Nutritional Assessment in CKD

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Introduction

- Suboptimal nutritional status is common in the latter stages of CKD.
- Malnutrition is associated with increased morbidity & mortality.
- Protein – Energy nutritional status deteriorates as GFR declines.
- 18 – 75% of dialysis patients have evidence of protein deficits.
- Nutritional status is predictor of increased hospitalization rate , hospital days & mortality.

Nutritional Assessment Evaluations

- Clinical profile
- Biochemical testing
- Anthropometric measurements
- Evaluation of dietary adequacy & habits
- Body composition
- SGA
- Functional tests : Grip strength

Patient interview and physical examination

ASSESSMENT OF NUTRITIONAL STATUS IN KIDNEY DISEASE

- **Identifies risk factors that increase chances of PEW**
- Diseases or conditions that have nutritional implications
- Excessive or inadequate intakes
- Dentition
- Reduced social contact
- Behavioral
- Depression
- Cognitive impairment
- Multiple medications
- Complex regimens and adherence difficulties
- Alteration of taste and nutrient metabolism
- Inappropriate medications or procedures
- Involuntary weight loss or gain
- Need assistance with self-care
- **Function-related problems and sensory and activity limitations**
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- **Nutritional Considerations in Kidney Disease: Core Curriculum 2010 James L. Bailey, MD,1 and Harold A. Franch, MD1,2**

Dietary intake assessment

- Can be used for screening
- Describe intake over a specific period of time
- Nutritional requirements & challenges change over the progression of CKD
- Help to determine the effectiveness of nutritional counseling
- Provide specific guidance for patients

Dietary Assessment

Methods include

- 24-Hour recall
- Food-frequency questionnaires
- Dietary history food diary or record
- Useful clinically, but less accurate than in general population

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Dietary intake assessment

Dietary Intake Assessment Tools for Chronic Kidney Disease (CKD) patients

Dietary Intake Methods			
Assessment method nutrient intake	*Description*	*Strengths*	*Weakness*
24-h recall	Clinician assists the patient to recall food intake of previous 24 h. Using food models or pictures can help the patient to identify portion size *(46–52,85)*	Good tool to use for large population studies and in the clinic. Useful for international comparisons of nutrient intake in both healthy and chronically ill patients. Inexpensive and easy to collect intake data for all populations, especially for illiterate patients. Random days can help to get valid estimates of usual intakes	Single recall does not represent the patient's usual intake and foods consumed infrequently may not be recorded. Elderly patients may not provide adequate information due to memory problems. Underreporting is common
Food record	Food records provide information on intakes of food and beverages (and dietary supplements) over specific periods. The most common food record includes 3 days which include 2 weekdays and 1 weekend day *(46,53,57,61,64,65,85)*	Useful to assess actual or usual food intakes. This method is widely used for dietary intake studies, especially macro- and micro-nutrient analysis	Accuracy is dependent on the number of days. Patients may change their usual diet pattern and under report intake. Patient should be literate. Underreporting is common

Dietary Intake Methods

Assessment method nutrient intake	*Description*	*Strengths*	*Weakness*
2-day diet diary dialysis day and non-dialysis day	Dietitian assists the food intake data specific for hemodialysis patients. Specific food models and pictures help patients to report better intake records *(30)*.	Food intake varies between non-dialysis day and dialysis day due to the dialysis schedule. Useful for comparing the dietary intake data for these days. Can also be used in CKD patients who are not in stage 5.	It often does not include weekend days during the data collection; therefore, patients can change his/her eating pattern on the weekend
Semi-quantitative food frequency questionnaire	Used to identify the food intake of specific foods over period of time (i.e., dairy products use in a day, week, month, or year). Data collection is usually self-administered and portion sizes are included in the questionnaire *(46,66–85)*	Useful in epidemiological studies and analysis includes a broad range of food intakes. Provide good comparison of specific foods, food components and nutrients with the prevalence or mortality of specific disease. Identify food patterns associated with inadequate intakes or specific nutrients. Better data collection from the study participant with faster analysis than other methods	Not very useful in CKD patients due to dietary restrictions. Making food lists and lists of dietary supplements inappropriate. Accuracy of data collection is lower

Level 2 Screen

- For individuals with suspected PEW who have identifiable risk factors identified by a
- level I screen
- Anthropometric and other body composition measurements
- Patient's height, weight, and trends in weight over time are the simplest and most useful anthropometric measurements
- Lean body mass (consists of fat-free body mass or body weight minus the weight of the body fat)
- Midarm muscle circumference; simple to do but only grossly abnormal with far advanced protein-calorie malnutrition
- Bioelectrical impedance is less reliable when edema is present
- Other anthropometric measurements (eg, skin folds at the triceps) may be used with proper training

