REVIEW

# Subjective Global Assessment in Chronic Kidney Disease: A Review

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Nutritional assessment of patients with chronic kidney disease is a vital function of health care providers. Subjective Global Assessment (SGA) is a tool that uses 5 components of a medical history (weight change, dietary intake, gastrointestinal symptoms, functional capacity, disease and its relation to nutritional requirements) and 3 components of a brief physical examination (signs of fat and muscle wasting, nutrition-associated alternations in fluid balance) to assess nutritional status. SGA was originally used to predict outcomes in surgical patients; however, its use has gone beyond this function and population. In chronic kidney disease patients, SGA is incorporated into the complete nutritional assessment. Validation of SGA as a screening tool for surgical patients was done by Detsky et al in 1984. Since that time, SGA has been altered by different researchers and clinicians to better meet the needs of the patients they served. Validation of the altered SGA formats has not been thoroughly done. Further work in establishing validity and reliability of each version of SGA in different patient populations should be done to enable clinicians and researchers to properly use this nutritional assessment tool.


SUBJECTIVE GLOBAL ASSESSMENT (SGA) is a tool used by health care providers to assess nutritional status and aid in the prediction of nutrition-associated clinical outcomes, such as postoperative infections[1] and/or mortality.[2] The tool has many strengths in the clinical and research setting: it is inexpensive; is rapid to conduct; can be used effectively by providers from different disciplines, such as nursing, dietitians, and physicians; and in some studies has been found to be reproducible, valid, and reliable.[3,4] Because of its strengths, SGA has been recommended by the National Kidney Foundation (NKF) Kidney Disease/Dialysis Outcomes and Quality Initiative (K/DOQI) for use in nutritional assessment in the adult dialysis population.[5]

However, for all its potential, SGA has yet to be thoroughly validated in the maintenance hemodialysis and peritoneal dialysis population. A study recently published disputed the validity and reliability of SGA in hemodialysis patients. Cooper et al[6] examined SGA ratings between 2 observers and against total body nitrogen. These investigators concluded that SGA can detect the presence of malnutrition but not the degree of malnutrition.[6] An additional complication in determining the usefulness of SGA in both the clinical and research arenas is the modification of the original tool. In the chronic kidney disease (CKD) literature, a minimum of 5 different SGA tools have been reported,[1,3,7-9] almost none of which have been tested in a large validation study.

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To address these issues, a Subjective Global Assessment Consensus Conference was organized by the Department of Nutrition of the School of Medicine of Case Western Reserve University and held on November 7 and 8, 2003, in Cleveland, OH. The objectives of the conference were (1) to review the methods, techniques, and tools being used for SGA; (2) to examine the validity of SGA; and (3) to identify how and by whom SGA is being used in clinical practice and research. Attendance at this conference was by invitation only; announcements were placed in the Journal of Renal Nutrition, the *American Journal of Kidney Disease*, the *Journal of the American Dietetic Association,* and on an SGA website: http://www-.nephrology.rei.edu/sgahome.htm. The announcements requested applications from people interested in attending and/or presenting at the conference. Thirty individuals (physicians and dietitians) were invited to attend. During the day-and-a-half conference, presentations included original research results, experiences with SGA in clinical practice, and experiences with SGA in education programs for dietetics students. Throughout the conference, attendees participated in roundtable discussions to generate ideas for validating SGA within the renal population. The consensus of the group of professionals who attended this conference is that further study must be conducted to standardize and validate SGA for the CKD population. Figure 1 outlines the recommended plan for further scholarly work with SGA. This article is one component of that plan, and is intended to review current literature available on SGA and to make recommendations on work to be done.

