Nutritional assessment of patients in a large Saudi dialysis center

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ABSTRACT

الأهداف : التنبؤ باحتمالية التحسن أو التدهور في الحالة الصحية نتيجة عوامل نقص أو سوء التغذية و كذلك تحديد معدل الإصابة بسوء التغذية و أمراض التغذية الأخرى .

الطريقة : شملت هذه الدراسة العرضية مرضى الفشل الكلوي المزمن في مركز الأمير سلمان للكلى– الرياض خلال الفترة من سبتمبر 2007 إلى سبتمبر 2008م. تم أخذ تاريخ المرض و عمل الفحص الطبي و الفحوصات المخبريه و حالة التغذية وفقاً للتقييم العالمي (SGA) .

النتائج : كان متوسط عمر المرضى في هذه الدراسة 16±50 عام و شملت 108 حالة من الذكور (54%) بينما 92 حالة من الإناث (46%) بمتوسط كفاءة ديلزة 0.15±1.4 و 0.2±1.13 nPCR . كان معدل كتلة الجسم (BMI) لدى 4% من المرضى اقل من المعدل الطبيعي، و49% في المتوسط، و 27.5% زيادة في الوزن، و 14% سمنة و 5.5% سمنة مفرطة. صنف التقيم العالمي المرضى إلى 68% حالة طبيعية، و 24% حالة متوسطة لسوء التغذية، و 8% حالة وخيمة لسوء التغذية .

خاتمة : إن استخدام معايير مختلفة لتقييم الحالات الأيضية لكل مريض و تحديد الاحتياجات الغذائية الموجودة أساسي لرعاية أمثل لمرضى الديلزة الدموية .

Objectives: To examine interventions used to manage malnutrition, and obesity, and to share experiences, concerns, and solutions to these problems for management of nutritional disorders in Saudi patients on maintenance hemodialysis.

Methods: The subjects included in this cross-sectional study were chronic hemodialysis patients in the Prince Salman Center for Kidney Diseases (PSCKD), Riyadh, Kingdom of Saudi Arabia during the period from September 2007 to September 2008. Medical history, examination, baseline laboratory tests, and the nutritional status was assessed using the subjective global assessment score (SGA).

Results: Subjects in the study had a mean age of 50 ± 16 years, 108 (54%) were males and 92 (46%) were females with a mean single pooled Kt/v of 1.4 ± 0.15, and a mean normalized protein catabolic ratio of 1.13 ± 0.2. Regarding body mass index, 4% of patients were underweight, 49% had average weight, 27.5% were overweight, 14% were obese, and 5.5% had morbid obesity. The SGA classified patients into 68% normal, 24% mild to moderately malnourished, and 8% with severe malnutrition.

Conclusion: Using different parameters for individualization of metabolic needs to each patient's own metabolic status, and for detection of the coexisting nutritional conditions is essential for optimal care for hemodialysis patients.

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Nutritional management of patients with chronic kidney disease is challenging as malnutrition can occur in up to 40%, and is associated with increased mortality and morbidity. The standard methods for assessing nutritional status can be applied to patients with end stage renal disease (ESRD), but some of these parameters are altered by uremia. Currently, with the use of modern technology in dialysis, malnutrition is less prevalent in those patients undergoing maintenance dialysis. However, there is evidence suggesting that many factors that promote malnutrition in renal failure persist even with modern methods of dialysis treatment.[1] There is no single measurement that can be used to determine or exclude the presence of malnutrition. As some measures for nutritional state are altered by uremia, so it is recommended to use a group of measurements including measurement of body composition, dietary protein intake, and serum protein status.[2,3] The purpose of nutritional screening in hemodialysis patients is to predict the probability for a better or worse outcome due to nutritional factors and to determine the prevalence of nutritional disorders (malnutrition, overweight, and obesity) per facility standards. Our study objectives is to examine interventions used to manage malnutrition, and obesity, and to share experiences, concerns, and solutions to these problems for management of nutritional disorders in Saudi patients on maintenance hemodialysis.