- KDOQI nutrition practice guidelines recommended the use of a panel of nutritional parameters
- No single index comprehensively summarizes all aspects of nutritional status
- Anthropometric , clinical & dietary assessment in addition of biochemical parametrs are recommended
- Nutritional markers are divided in to tests to be done :
- Routinely
- Confirmatory to be done as needed
- Screening requiring further confirmation

Table 1
KDOQI Biochemical Testing Regimen in Stages 2–5 CKD *(3)*

Marker type	*Marker*	*Measurement frequency*
Routine	Predialysis serum albumin	Monthly in maintenance dialysis (every 1–3 months in CKD)
	nPNA	Monthly (every 3–4 months for peritoneal dialysis; every 3–4 months in CKD)
Confirmatory	Predialysis serum prealbumin	As needed
Screening	Predialysis serum creatinine	As needed
	Predialysis serum cholesterol	As needed
	Creatinine index	As needed

CKD, Chronic kidney disease; nPNA, normalized protein equivalent of nitrogen appearance.

Table 1. Recommended Measures for Monitoring Nutritional Status of Maintenance Dialysis Patients

Category	Measure	Minimum Frequency of Measurement
I. Measurements that should be performed routinely in all patients.	Predialysis or stabilized serum albumin*	Monthly
	% of usual postdialysis (MHD) or post-drain (CPD) body weight	Monthly
	% of standard (NHANES II) body weight	Every 4 months
	Subjective global assessment (SGA)	Every 6 months
	Dietary interview and/or diary	Every 6 months
	nPNA	Monthly MHD; every 3-4 months CPD
II. Measures that can be useful to confirm or extend the data obtained from the measures in Category I	Predialysis or stabilized serum pre-albumin	As needed
	Skinfold thickness	As needed
	Mid-arm muscle area, circumference, or diameter	As needed
	Dual energy x-ray absorptiometry	As needed
III. Clinically useful measures, which, if low, might suggest the need for a more rigorous examination of protein-energy nutritional status	Predialysis or stabilized serum	
	—Creatinine	As needed
	—Urea nitrogen	As needed
	—Cholesterol	As needed
	Creatinine index	As needed

American Journal of Kidney Diseases, Vol 37, No 1, Suppl 2 (January), 2001: pp S66-S70

Biochemical Estimates of Protein Intake for Determining Dietary Adherence

In predialysis patients with CKD, 24-hour urine urea nitrogen excretion is used to estimate protein intake

Estimated protein intake (g protein/kg/d) =

6.25x [UUN+ (0.031 x weight in kg)],

where UUN is urine urea nitrogen excretion in grams of nitrogen per kilogram per day

The same formula can be used to estimate non dialysis clearance from residual kidney function

PCR in HD patients

- PCR = $\frac{0.22 + (0.0356 \,.\, \text{ID rise in BUN} \,.24)}{\text{ID intervals (hrs)}}$
-
- PCR = (0.0136 . F) + 0.251
- F = Kt/V . ({predialysis BUN + postdialysis BUN} : 2)

PNA in PD patients

- PNA(g/d) = 20.1 + 7.5 UNA (g / d)
- UNA (g/d) = urinary urea losses (g/d) + dialysate urea losses)g/d)

- If protein loss from dialysate measured:
- PNA (g/d) = 15.1 + 6.95 UNA (g/d) + dialysate protein loss (g/d)

Interpretation of nPNA

Observation	*Interpretation*	*Consider*
nPNA exceeds DPI or is unexpectedly high	Only tentative conclusions about protein intake possible	Catabolic state • Inadequate energy intake • Presence of inflammation or inflammatory stressors (fever, infection, etc.) • Weight loss • Metabolic acidosis • Bioincompatible dialysis membrane Inaccurate diet record Low lean body mass
nPNA less than DPI or is unexpectedly low	Only tentative conclusions about protein intake possible	Anabolic state • Corticosteroid use • Recovery from infection, illness • Pregnancy or growth Inaccurate diet record Edema Excess body weight
nPNA = DPI	nPNA reflects protein intake	Conclude patient is in nitrogen balance and nPNA reflects intake if none of the above apply

DPI (g/kg/day), normalized dietary protein intake; nPNA, normalized protein equivalent of nitrogen appearance.