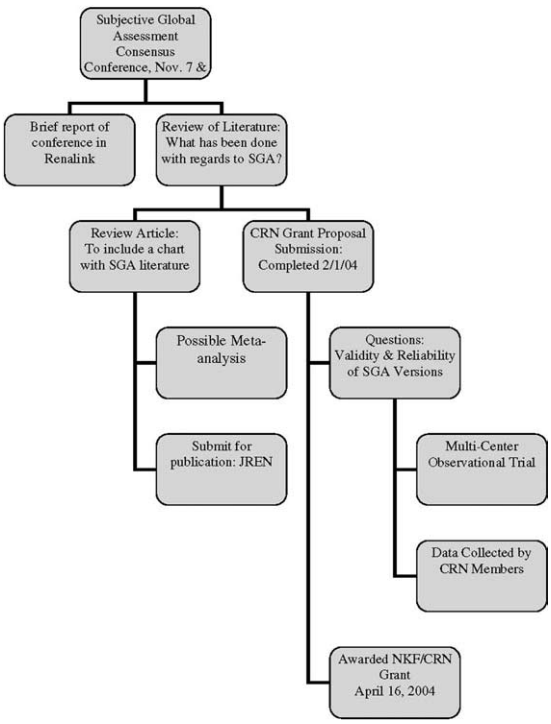


**Figure 1.** Plan for scholarly work by the SGA Consensus Conference Group.

## History of SGA

Detsky et al[1,10] published the first reports of a nutritional assessment tool, entitled SGA, that used clinical judgment to assess nutritional status in preoperative surgical patients and to predict postoperative infections; SGA had the best sensitivity and specificity for predicting infection after surgery. SGA was quickly used in other populations such as elderly patients,[11-13] patients with cancer[14] or liver transplants,[15] and adult patients undergoing maintenance dialysis.[2,3,6,16] The original SGA form (Fig 2) as reported by Detsky et al[1] had clinicians score 5 components of a medical history (ie, weight change, dietary intake, gastrointestinal symptoms, functional capacity, disease and its relation to nutritional requirements) and 3 components of a brief physical examination (ie, signs of fat and muscle wasting, nutrition-associated alternations in fluid balance). The patient is then assigned a rating of well nourished (A), moderately undernourished (B), or severely undernourished (C) by subjective consideration of the data collected in the 8 areas, without adhering to a rigid scoring system. From this original form, the tool has been modified by many others in an attempt to increase its predictive value and reproducibility.[2,7,8] Hirsch et al validated SGA in 175 gastroenterology patients in 1990. That study found significant differences between well-nourished and moderately or severely undernourished patients in serum albumin, weight, midarm muscle circumference (MAMC), and triceps skinfold measurements.[17]

The first validation study in CKD patients occurred in 1993[16] with continuous ambulatory peritoneal dialysis (CAPD) patients. SGA was performed on 23 CAPD and 36 hemodialysis patients, and significant correlations were seen between the subjects' SGA ratings and values for serum albumin, bioelectrical impedance,

Patient Name:_____Patient ID:_____Date:_____

**Part 1: Medical History**

| | | | | SGA Score | | |
|---|---|---|---|---|---|---|
| | | | | **A** | **B** | **C** |
| **1. Weight Change** | | | | | | |
| A. | Overall change in past 6 months: | _____ | kgs. | | | |
| B. | Percent change: _____ gain - | < 5% loss | | | | |
| | _____ 5-10% loss | | | | | |
| | _____ > 10% loss | | | | | |
| C. | Change in past 2 weeks: _____ | increase | | | | |
| | _____ | no change | | | | |
| | _____ | decrease | | | | |
| **2. Dietary Intake** | | | | | | |
| A. | Overall change: _____no change | | | | | |
| | _____change | | | | | |
| B. | Duration: _____weeks | | | | | |
| C. | Type of change: | | | | | |
| | _____suboptimal solid diet | _____ | full liquid diet | | | |
| | _____hypocaloric liquid | _____ | starvation | | | |
| **3. Gastrointestinal Symptoms** | | **(persisting for >2 weeks)** | | | | |
| ____none | _____nausea | diarrhea | _____ anorexia | | | |
| | _____vomiting____ | | | | | |
| **4. Functional Impairment** | | **(nutritionally related)** | | | | |
| A. | Overall impairment: | _____ | none | | | |
| | | _____ | moderate | | | |
| | | _____ | severe | | | |
| B. | Change in past 2 weeks: | _____ | improved | | | |
| | | _____ | no change | | | |
| | | _____ | regressed | | | |

**Part 2: Physical Examination**

| | | SGA Score | | | |
|---|---|---|---|---|---|
| | | **Normal** | **Mild** | **Moderate** | **Severe** |
| **5. Evidence of:** | Loss of subcutaneous fat | | | | |
| | Muscle wasting | | | | |
| | Edema | | | | |
| | Ascites (hemo only) | | | | |

