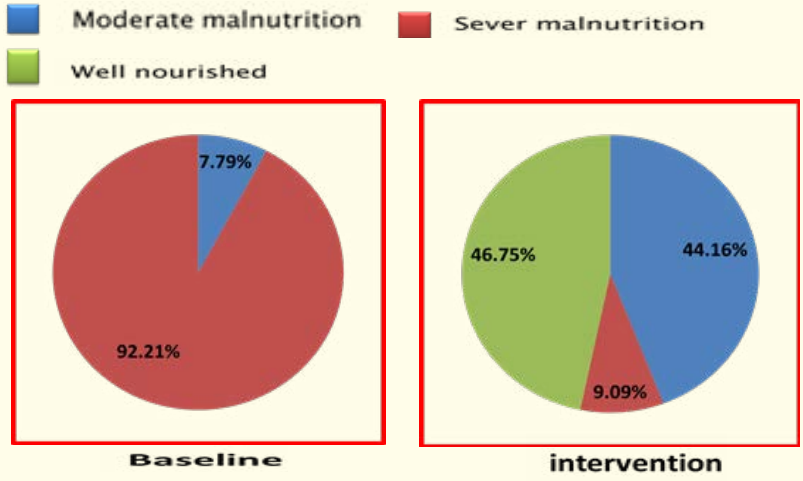

Figure 2: *Comparison of Nutritional status differences of test group according to changes in SGA score during the study (on baseline & after intervention) (n=77).*

Discussion

Many studies pointed to the high incidence of malnutrition (PEM) among HD patients, an established fact today. Examples from Sudan [50,22], Saudi Arabia [30], Iraq [51], Jordan [29], India [35], Serbia [32], Iran [34], and Brazil [33].

NKF-KDOQI [52] recommended higher energy and protein intakes by HD patients (30 - 35 kcal/kg/day and 1.2g protein/kg/day) because of dialysis losses of amino acids, peptides, negligible amounts of proteins, metabolic acidosis and co-morbid conditions. Thus the dietary treatment to control the disease needs more energy and protein to meet the extra needs for body repair functions and immunity [53]. Many studies approve that HD patients are not taking their intakes of energy and protein of NKF/DOQI recommendations) and usually reported lower than the recommended intake levels, an examples in Korea [54], in Brazil [33] and in the USA [55]. This is the reason why malnutrition is frequently observed among HD patients.

In our study high incidence of malnutrition was observed at baseline in both groups but after 6 months the nutritional status of the test group improved markedly as evidenced by the decrease in severe malnutrition cases (92.2% → 9.09%), increase in the moderate cases (7.79% → 44.16%) and 46.75% became well-nourished from previously suffering from malnutrition. No change was noticed in the nutritional status of the control group. This is proof of the efficacy of individualized meal plan for improving the nutritional status of HD patients. Which is highly approved that the Inadequate nutrient intake is probably the most important single cause of malnutrition in HD patients, and the providing of high calorie high protein diet as per NKF recommendation is help in improving malnutrition among this group of patients. The effect of followed the individualized meal plan based on the NKF-DOQI recommendations for energy and protein intakes for 6 months after receiving full dietary counseling (30 - 35 kcal/kg/day and 1.2g protein/kg/day) were very effective on management of malnutrition among ESRD patients on HD.

The study showed that proper nutritional counseling by a dietitian to HD patients on the intake of individualized meal plan can result in a better nutritional status and good improvement of malnutrition.

Conclusion

This study was the first one which was done to evaluate the effect of individual meal plan on the nutritional status among HDP in Khartoum, Sudan. Our study demonstrates signi¬ficant improvement in nutritional status by providing active nutritional counseling in the form of individual meal plan, through the improvement in important nutritional and clinical parameter (SGA score). The use of SGA scores showed a clinically impressive improvement among studied HDP after following individual meal plan which helped in decreasing the prevalence of malnutrition among these categories. Every HD patient needs to be seen by renal dietitian, to help in providing an intensive nutritional counseling.

Bibliography

1. Fouque D., *et al.* "A proposed nomenclature and diagnostic criteria for protein-energy wasting in acute and chronic kidney disease". *Kidney International* 73.4 (2008): 391-398.

2. Kopple JD. McCollum Award Lecture, 1996: "Protein-energy malnutrition in maintenance dialysis patients". The American Journal of Clinical Nutrition 65.5 (1997): 1544-1557.

3. Kovesdy CP and Kalantar-Zadeh K. "Why is protein-energy wasting associated with mortality in chronic kidney disease?" Seminars in Nephrology 29.1 (2009): 3-14.