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Biochemical Assessment

- Biochemical testing : objective
- requiring minimal patient cooperation
- commonly available
- help to identify : malnutrition, inflammation

- Serum Albumin
- Most abundent protein in the blood
- Half life 20 days
- Nonmodifiable predictors of serum albumin :
- Older age , female sex , white race , chronic diseases
- Modifiable factors : smoking cessation , use of AVF , biocompatible dialysis membranes

Serum Albumin

- Can be preserved with chronically low food intake because REE is down regulated
- Inflammation inhibits this normal adaptation
- Inflammation both inhibits albumin synthesis & increases fractional catabolic rate
- Subnormal albumin level < 4 g/dl predicts all – cause & cardiovascular mortality in HD patients

Pre-albumin

- A negative acute phase protein
- Half life about 2 days
- Very responsive to recent events
- Useful in acute illnesses or following initiation of nutritional intervention
- Pre-dialysis serum pre albumin <30 mg/dl should be evaluated for nutritional adequacy

Creatinine

- A nutrtional screening parameter in HD patients
- Predialysis creatinine is proportional to lean body mass under steady state conditions
- Directly correlated to serum albumin & prealbumin
- A decline in creatinine over time predicts all cause mortality
- Low serum creatinine reflects low intake & low lean body mass

Serum Total Cholesterol

- Low serum cholesterol is correlated with markers of protein nutritional status & with mortality in most trials.
- Hypocholesterolemia < 150 – 180 mg/dl or a declining cholesterol concentration can be an indicator of chronically inadequate protein & energy intake
- Cholesterol also is depressed with chronic inflammation
- The relationship between mortality & cholesterol is "U" shaped.
- Lowest mortality with cholesterol levels about 200 – 220 mg/dl.

Serum Transferrin

- Half life 8.5 days
- Smaller pool size (than albumin)
- More responsive to nutritional deficits than albumin
- Transferrin is influenced by anemia
- It is not recommended for nutritional assessment in stage 4 or 5 CKD.

Markers of Inflammation

- 30-50% HD patients have evidence of an active inflammatory response
- Inflammation is closely associated with accelerated development of CVD
- Albumin & prealbumin generally rise during the first year following initiation of dialysis
- Inflammatory mediators(CRP , IL-6 , IL-10)do not improve with initiation of dialysis
- Inflammation blunts appetite , increases protein catabolism , lipolysis & REE

C – Reactive Protein

- A non specific marker of inflammation & proinflammatory cytokine activity
- Half life of 19 hours
- Catabolic rate is not affected by inflammation
- Synthetic rate & release is upregulated during acute phase response
- Albumin is inversely correlated with CRP

- Protein intake can be estimated by diet records or recalls
- Protein equivalent of total nitrogen appearance (PNA) can be used for protein intake estimation
- nPNA can be compared to dietary records obtained over the same inter-dialytic interval
- formula

- Predialysis HCO3 should be considered when performing nutritional assessment
- HCO3 is not a nutritional marker
- Metabolic acidosis is correlated with low serum albumin , prealbumin , n PNA
- Acidosis reduces albumin synthesis , increases amino acid oxidation , ↓IGF, GH receptor expression

Dietary Acid Load: A Novel Nutritional Target in Chronic Kidney Disease?

Julia J. Scialla and Cheryl A. M. Anderson

Nonvolatile acid is produced from the metabolism of organic sulfur in dietary protein and the production of organic anions during the combustion of neutral foods. Organic anion salts that are found primarily in plant foods are directly absorbed in the gastrointestinal tract and yield bicarbonate. The difference between endogenously produced nonvolatile acid and absorbed alkali precursors yields the dietary acid load, technically known as the net endogenous acid production, and must be excreted by the kidney to maintain acid-base balance. Although typically 1 mEq/kg/day, dietary acid load is lower with greater intake of fruits and vegetables. In the setting of CKD, a high dietary acid load invokes adaptive mechanisms to increase acid excretion despite reduced nephron number, such as increased per nephron ammoniagenesis and augmented distal acid excretion mediated by the renin-angiotensin system and endothelin-1. These adaptations may promote kidney injury. Additionally, high dietary acid loads produce low-grade, subclinical acidosis that may result in bone and muscle loss. Early studies suggest that lowering the dietary acid load can improve subclinical acidosis, preserve bone and muscle, and slow the decline of glomerular filtration rate in animal models and humans. Studies focusing on hard clinical outcomes are needed.