Methods. The subjects included in this cross-sectional study were chronic hemodialysis patients in Prince Salman Center for Kidney Diseases (PSCKD), which is a well equipped center for dialysis either peritoneal (PN) or hemodialysis (HD) that can serve up to 600 patients with ESRD in Riyadh, Saudi Arabia. Approval was obtained from the scientific and ethical committee in the center, and each patient gave written informed consent for the study, which was carried out from September 2007 to September 2008. Those patients that were hospitalized for more than 2 weeks for non-vascular access complications, or with signs of active infection were excluded from the study and all patients had to complete a minimum of 6 months duration of hemodialysis in the center. Finally, 200 patients completed the study. All subjects were evaluated and examined by 2 physicians, and 2 registered dietitians. A complete medical history included details of the patient's diet, and physical examination with recording of the dry body weight. Baseline laboratory tests included an evaluation of visceral protein by serum albumin and total proteins, fasting lipid profile (total cholesterol, triglycerides, high-density lipoprotein [HDL] and low-density lipoprotein [LDL]), somatic proteins by serum creatinine, also serum calcium and phosphorus, peripheral blood cell count for lymphocytes, fasting glucose, glycosylated hemoglobin (HgA1c), pre and post dialysis blood urea nitrogen (BUN) to determine the normalized protein catabolic ratio (nPCR) and urea kinetics by single pool Kt/v. Additionally, the nutritional state was assessed using the subjective global assessment score (SGA) that was originally developed to assess post operative nutritional state, but has been applied in hemodialysis patients. The history of SGA consists of 5 criteria and focuses on weight loss in the preceding 6 months, gastrointestinal tract symptoms such as anorexia, nausea, vomiting and diarrhea, the type of dietary food intake, functional capacity of the patients and associated comorbidities. Physical examination in SGA includes 3 items that focus on loss of subcutaneous fat over the triceps and mid-axillary line of the lateral chest wall, muscle wasting in the deltoid and quadriceps and the presence of ankle edema and/or ascites, and the patients were classified into normal, mild to moderate, or severely malnourished. The total lymphocytic count (TLC) is calculated using the following equation: TLC = [% lymphocytes x white blood counts]/100. A TLC less than 900 indicates severe depletion, 900-1500 is moderate, and 1500-1800 is mild depletion.[2] All patients received 4 hours hemodialysis per session 3 times/week, using bicarbonate buffered dialysate and a polysulfone dialyzer membrane. **Table 1** shows the recommended nutritional parameters according to the stage of chronic kidney disease and the type of dialysis whether HD or PN, which represents initial guidelines. Individualization to the patient's own metabolic status and coexisting metabolic conditions is essential for optimal care.[1]

Statistical analysis was performed using the SPSS software (Statistical Package for Social Science, Version 14, SPSS Inc, Chicago, IL, USA). All values are expressed as mean ± SD, and a $p<0.05$ was considered statistically significant.

Results. The 200 hemodialysis patients in this study comprised 108 males and 92 females of mean age 50 ± 16 years. The cause of chronic renal failure in 82 patients (41%) was due to diabetic nephropathy, in 40 patients (20%) due to hypertension, 12 patients (6%) chronic glomerulonephritis, 4% hypoplastic kidney, 3% lupus nephritis, 22% were of unknown etiology, other causes included were, obstructive uropathy 2%, tubulo-interstitial nephritis 1%, and contrast nephropathy in 1%. Subjects in the study had a mean single pooled Kt/v of 1.4 ± 0.15, and mean nPCR was 1.13 ± 0.2. Data in **Tables 2 & 3** show the demographic data of the studied population. **Table 4** shows the relation between body mass index (BMI) and gender. Regarding diet changes, 89% has minimal or no change in their diet, while 9% had mild to moderate decrease in their diet. The SGA classified patients into 68% normal, 24% mild to moderately malnourished, and 8% with severe malnutrition. Severe malnutrition by SGA was significantly correlated with male gender (p=0.04). The mean duration of dialysis was 23 months, ranging from 6-30 months. The incidence of comorbid diseases associated with maintenance hemodialysis patients was, 26% viral hepatitis either B or C, 13% cardiovascular diseases, 8% central nervous system disorders, 3.5% gastrointestinal tract diseases, 3% malignancy, 3% collagen diseases (systemic lupus erythematosus, scleroderma), and 4% chronic respiratory diseases (bronchial asthma, bronchiectasis). Severe malnutrition

Table 1 - Recommended nutritional parameters according to the stage of chronic kidney disease and the type of dialysis.[1]

Nutritional parameter	Stages 1-4 CKD	Stage 5 hemodialysis	Stage 5 peritoneal dialysis
Calories (kcal/kg/d)	35 <60 years 30-35 ≥60 years	35 <60 years 30-35 ≥60 years	35 <60 years 30-35 ≥60 years, include kcals from dialysate
Protein (g/kg/d)	0.6-0.75	1.2	1.2-1.3
Fat (% total kcal)	For patients at risk for CVD, <10% saturated fat, 250-300 mg cholesterol/d		
Sodium (mg/d)	2000	2000	2000
Potassium (mg/d)	Match to laboratory values	2000-3000	3000-4000
Calcium (mg/d)	1200	≤2000 from diet and meds	≤2000 from diet and meds
Phosphorus (mg/d)	Match to laboratory values	800-1000	800-1000
Fluid (mL/d)	Unrestricted w/ normal urine output	1000 + urine	Monitor; 1500-2000

CKD - chronic kidney disease, CVD - cardiovascular diseases

Table 2 - Demographic findings.