4. Hakim RM and Levin N. "Malnutrition in hemodialysis patients". American Journal of Kidney Diseases 21.2 (1993): 125-137.

5. Owen WF. "Nutritional status and survival in end-stage renal disease patients". Mineral and Electrolyte Metabolism 24.1(1998):72-81.

6. Cano N. "Malnutrition and chronic renal failure". Annals of Internal Medicine 151.7 (2000): 563-574.

7. National Kidney Foundation. "KDOQI Clinical Practice Guide-lines for Nutrition in Chronic Renal Failure". *American Journal of Kidney Diseases* (2000): S1-S104.

8. Pifer TB., *et al.* "Mortality risk in hemodialysis patients and changes in nutritional indicators: DOPPS". *Kidney International* 62.6 (2002): 2238-2245.

9. Kopple JD., *et al.* "Evaluating modi-fied protein diets for uremia". *Journal of the American Dietetic Association* 54.6 (1969): 481-485.

10. Kopple JD., *et al.* "Optimal dietary protein treatment during chronic hemodialysis". *ASAIO American Society for Artificial Internal Organs* 15 (1969): 302-308.

11. Slomowitz LA., *et al.* "Effect of energy intake on nutritional status in maintenance hemodialysis patients". *Kidney International* 35.2 (1989): 704-711.

12. Borah MF., *et al*. "Nitrogen balance during intermittent dialysis therapy of uremia". *Kidney International* 14 .5 (1978): 491-500.

13. Suzuki H and Kimmel PL. "Nutrition and kidney disease A New Era". Karger Switzerland (2008).

14. Lim VS., *et al.* "The effect of hemodialysis on protein metabolism". *The Journal of Clinical Investigation* 91.6 (1993): 2429-2436.

15. Guiterrez A., *et al.* "The effect of in vivo contact between blood and dialysis membranes on protein catabolism in humans". *Kidney International* 38 (1990): 487-494.

16. May RC., *et al.* "Mechanism for defects in muscle protein metabolism in rats with renal failure". *Journal of Clinical Investigation* 79 (1987): 1099-1103.

17. Wolfson M., *et al.* "Amino acid losses during hemodialysis with infusion of amino acids and glucose". *Kidney International* 21.3 (1982): 500-506.

18. Kaplan AA., *et al* "Dialysate losses with bleach reprocessed polysulfone dialyzers". *Kidney International* 47 (1985): 573-578.

19. Wolfson M. "Use of water-soluble vitamins in patients with chronic renal failure". Seminars in Dialysis 1.1 (1998): 28-32.

20. Falkenhagen D., *et al.* "Serum complement and protein metabolism in chronic dialysis patients". *The International journal of Artificial Organs* 72.2 (1979): 65-68.

21. Hylander B., *et al.* "Eating behavior in continuous ambulatory peritoneal dialysis and hemodialysis patients". *American Journal of Kidney Diseases* 20.6 (1992): 592-597.

22. Zammrawi FY., *et al.* "The severity and causes of malnutrition among hemodialysis patients in Sudan". *Journal of renal nutrition*. 18.3 (2008): S4 (010).

23. Asgarani F., *et al.* "Correlation between modified Subjective Global Assessment with anthropometric measurements and laboratory parameters". *Acta Medica Iranica*. 42.5 (2004): 331-337.

24. Alshatwi AA., *et al.* "Nutritional assessment of hemodialysis patients". *Journal of Medical Science* 7.2 (2007): 294-298.

25. Alshatwi AA. "A comparative study of nutritional parameters in hemodialysis patients". *Bulletin of Faculty of Agriculture, Cairo University* 58 (2007): 105-111.

26. Gurreebun F., *et al*. "Nutritional screening in patients on hemodialysis: is subjective global assessment an appropriate tool?" *Journal of Renal Nutrition* 17.2(2007):114-117.

27. Bossola M., *et al.* "Malnutrition in hemodialysis patients". *Italian Enteral and Parenteral Nutrition Journal.* 19.1 (2003): 1-11.

28. Afsar B., *et al.* "Reliability of mini nutritional assessment in hemodialysis compared with subjective global assessment". *Journal of Renal Nutrition* 16.3 (2006):277-282.

29. Tayyem RF., *et al.* "Assessment of nutritional status among ESRD patients in Jordanian hospitals". *Journal of Renal Nutrition* 18.3 (2008): 281-287.

30. Alharbi K and Enrione EB. "Malnutrition is prevalent among hemodialysis patients in Jeddah, Saudi Arabia". Saudi Journal of Kidney Diseases and Transplantation 23.3 (2012): 598-608.

31. Byham-Gray L and Wiesen K. "A clinical guide to nutrition care in kidney disease". *American Dietetic Association* (2004).