Key Words: Chronic kidney disease, Nutrition, Metabolic acidosis, Net endogenous acid production

Advances in Chronic Kidney Disease, Vol 20, No 2 (March), 2013: pp 141-149

Kidney Disease Outcomes Quality Initiative (K/DOQI) and the Dialysis Outcomes and Practice Patterns Study (DOPPS): Nutrition Guidelines, Indicators, and Practices

Christian Combe, MD, PhD, Keith P. McCullough, MS, Yasushi Asano, MD, Nancy Ginsberg, MS, RN, Bradley J. Maroni, MD, and Trinh B. Pifer, MPH

• *Background:* Nutritional markers are important predictors of morbidity and mortality in dialysis patients. The Clinical Practice Guidelines for Nutrition in Chronic Renal Failure provides guidelines for assessing nutritional status that were evaluated using data from the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Methods:* The level of various nutritional markers (serum albumin, modified subjective global assessment, serum creatinine, normalized protein catabolic rate [nPCR], and body mass index) were described for representative samples of patients and facilities from 7 countries (France, Germany, Italy, Spain, Japan, United Kingdom, and United States) participating in the DOPPS. *Results:* A strong inverse association was observed between mortality and serum albumin, with a mortality risk 1.38 times higher for patients with serum albumin concentration less than 3.5 g/dL (35 g/L). There were significant differences by country in the proportion of moderately and severely malnourished patients as determined by the modified subjective global assessment score. In the US sample, severely and moderately malnourished patients had a higher mortality risk compared with those not malnourished, 33% and 5% higher, respectively. An inverse relationship exists between serum creatinine concentration and mortality, with a mortality risk 60% to 70% higher in the lowest quartile group compared with the highest quartile group in Europe and the United States. Levels of nPCR varied significantly between European countries, and there was no association between mortality and nPCR in US data. After adjustment for demographic and comorbidity factors, the mortality risk decreased as body mass index increased in both US and European samples. *Conclusion:* DOPPS data highlight the importance of routine assessment of nutritional status, using multiple parameters, in clinical practice to improve patient care. *Am J Kidney Dis* 44(S2):S39-S46.

INDEX WORDS: Albumin; body mass index; hemodialysis; nutrition; survival.

American Journal of Kidney Diseases, Vol 44, No 5, Suppl 2 (November), 2004:

Table 1. Nutritional Indicators in the United States and 5 European Countries From Data Aggregated From Pifer et al[4] and Hecking et al[5]

Measure	US	France	Germany	Italy	Spain	UK
Predialysis serum albumin (g/dL)	3.6	3.87	4.17*	3.98	3.98	3.72†
Predialysis serum creatinine (mg/dL)	8.8	9.5	8.7‡	9.8*	9.1	9.2
nPCR (g/kg/d)	1.0	1.12‡	0.97‡	1.14*	1.09	1.03*
Weight (kg)	73.1	63.6*	69.7†	63.9*	63.5†	68.1*
BMI (kg/m^2)	25.4	23.2*	24.5*	23.5	23.9	24.2
mSGA score (%)						
Moderately malnourished	7.6	18.0	14.1	16.1	11.2‡	15.4
Severely malnourished	11.0	4.5	2.6	2.3	3.2	6.5*

NOTE. Patients entering the study within 90 days of their first dialysis treatment were excluded from this analysis. In Germany, albumin commonly is measured using total protein and serum protein electrophoresis, which may overestimate albumin compared with the direct method. To convert serum albumin in g/dL to g/L, multiply by 10; serum creatinine in mg/dL to μmol/L, multiply by 88.4.

Abbreviations: nPCR, normalized protein catabolic rate; BMI, body mass index; mSGA, subjective global assessment, modified to adapt to available DOPPS data.

*$P < 0.01$.

†$P < 0.0001$.

‡$P < 0.05$ versus all Euro-DOPPS, accounting for facility clustering.