Demographic findings	Minimum	Maximum	Mean ± SD
Age (years)	18	82	50 ± 16
Body mass index	15.5	45	25.2 ± 5.5
nPCR	0.7	1.86	1.13 ± 0.06
Kt/v	0.97	1.9	1.4 ± 0.15
Dialysis duration/month	6	300	23.4 ± 3.9
Calcium (mmol/l)	1.85	2.6	2.25 ± 0.16
Phosphorus (mmol/l)	0.7	2.6	1.5 ± 0.4
Cholesterol (mmol/l)	2.3	7	4.6 ± 0.87
Triglyceride (mmol/l)	5.8	0.4	1.9 ± 0.96
HDL (mmol/l)	3	0.4	0.96 ± 0.3
Total protein (g/l)	87	47	69.7 ± 8.7
Albumin (g/l)	43	22	34 ± 4.4
Lymphocytic count	3890	1570	1820 ± 752

nPCR - normalized protein catabolic ratio,
HDL - high-density lipoprotein,
Kt/V - K = in vitro dialyser urea clearance, T= dialysis duration
V= urea volume of distribution

Table 3 - Body mass index (BMI).

BMI	Male	Female	Total
<18.5	3.5	0.5	4
18.5 - 24.9	29	20	49
25 - 30	16.5	11	27.5
30.5 - 35	4.5	9.5	14
>35.5	0.5	5	5.5

Data are expressed as percentage.

Table 4 - Demographic findings regarding diabetes mellitus, hypertension, Ischemic heart disease (IHD).

Demographic findings	Number of patients (%)
Smoking	33 (16.5)
Diabetes mellitus	88 (44)
Hypertension	162 (81)
IHD	54 (27)

by SGA was significantly correlated with duration of dialysis, functional capacity, associated comorbid diseases, and nPCR. The total cholesterol level was correlated significantly with serum albumin level, patient's age, and presence of diabetes mellitus and ischemic heart disease.

Discussion. The reported prevalence of chronic renal failure is 80-120 per million populations (pmp) in the Kingdom of Saudi Arabia.[4] The standard energy intake for stable adults could be applied to those patients on maintenance dialysis as their metabolic needs, based on resting energy expenditure, are similar to those of normal adults, namely, 35 kcal/kg/day. Energy balance studies, mainly in PD patients, confirmed that a positive nitrogen balance could only be attained with energy intakes >30 kcal/kg/day.[5] Although a level of 0.7–0.8 g of protein/kg may be sufficient to permit a neutral nitrogen balance in a pre-dialysis stable adult, the dialysis procedure itself increases protein demands. Based on nitrogen studies in HD and PD dialysis patients, the Dialysis Outcome Quality initiative (DOQI) guidelines for nutrition have recommended that a minimum of 1.2 g in HD and 1.3 g of proteins/kg in PD represents the minimum daily intake to ensure a neutral protein balance. Half of this intake should be made by proteins of high biological value from animal origin, for example, meat, fish, or dairy products.[5] For those patients on dialysis, the current K/DOQI guidelines in 2007 suggest increased protein intake (approximately 1.2 g/kg/d).[1] Malnutrition is present in approximately 40% of patients treated with maintenance hemodialysis.[7] The National Kidney Foundation-Kidney/DOQI (NKF-K/DOQI) clinical practice guidelines for nutrition in CRF, adult guidelines for maintenance dialysis and for evaluation of protein-energy malnutrition, and nutritional status recommended assessment with a combination of valid, and complementary measures rather than any single measure alone as malnutrition may be identified with greater sensitivity and specificity using a combination of factors.[8,9] To determine the nutritional requirements, a nutritional assessment ideally should be used to monitor the patient's progress and any alteration in his requirements. The nutritional assessment should be able to identify groups of patients who are at risk from the effects of malnutrition. Finally, the parameters used for assessment should be simple, yet effective, and readily available to any hospital.[10] Registered dietitians should be consulted for the nutritional management of chronic kidney disease (CKD) patients. All medical staff and clinical personnel should also strongly encourage dietary compliance of the patients because dietary adherence can determine the outcome in CKD.[11] The serum albumin concentration, even when only slightly less than 4.0 g/dL, is one of the most important markers of protein energy malnutrition (PEM) in patients with CKD. It is a very reliable indicator for visceral protein status, although its concentration is affected by the rate of synthesis and its catabolism (half-life 20 days), which is altered negatively in the presence of inflammation.[12,13] Hypoalbuminemia is highly predictive of future mortality risk when present at the time of initiation of chronic dialysis as well as during the course of maintenance dialysis.[13] The increased mortality with hypoalbuminemia, which is seen in 60-67% of patients on maintenance hemodialysis appears to occur even at near normal albumin levels (35 g/L), however, the risk is greater with more severe hypoalbuminemia, being greatest in patients with a plasma albumin concentration below (30 g/L).[13,15] Our results are in agreement with what was reported by Akash et al,[16] as inspite of efficient dialysis provided to our patients, as indicated by Kt/V of 1.4 ± 4, they still have low albumin levels (mean 34±4 g/l). Serum proteins (for example, albumin, transferrin, and pre-albumin) levels may not be accurate enough to detect rapid changes in nutritional status, and may not correlate properly with changes in other nutritional parameters, as they can be influenced by non-nutritional factors.[17] The height and weight allow the calculation of BMI and its classification as normal range from 20-25, obesity over 30, borderline underweight from 18.5-20, and severe underweight below 18.5 kg/m^2.[18] It is recommended that the BMI of maintenance dialysis patients be maintained in the upper 50th percentile for normal individuals, which would mean a BMI for men not lower than approximately 23.6 kg/m^2, and women not lower than 24.0 kg/m^2. This recommendation also appears appropriate for CKD patients with significant glomerular filtration rate (GFR) reductions, stages 3-5.[19] In the present study, it was observed that 47% of the patients were either overweight or obese, and 4% were underweight, 0.5% of women in the studied population had a morbid obesity, which could be attributed to hormonal factors or possibly the indoor activity of women in Saudi society, and the demand to further study the etiology of a high of prevalence of overweight and obesity in Saudi hemodialysis patients. However, as renal transplantation offers an overall better quality of life to hemodialysis patients, severe obesity with BMI greater than 35 kg/m^2 is associated with wound infection, multisystem organ failure, increased transplantation costs, and also delayed transplantation.[20]