**Part 3: SGA Rating (check one)**

A. Well-Nourished B. Mildly-Moderately Malnourished C. Severely Malnourished

**Figure 2.** A, B, and C original SGA.

MAMC, percent body fat, and normalized protein catabolic rate. This study's SGA methodology was used in the next major study in Canada and the United States (CANUSA) in the CKD population. CANUSA was a multicenter study conducted in Canada and the United States that investigated mortality and nutritional status in 680 patients on peritoneal dialysis.[12] This study changed Detsky's A, B, C method of rating SGA to a 7-point scale (Fig 3). The components assessed remained the same, but the rating scale was expanded. Using survival analysis, the relative risk of death was increased with worsening nutritional status as defined by SGA and loss of lean body mass.[2] A major outcome of the CANUSA study was that a 1-unit decrease in SGA equaled a 25% increase in mortality for CAPD patients. The 7-point rating scale has been pilot tested by Visser et al[3] and Jones et al.[4] The cross-sectional study by Visser et al[3] on 13 hemodialysis and 9 peritoneal dialysis patients showed that SGA was positively correlated with body mass index (BMI), percent body fat, and MAMC. In a recently published article by Jones et al,[4] both the A, B, C (3-point) scale and the 7-point scale SGA forms were conducted with 72 hemodialysis patients. Statistical differences were found between SGA scores (both A, B, C and 7-point scales) for MAMC and serum creatinine.[4] The A, B, C scale was also statistically different between A and B groups with the serum C-reactive protein concentration.[3]

Kalantar-Zadeh et al,[7] Stenvinkel et al,[9] and Pifer et al[8] have each studied different modified versions of SGA in samples ranging from 41 to 7,719 patients. Modifications in the rating scale (ie, from 7 points to 4[9] or 5[7] points) and the direction of data collection (ie, from prospective to retrospective[8]) have been made.

In 1999, Kalanter-Zadeh et al[7] presented another version of the SGA that was originally referred to as modified quantitative SGA and in subsequent publications as the Dialysis Malnutrition Score (DMS).[18,19] This fully quantitative version of SGA used the 7 original SGA components and created a quantitative scoring system. The scoring was a 5-point scale with 1 as normal and 5 as very severe malnutrition (Fig 4). The final score was the total sum of all 7 components. Each component was rated on a scale of 1 to 5 with a possible total range from 7 to 35. This method of SGA scoring produced high correlations with objective nutritional indicators such as total iron-binding capacity (TIBC) ($r = 0$ to 0.77) and MAMC ($r = 0$ to 0.66) and moderate correlations with serum albumin, BMI, bicep skinfold, age, and years on dialysis.[7]

The Malnutrition-Inflammation Score (MIS), developed by Kalantar-Zadeh, is a recently introduced, fully quantitative tool that is based on the 7 original SGA components and also includes 3 additional items (BMI and serum concentrations of albumin and serum TIBC).[18,20] Each MIS component has 4 levels of severity from 0 (normal) to 3 (very severe). The sum of all 10 MIS components ranges from 0 to 30, denoting the increasing degree of severity (Fig 5). In a 2001 prospective study on 83 hemodialysis patients, MIS was compared with conventional SGA, its fully quantitative version (DMS), anthropometry, near-infrared measured body fat percentage, laboratory measures including serum C-reactive protein (CRP), and 12-month prospective hospitalization and mortality rates.[18] MIS had significant correlations with prospective hospitalization and mortality as well as measures of nutrition, inflammation, and anemia in dialysis patients. The correlations were higher for MIS than either the conventional SGA or DMS with individual laboratory values as a predictor of outcome. In a 2004 recent multicenter study by the same group of investigators, the mortality and hospitalization predictability of the MIS was assessed in 378 hemodialysis patients; MIS was found to be comparable with serum CRP and serum interleukin-6.[20] The MIS is currently being used in the multicenter Nutritional and Inflammatory Evaluation in Dialysis study (www.NIEDstudy.org).[21,22]

In 1999, Stenvinkel et al[9] published another version of the SGA. Although these researchers cited Detsky et al and Baker et al in their methods sections, Stenvinkel et al changed the scoring from the original A, B, C scale to a 4-point scale using 1 as normal nutritional status and 4 as severe malnutrition.[9] Data on 109 adults with chronic kidney failure were analyzed by creating a bivariate variable with SGA scores 2 to 4 as one group and an SGA score of 1 as another group. In this manner they found those with scores between 2 and 4 were older, more frequently had a history