32. Stojanovic M., *et al.* "The Impact of Malnutrition on Mortality in Patients on Maintenance Hemodialysis in Serbia". *Artificial Organs* 32.5 (2008): 398-405.

33. Morais A A C., *et al.* "Correlation of nutritional status and food intake in hemodialysis patients". *Clinics* 60.3 (2005): 185-192.

34. Afshar R., *et al.* "Assessment of nutritional status in patients undergoing maintenance hemodialysis: a single-center study from Iran". *Saudi Journal of Kidney Diseases and Transplantation* 18.3 (2007):397-404.

35. Tapiawala S., *et al*. "Subjective Global Assessment of Nutritional Status of Patients with Chronic Renal Insufficiency and End Stage Renal Disease on Dialysis". *Journal of Association of Physician of India* 54 (2006): 923-926.

36. National Kidney Foundation. "Pocket Guide to Nutrition Assessment of the Patient with Chronic Kidney Disease". In: McCann L. 4th ed. New York (2009).

37. Anees M., *et al.* "Evaluation status of patients on hemodialysis". *Journal of College of Physicians and Surgeons Pakistan* 14.11 (2004): 665-669.

38. Alsaran K., *et al.* "Nutritional assessment of patients in a large dialysis Saudi center". *Saudi Medical Journal* 30.8 (2009): 179-184.

39. Baker JP., *et al*. "Nutritional assessment: a comparison of clinical judgement and objective measurements". *The New England Journal of Medicine* 306.16 (1982): 969-972.

40. Detsky AS., *et al.* "What is subjective global assessment of nutritional status?" *Journal of Parenteral and Enteral Nutrition* 11 (1987): 8-13.

41. Steiber A., *et al.* "Subjective Global Assessment in Chronic Kidney Disease: A Review". *Journal of Renal Nutrition* 14.4 (2004): 191-200.

42. Desbrow B., *et al.* "Assessment of nutritional status in hemodialysis patients using patient-generated subjective global assessment". *Journal of Renal Nutrition* 15.2 (2005): 211-216.

43. Mutsert RD., *et al.* "Subjective global assessment of nutritional status is strongly associated with mortality in chronic dialysis patients". *American Journal of Clinical Nutrition* 89.3 (2009): 787-793.

44. Enia G., *et al.* "Subjective global assessment of nutrition in dialysis patients". *Nephrology Dialysis Transplantation* 8.10 (1983):1094-1098.

45. Cooper BA., *et al*. "Validity of subjective global assessment as a nutritional marker in end-stage renal disease". *American Journal of Kidney Diseases* 40.1 (2002): 126-132.

46. Raza H., *et al.* "The effect of active nutritional counseling in improving biochemical nutritional parameters and fluid overload problems in maintenance hemodialysis patients". *Saudi Journal of Kidney Diseases and Transplantation* 15.2 (2004): 140-143.

47. Webster-GandyJ., *et al.* Oxford handbook of nutrition and dietetics. Oxford, New York (2006).

48. Mahan LK and Escott-Stump. "Krause's Food, Nutrition, and Diet Therapy". 12th edition W.B. Saunders Company USA (2006).

49. Locatelli F., *et al*. "Management of disturbances of calcium and phosphate metabolism in chronic renal insufficiency, with emphasis on the control of hyperphosphatasemia". *Nephrology Dialysis Transplantation* 17.5 (2002) :723-731.

50. Mohammed NA. "Chronic renal failure: a cause of malnutrition among Sudanese patients in Khartoum North Hospital". MSc dissertation, Ahfad University for Women, Sudan (2010).

51. Al-Saedy AJH and Al-Kahich HRA. "The current status of hemodialysis in Baghdad". *Saudi Journal for Kidney Transplantation* 22.2 (2011): 362-367.

52. Hwang J., *et al.* "Family history of chronic renal failure is associated with malnutrition in Korean hemodialysis patients". *Nutrition Research and Practice* 3.3 (2009): 247-252.

53. Thomas D., *et al*. "Effect of patient counseling on quality of life of hemodialysis patients in India". *Pharmacy Practice (Internet)* 7.3 (2009) :181-184.

54. Kim S., *et al.* "Comparison of nutritional status and inflammational markers in DM and non DM hemodialysis patients". *Korean Journal of Community Nutrition.* 10 (2005): 693-699.

55. Rocco MV., *et al.* "HEMO Study Group. The effect of dialysis dose and membrane flux on nutritional parameters in hemodialysis patients. Results of the HEMO study". *Kidney International* 65 (2003): 2321-2324.

Volume 5 Issue 2 September 2016