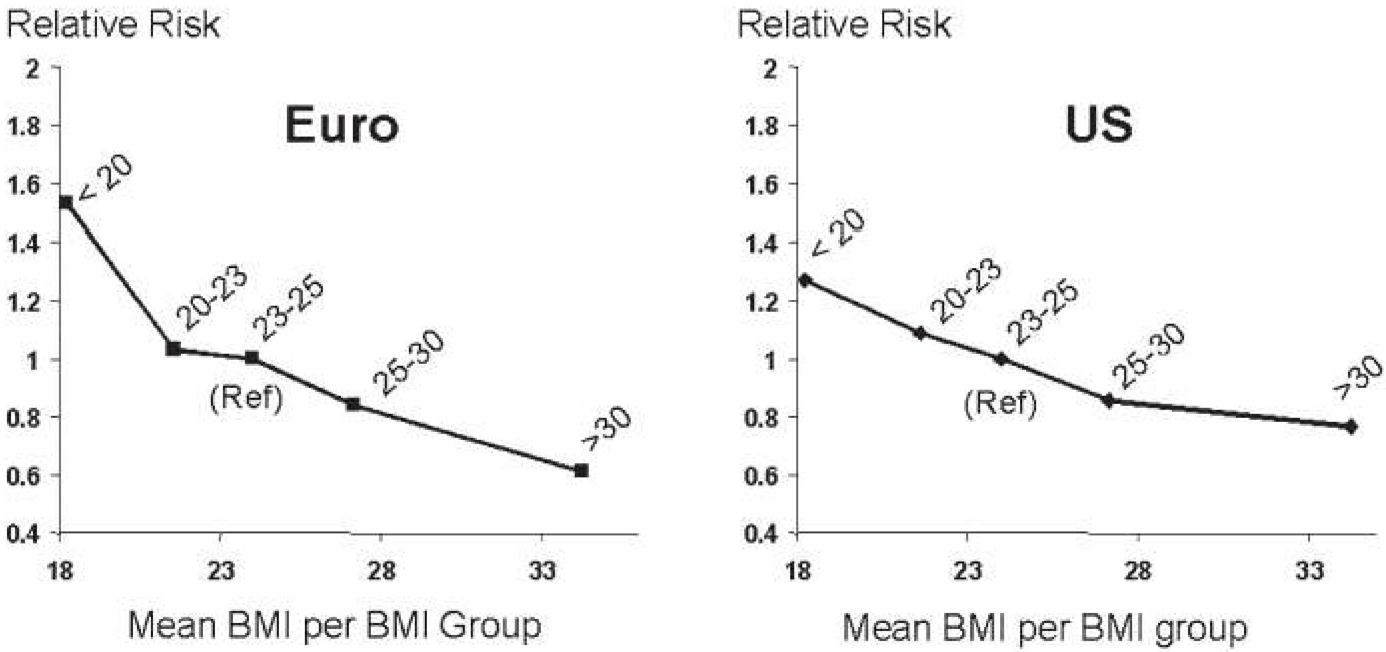

Fig 1. **Mortality versus BMI, Euro- and US-DOPPS. Adjusted for demographics, comorbidity, and albumin (left truncated models). Reprinted from Leavey et al[3] with the permission of the Oxford University Press. © 2001 European Renal Association—European Dialysis and Transplant Association.**

Assessment of Body Composition

- Simple assessment :
- subcutaneous fat thickness
- muscle tissues
- Dual Energy X- ray absorptiometry (DXA)
- BIA
- TBW

Anthropometric Assessment

- Quantification of energy reserves in the forms of fat & muscle mass
- Clinically useful tools : upper arm skinfold
- upper arm circumference
- weight & weight change
- BMI

- Skinfold thickness can be used to assess body fat
- Mid-upperarm muscle circumference (MAMC) is for assessment of muscle mass
- MAMC(cm)=Midarm circumference _ (3.14 x triceps skinfold)
- Anthropometric measurements are inexpensive , easy to learn ,they are limited by intrervariability & intravariability.
- Seiral measures over time can be useful
- They are used in conjunction with other nutritional indices

Dual Energy X-Ray Absorptiometry

- DXA quantifies bone mineral content
- Total & regional analysis of adipose (fat mass) & non-skeletal fat free mass(FFM)
- DXA is easy & convenient method for measuring body composition

Bioelectric Impedance Analysis

- BIA at 50 KHZ is used to estimate TBW , FFM , TBF
- Multi – frequency BIA uses at least two different frequencies.
- At low frequency , the current is unable to pass through cell membranes so that low frequency currents are conducted only through ECW.
- At high frequency , currents penetrate cell membranes and thus are used to estimate TBW.