**SUBJECTIVE GLOBAL ASSESSMENT RATING FORM**

**Patient Name:** **ID #:** **Date:**

**HISTORY**

**WEIGHT/WEIGHT CHANGE:** ***(Included in K/DOQI SGA)*** **Rate 1-7**

1. **Baseline Wt:** _____(Dry weight from 6 months ago)
   **Current Wt:** _____(Dry weight today)
   **Actual Wt loss/past 6 mo:** _____ **% loss:**_____(actual loss from baseline or last SGA)
2. **Weight change over past two weeks:** _____No change _____Increase _____Decrease

**DIETARY INTAKE** No Change_____(Adequate) No Change_____(Inadequate)

1. Change: Sub optimal Intake: _____ Protein _____ Kcal _____ Duration_____
   Full Liquid: _____ Hypocaloric Liquid _____ Starvation _____

**GASTROINTESTINAL SYMPTOMS** ***(Included in K/DOQI SGA-anorexia or causes of anorexia)***

| **Symptom:** | **Frequency:*** | **Duration:+** |
|---|---|---|
| _____ None | _____ | _____ |
| _____ Anorexia | _____ | _____ |
| _____ Nausea | _____ | _____ |
| _____ Vomiting | _____ | _____ |
| _____ Diarrhea | _____ | _____ |
| | Never, daily, 2-3 times/wk, 1-2 times/wk | > 2 weeks, < 2 weeks |

**FUNCTIONAL CAPACITY** b

| **Description** | **Duration:** |
|---|---|
| _____ No Dysfunction | _____ |
| _____ Change in function | _____ |
| _____ Difficulty with ambulation | _____ |
| _____ Difficulty with activity (Patient specific "normal") | _____ |
| _____ Light activity | _____ |
| _____ Bed/chair ridden with little or no activity | _____ |
| _____ Improvement in function | _____ |

**DISEASE STATE/COMORBIDITIES AS RELATED TO NUTRITIONAL NEEDS**

Primary Diagnosis_____Comorbidities_____
Normal requirements ____Increased requirements____ Decreased requirements _____
Acute Metabolic Stress: _____None _____Low _____Moderate _____High

**PHYSICAL EXAM**

_____ Loss of subcutaneous fat (Below eye, triceps, biceps, chest) ***(Included in K/DOQI SGA)*** ____Some areas _____All areas

_____ Muscle wasting (Temple, clavicle, scapula, ribs, quadriceps, calf, knee, interosseous ***(Included in K/DOQI SGA)*** ____Some areas _____All areas

_____ Edema (Related to undernutrition/use to evaluate weight change)

**OVERALL SGA RATING**

**Very mild risk to well-nourished**=6 or 7 most categories or significant, continued improvement.
**Mild-moderate** = 3, 4, or 5 ratings. No clear sign of normal status or severe malnutrition.
**Severely Malnourished** = 1 or 2 ratings in most categories/significant physical signs of malnutrition.

**Figure 3.** The 7-point scale SGA form.

of tobacco use, and had significantly lower BMI, serum creatinine, serum albumin, urine urea, and lean body mass (measured by dual-energy x-ray absorptiometry).[9]

The Dialysis Outcomes and Practice Patterns Study (DOPPS) study created m-SGA that was graded retrospectively using a patient interview. The score was based on the caregiver's ratings