Serum cholesterol is an independent predictor of mortality in maintenance hemodialysis patients. The relationship between serum cholesterol and mortality has been described as either "U-shaped" or "J-shaped," with increasing risk for mortality as the serum cholesterol rises above the 200-300 mg/dL range, or falls below approximately 200 mg/dL.[21] The mortality risk in most studies appears to increase progressively as the serum cholesterol decreases to, or below, the normal range for healthy adults (<200 mg/dL).[9,13] Predialysis serum cholesterol is generally reported to exhibit a high degree of co-linearity with other nutritional markers such as albumin, pre-albumin, and creatinine, as well as age.[22,23] Our results are supported by the findings of Cano et al,[24] and Avram et al,[23] as serum cholesterol exhibits a high degree of co-linearity with other nutritional markers such as serum albumin, as well as with age. Patients on maintenance hemodialysis have normal energy expenditure and approximately normal requirements for maintenance of protein balance, body weight, and body fat. An average energy intake of around 38 kcal/kg for desirable weight/day may be necessary to maintain nitrogen balance in these patients.[25] The protein catabolic rate (PCR), also called the protein equivalent of nitrogen appearance (PNA), is the parameter used in most hemodialysis units to assess dietary protein intake in patients who are in a steady state. Increased mortality was observed with a nPNA (normalized protein equivalent of nitrogen appearance, which is the same as the nPCR) of less than 0.8 or greater than 1.4 g/kg per day, while the best survival was noted with levels between 1.0-1.4 g/kg per day.[26] It is recommended a minimal nPCR not less than 0.8 g/kg per day, but a target of 1.0-1.2 g/kg per day or higher is recommended.[27] Our results support previous studies, and indicate adequate protein intake in our patients as the mean nPCR was 1.13 ± 0.06. It is well known that malnutrition leads to a decline in immune function. Total lymphocyte count (TLC) is a clinical measure of immune function that is often used in nutritional assessment. The TLC is an indicator of immune function that reflects both B cells and T cells. The TLC is increased with infection and leukemia, and decreased following surgery, and in chronic disease states. Because TLC is not specific to nutritional status, it is not useful for assessment of a hospitalized patient.[28] In our study, we could not demonstrate a correlation between total lymphocytic count and any other variants related to nutritional state.

The SGA is a clinical evaluation of PEM based on evidence of edema, ascites, muscle wasting, subcutaneous fat loss, changes in functional capacity, and gastrointestinal symptoms of diarrhea, nausea, vomiting. This tool has also been studied for use in assessing patients on dialysis.[29] Based on the results of this history and physical assessment, patients can be classified into nutritional risk categories of well nourished, mildly to moderately malnourished, or severely malnourished.[30] Moreover, the SGA has been validated prospectively in both uremic and non uremic patient populations and also predicts the likelihood of complications and poor outcome allowing implantation of preventive interventions. Studies by McCann,[31] Chertow et al,[32] and Kalantar et al,[33] 1999 supports our results for the correlation of SGA with impaired functional capacity and associated comorbid diseases.

Study limitations and recommendations. This study was performed in a tertiary referral center for hemodialysis, thus, samples of patients with ESRD do not represent the typical hemodialysis population seen in the Saudi Arabia. We recommend a multi center study for better evaluation.

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Related topics

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