Body Composition Assessment Methods

Method	*Assessment*	*Precision*	*Reliability*	*Utility*
Neutron activation	Total body nitrogen, calcium	Very high	Very high	Low
Computed tomography	Bone, adipose tissue	Very high	Very high	Low
Magnetic Resonance Spectroscopy	Adipose tissue	Very high	Very high	Moderate
Dual Energy X-ray Absorptiometry	Bone, adipose tissue, fat-free mass	Very high	Moderate	High
Total body water	Total body water, fat-free mass	High	Moderate	Moderate
Total body scanning	Total body potassium 40	High	Moderate	Moderate
Bioelectrical impedance	Total body water	Very high	Moderate	High
Anthropometry	Body size, subcutaneous adipose tissue	High to medium	Moderate	Very high

AJKD
Original Investigation

Comparison of Multifrequency Bioelectrical Impedance Analysis and Dual-Energy X-ray Absorptiometry Assessments in Outpatient Hemodialysis Patients

Antje Fürstenberg, MD,[1] and Andrew Davenport, FRCP[2]

Conclusions: Compared with DEXA, multifrequency BIA appears to be a robust tool for measuring and
monitoring total-body fat and lean body mass in hemodialysis patients; however, there is less agreement in bone mineral content assessment between the 2 methods.

Am J Kidney Dis. 57(1):123-129.

AJKD
Original Investigation

Novel Equations to Estimate Lean Body Mass in Maintenance Hemodialysis Patients

Nazanin Noori, MD, PhD,[1] Csaba P. Kovesdy, MD,[2] Rachelle Bross, RD, PhD,[1,3,4] Martin Lee, PhD,[5] Antigone Oreopoulos, MSc, PhD,[6] Deborah Benner, RD,[7] Rajnish Mehrotra, MD,[1,9] Joel D. Kopple, MD,[4,5,9] and Kamyar Kalantar-Zadeh, MD, MPH, PhD[1,5,8,9]

Background: Lean body mass (LBM) is an important nutritional measure representing muscle mass and somatic protein in hemodialysis patients, for whom we developed and tested equations to estimate LBM.

Study Design: A study of diagnostic test accuracy.

Setting & Participants: The development cohort included 118 hemodialysis patients with LBM measured using dual-energy x-ray absorptiometry (DEXA) and near-infrared (NIR) interactance. The validation cohort included 612 additional hemodialysis patients with LBM measured using a portable NIR interactance technique during hemodialysis.

Index Tests: 3-month averaged serum concentrations of creatinine, albumin, and prealbumin; normalized protein nitrogen appearance; midarm muscle circumference (MAMC); handgrip strength; and subjective global assessment of nutrition.

Reference Test: LBM measured using DEXA in the development cohort and NIR interactance in validation cohorts.

Results: In the development cohort, DEXA and NIR interactance correlated strongly ($r = 0.94$, $P < 0.001$). DEXA-measured LBM correlated with serum creatinine level, MAMC, and handgrip strength, but not with other nutritional markers. Three regression equations to estimate DEXA-measured LBM were developed based on each of these 3 surrogates and sex, height, weight, and age (and urea reduction ratio for the serum creatinine regression). In the validation cohort, the validity of the equations was tested against the NIR interactance–measured LBM. The equation estimates correlated well with NIR interactance–measured LBM ($R^2 \geq 0.88$), although in higher LBM ranges, they tended to underestimate it. Median (95% confidence interval) differences and interquartile range for differences between equation estimates and NIR interactance–measured LBM were 3.4 (−3.2 to 12.0) and 3.0 (1.1-5.1) kg for serum creatinine and 4.0 (−2.6 to 13.6) and 3.7 (1.3-6.0) kg for MAMC, respectively.

Am J Kidney Dis. 2011;57(1):130-139

Randomized Controlled Trial of Nutritional Counseling on Body Composition and Dietary Intake in Severe CKD

Katrina L. Campbell, PhD,[1,2] Susan Ash, PhD,[1,2] Peter S.W. Davies, PhD,[3] and Judith D. Bauer, PhD[4]

Background: Progressive loss of kidney function results in an increased risk of malnutrition. Despite this, there is little evidence informing the impact of nutrition intervention on predialysis patients with chronic kidney disease (CKD; stages 4 and 5).

Study Design: Randomized controlled trial.

Setting & Participants: 56 outpatients (men, 62%; mean age, 70.7 ± 14.0 [SD] years) with CKD were randomly allocated to intervention (n = 29) or control (n = 27) by using a concealed computer-generated sequence.

Intervention: The intervention group, provided with individualized dietary counseling with regular follow-up aimed at achieving an intake of 0.8 to 1.0 g/kg of protein and greater than 125 kJ/kg of energy, or control, receiving written material only.

Outcomes & Measures: Change in body composition (body cell mass, measured by means of total-body potassium, in 40 of 56 participants), nutritional status (Subjective Global Assessment), and energy and protein intake (3-day food record).