| | | | | |
|---|---|---|---|---|
| ***(A) Patients related medical history:*** | | | | |
| **1- Weight change** (overall change in past 6 months) | | | | |
| 1 | 2 | 3 | 4 | 5 |
| no weight change or gain | minor Wt loss (<5%) | Wt loss 5 to 10 % | Wt loss 10 to 15% | Wt loss > 15% in |
| **2- Dietary intake** | | | | |
| 1 | 2 | 3 | 4 | 5 |
| no change | sub-optimal solid diet | full liquid diet or moderate overall decrease | hypo-caloric liquid | starvation |
| **3- Gastrointestinal symptoms** | | | | |
| 1 | 2 | 3 | 4 | 5 |
| no symptoms | nausea | vomiting or moderate GI symptoms | diarrhea | severe anorexia |
| **4- Functional capacity** (nutritionally related functional impairment) | | | | |
| 1 | 2 | 3 | 4 | 5 |
| none (improved) | difficulty with ambulation | difficulty with normal activity | light activity | bed/chair-ridden with no or little activity |
| **5- Co-morbidity** | | | | |
| 1 | 2 | 3 | 4 | 5 |
| dialysis<12 months and healthy otherwise | dialysis 1-2 yrs or mild comorbidity | dialysis 2-4 yrs or age>75 or moderate co-morbidity | dialysis>4 yrs or severe co-morbidity | very severe multiple comorbidity |
| ***(B) Physical Exam:*** | | | | |
| **1- Decreased fat stores or loss of subcutaneous fat** (below eyes, triceps, biceps, chest) | | | | |
| 1 | 2 | 3 | 4 | 5 |
| none (no change) | | moderate | | severe |
| **2- Signs of muscle wasting** (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous) | | | | |
| 1 | 2 | 3 | 4 | 5 |
| none (no change) | | moderate | | severe |
| ***Malnutrition Score:*** *(sum of all number)* | | | | |

**Figure 4.** The fully quantitative version of the SGA, also known as modified SGA or DMS. Five scale parameters are used, and the values are summed. A value of 7 is normal, and 35 is the most severe malnutrition.

relative to weight loss, visual somatic store loss, appetite, nausea and vomiting, energy level, and disease burden. The rating for m-SGA is normal, moderate (any 3 areas rated as a moderate or severe level), or severe (at least 3 areas at severe level). Those patients who rated a severe m-SGA

| MALNUTRITION INFLAMMATION SCORE (M.I.S.) | | | |
|---|---|---|---|
| | | | |
| ***(A) Patients' related medical history:*** | | | |
| **1- Change in end dialysis dry weight (overall change in past 3-6 months):** | | | |
| 0 | 1 | 2 | 3 |
| No decrease in dry weight or weight loss <0.5 kg | Minor weight loss (≥0.5 kg but <1 kg) | Weight loss more than one kg but <5% | Weight loss >5% |
| **2- Dietary intake:** | | | |
| 0 | 1 | 2 | 3 |
| Good appetite and no deterioration of the dietary intake pattern | Somewhat sub-optimal solid diet intake | Moderate overall decrease to full liquid diet | Hypo-caloric liquid to starvation |
| **3- Gastrointestinal (GI) symptoms:** | | | |
| 0 | 1 | 2 | 3 |
| No symptoms with good appetite | Mild symptoms, poor appetite or nauseated occasionally | Occasional vomiting or moderate GI symptoms | Frequent diarrhea or vomiting or severe anorexia |
| **4- Functional capacity (nutritionally related functional impairment):** | | | |
| 0 | 1 | 2 | 3 |
| Normal to improved functional capacity, feeling fine | Occasional difficulty with baseline ambulation, or feeling tired frequently | Difficulty with otherwise independent activities (e.g. going to bathroom) | Bed/chair-ridden, or little to no physical activity |
| **5- Co-morbidity including number of years on Dialysis:** | | | |
| 0 | 1 | 2 | 3 |
| On dialysis less than one year and healthy otherwise | Dialyzed for 1-4 years, or mild co-morbidity (excluding MCC*) | Dialyzed >4 years, or moderate co-morbidity (including one MCC*) | Any severe, multiple co-morbidity (2 or more MCC*) |
| ***(B) Physical Exam (according to SGA criteria):*** | | | |
| **6- Decreased fat stores or loss of subcutaneous fat (below eyes, triceps, biceps, chest):** | | | |
| 0 | 1 | 2 | 3 |
| Normal (no change) | mild | moderate | Severe |
| **7- Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous):** | | | |
| 0 | 1 | 2 | 3 |
| Normal (no change) | mild | moderate | Severe |
| ***(C) Body mass index:*** | | | |
| **8- Body mass index: BMI = Wt(kg) / Ht$^2$(m)** | | | |
| 0 | 1 | 2 | 3 |
| BMI≥20 kg/m$^2$ | BMI: 18-19.99 kg/m$^2$ | BMI: 16-17.99 kg/m$^2$ | BMI<16 kg/m$^2$ |
| ***(D) Laboratory Parameters:*** | | | |
| **9- Serum albumin:** | | | |
| 0 | 1 | 2 | 3 |
| Albumin≥ 4.0 g/dL | Albumin: 3.5-3.9 g/dL | Albumin: 3.0-3.4 g/dL | Albumin: <3.0 g/dL |
| **10- Serum TIBC (total Iron Binding Capacity): ♣** | | | |
| 0 | 1 | 2 | 3 |
| TIBC≥ 250 mg/dL | TIBC: 200-249 mg/dL | TIBC: 150-199 mg/dL | TIBC: <150 mg/dL |
| ***Total Score = sum of above 10 components (0-30):*** | | | |