Results: During the 12 weeks, the intervention group had 3.5% (95% confidence interval, −2.1 to 9.1) less decrease in body cell mass, 17.7-kJ/kg/d (95% confidence interval, 8.2 to 27.2) greater increase in energy intake, greater improvement in Subjective Global Assessment ($P < 0.01$), and no significant difference in protein intake compared with the control group (−0.04 g/kg/d; 95% confidence interval, −0.73 to 0.16). The intervention was associated with greater increases in energy and protein intake in women than men (interaction $P < 0.001$ for both).

Limitations: Power to detect change in body cell mass, potential bias in ascertainment of Subjective Global Assessment.

Conclusions: In predialysis patients with CKD, structured nutrition intervention had a greater effect on energy and protein intake in women than men. Additional investigations are warranted to determine the impact on body composition.

Am J Kidney Dis 51:748-758.

counseling and regular follow-up with afocus on promoting intake produces beneficial

patient outcomes.

Assessment of Nutritional Status of Nepalese Hemodialysis Patients by Anthropometric Examinations and Modified Quantitative Subjective Global Assessment

Libertas Academica
FREEDOM TO RESEARCH

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[1]Department of Nephrology, National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu, Nepal. [2]Advanced Analytics, OptumInsight, Rocky Hill, CT, USA. Study location: Department of Nephrology, National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu, Nepal.

ABSTRACT:

OBJECTIVE: To assess the nutritional status of patients on maintenance hemodialysis by using modified quantitative subjective global assessment (MQSGA) and anthropometric measurements.

METHOD: We Conducted a cross sectional descriptive analytical study to assess the nutritional status of fifty four patients with chronic kidney disease undergoing maintenance hemodialysis by using MQSGA and different anthropometric and laboratory measurements like body mass index (BMI), mid-arm circumference (MAC), mid-arm muscle circumference (MAMC), triceps skin fold (TSF) and biceps skin fold (BSF), serum albumin, C-reactive protein (CRP) and lipid profile in a government tertiary hospital at Kathmandu, Nepal.

RESULTS: Based on MQSGA criteria, 66.7% of the patients suffered from mild to moderate malnutrition and 33.3% were well nourished. None of the patients were severely malnourished. CRP was positive in 56.3% patients. Serum albumin, MAC and BMI were (mean + SD) 4.0 + 0.3 mg/dl, 22 + 2.6 cm and 19.6 ± 3.2 kg/m^2 respectively. MQSGA showed negative correlation with MAC ($r = -0.563$; $P = <0.001$), BMI ($r = -0.448$; $P = <0.001$), MAMC ($r = -0.506$; $P = <.0001$), TSF ($r = -0.483$; $P = <.0002$), and BSF ($r = -0.508$; $P = <0.0001$). Negative correlation of MQSGA was also found with total cholesterol, triglyceride, LDL cholesterol and HDL cholesterol without any statistical significance.

CONCLUSION: Mild to moderate malnutrition was found to be present in two thirds of the patients undergoing hemodialysis. Anthropometric measurements like BMI, MAC, MAMC, BSF and TSF were negatively correlated with MQSGA. Anthropometric and laboratory assessment tools could be used for nutritional assessment as they are relatively easier, cheaper and practical markers of nutritional status.

KEYWORDS: nutritional status, CKD, MQSGA, anthropometric measuremen, hemodialysis

Subjective Global Assessment

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems

F1 Body Mass Index (BMI) (weight in kg) / (height in m^2)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater

Screening score
(max. 14 points)

12-14 points:	Normal nutritional status
8-11 points:	At risk of malnutrition
0-7 points:	Malnourished

Validity of Subjective Global Assessment as a Nutritional Marker in End-Stage Renal Disease

Bruce A. Cooper, MBBS, Louise H. Bartlett, MND, Alireza Aslani, MSc, Barry J. Allen, DSc, Lloyd S. Ibels, MD, and Carol A. Pollock, PhD

• Subjective global assessment (SGA) is a widely available clinical tool established to be of prognostic value in patients with end-stage renal disease (ESRD). Although it is reported to reflect a patient's nutritional status, its direct relationship to nutrition has not been determined. The aim of this study is to compare SGA with the gold standard for nutrition, total-body nitrogen (TBN) level, and thus determine the validity of SGA as a marker of nutritional status in patients with ESRD. Seventy-six consecutive dialysis patients referred from the renal service for routine measurement of TBN underwent simultaneous assessment of SGA determined by two independent examiners. Both examiners were blinded to TBN results. Only a moderate level of agreement was found in SGA score between the two examiners (weighted κ score, 0.6). When patients were stratified into three nutritional groups determined by their SGA score, mean TBN values for each group by observer differed significantly ($P = 0.0008$ and $P = 0.02$, respectively). However, a significant statistical trend of worsening nutrition across SGA strata was found only for observer 2 ($P = 0.049$). Test performance of SGA as a predictor of malnutrition using a cutoff score of B (SGA = B or C) or C (SGA = C) was poor (positive likelihood ratios [LRs], 0.7 to 2.3; negative LRs, 0.5 to 1.0). Therefore, SGA appears not to improve the posttest probability of detecting malnutrition. SGA may differentiate severely malnourished patients from those with normal nutrition, but is not a reliable predictor of degree of malnutrition.

INDEX WORDS: Subjective global assessment (SGA); total body nitrogen (TBN); malnutrition; end-stage renal disease (ESRD).

American Journal of Kidney Diseases, Vol 40, No 1 (July), 2002: pp 126-132

Association of Handgrip Strength With Malnutrition-Inflammation Score as an Assessment of Nutritional Status in Hemodialysis Patients

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Keywords. handgrip strength, malnutrition, protein-energy wasting, hemodialysis

Introduction. Protein-energy wasting (PEW) is very common in patients with chronic kidney disease and those undergoing maintenance dialysis. Reduced handgrip strength is associated with PEW and considered as a reliable nutritional parameter that reflects loss of muscle mass. This study aimed to evaluate the handgrip strength and its relationship with the Malnutrition-Inflammation Score (MIS) among Iranian dialysis patients.

Materials and Methods. The study population consisted of 83 randomly selected hemodialysis patients from the dialysis centers in Kerman, Iran. Handgrip strength was measured using a dynamometer according to the recommendations of the American Society of Hand Therapists. All the patients were interviewed and the MIS of the patients were recorded.

Results. The PEW was prevalent in Kerman hemodialysis patients, with 83% and 17% having mild and moderate PEW based on MIS, respectively. Handgrip strength was significantly associated with age, sex, height, weight, and diabetes mellitus. After adjustment for age, handgrip strength was significantly associated with nutritional assessment markers on the basis of the MIS.

Conclusions. Handgrip strength can be incorporated as a reliable tool for assessing nutrition status in clinical practice. However, further research is needed to determine the reference values and cutoff points both in healthy people and in hemodialysis patients to classify muscle wasting.

IJKD 2016;10:30-5
www.ijkd.org

Original article

Diagnostic accuracy of handgrip strength in the assessment of malnutrition in hemodialyzed patients

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ARTICLE INFO

Article history:
Received 11 January 2013
Accepted 15 June 2013

Keywords:
Handgrip strength
Malnutrition-inflammation score
Subjective global assessment
Nutritional risk screening 2002
Hemodialysis
Nutritional assessment

SUMMARY

Background & aims: Parameters with diagnostic accuracy to malnutrition assessment may be a challenge for patients in hemodialysis (HD). Thus, the objective of this study was to verify the accuracy and cutoff of handgrip strength (HGS) in nutritional assessment.

Methods: Validation study of diagnostic tests. Cutoff to malnutrition was investigated by the ROC curves, using as reference standard the subjective global assessment (SGA), nutritional risk screening 2002 (NRS 2002) and malnutrition-inflammation score (MIS). The association of HGS with: phase angle (PA), body mass index, percentage of fat mass, fat-free mass (FFM), was verified by multiple linear regression, $P < 0.05$.

Results: 138 patients were evaluated (85 men), mean 55.4 ± 15.2 years. The area under the curve of the HGS showed moderate accuracy in women (SGA = 0.818; MIS = 0.834; NRS 2002 = 0.882) and low accuracy in men (SGA = 0.646; MIS = 0.606; NRS 2002 = 0.620). Cutoff values of HGS for the diagnosis of malnutrition, according to the reference standard were: <18 kg for women and <28.5 kg for men. The women classified as malnourished by HGS had lower values of PA ($\beta = -1.00$), FFM ($\beta = -3.15$) and MAC ($\beta = -2.80$), while malnourished men had lower values of FFM ($\beta = -4.35$), MAC ($\beta = -1.71$) and MAMC ($\beta = -1.28$).

Conclusion: HGS was accurate in the diagnosis of malnutrition in women in HD, and provided consistent results of association with most of the nutritional parameters, for both genders.

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