**Figure 5.** MIS. *Major comorbid conditions include congestive heart failure class III or IV, full-blown AIDS, severe coronary artery disease, moderate to severe chronic obstructive pulmonary disease, major neurologic sequelae, and metastatic malignancies or s/p recent chemotherapy. ♣Suggested equivalent increments for serum transferrin are >200 (0), 170 to 200 (1), 140 to 170 (2), and <140 mg/dL.

level had a relative risk of 1.33 for mortality compared with those with a moderate or normal rating,[8] which was statistically significant.

Although each of the versions has strengths, their lack of uniformity makes it difficult both to compare research results on nutritional status from one study to the next and to provide consistent methodology guidance for clinicians wishing to use this tool. Currently the NKF regularly offers training sessions at its Clinical Nephrology meetings to train renal dietitians in the use of the 7-point SGA. No other formal training forum currently exists. Therefore, it is assumed that the majority of renal dietitians currently conducting SGA are using the version recommended by K/DOQI and studied by Visser et al[3] and Jones et al.[4]

## Current Literature With SGA as a Nutritional Assessment Tool

Table 1 includes studies that used SGA as a method of nutritional status determination for further comparisons against a dependent variable (eg, mortality). From this table it is clear that SGA, using either the A, B, C or the 7-point scale, detects the presence of malnutrition; however, the controversy appears when SGA is correlated with serum albumin. In some studies serum albumin was significantly lower in the SGA malnourished group,[9,23–25] whereas in others, serum albumin was not significantly different between the normal and the malnourished groups.[4,26] Serum albumin is one of the most commonly used indicators for malnutrition in the CKD population, and although it is affected by several other factors including inflammation, this inconsistency has raised questions about the validity of SGA. To that end, incorporating serum laboratory markers for malnutrition may be a solution, as done in the MIS.

Studies have shown significant differences between SGA categories for many other nutrition-related variables, ie, BMI, MAMC, serum prealbumin, TIBC or transferrin, ferritin, insulin-like growth factor 1, phase angle (bioelectrical impedance analysis), percent body fat, lean body mass, comorbidity state (diabetes, cardiovascular disease, etc), c-reactive protein and cytokines, and creatinine clearance.[4,7,9,24–31]

The risk of mortality has been assessed by CANUSA,[2] Lawson et al,[27] Davies et al,[28] Kalantar-Zadeh,[18,20] and Pifer et al,[8] with all showing a statistically significant increase in risk or rate of mortality with the presence of malnutrition as determined by SGA.

Interventional trials using kilocalorie and protein supplements, such as in the studies by Caglar et al[32] and Steiber et al,[33] have shown varying effects on changes in an individual's pre-SGA and post-SGA rating, depending on the intervention duration. The trial by Caglar et al[32] was 6 months, included 85 patients, and used the 7-point scale. They were able to show an improvement in the 7-point SGA over time; however, Steiber et al[33] did not see a significant change in pre-SGA and post-SGA scores over a 3-month period when the A, B, C rating system was used in 22 patients.

## Recommendations

A review of the literature indicates that use of SGA as a nutrition assessment tool for CKD patients is growing, in both the clinical and research settings. However, given the variability of published results, SGA cannot be considered a gold standard in nutrition assessment for CKD patients. The validity and reliability of SGA must be proven in a large, multicenter trial with sufficient power to be able to prevent type I and II errors. Additionally, the study's sample must represent the current CKD population. One of the difficulties associated with conducting a study such as this is choosing which version of SGA to test. It may be that different SGA versions are appropriate for different patient disease states, different age stages, or different clinical purposes (eg, screening preoperatively versus full assessment of maintenance hemodialysis patients). Another difficulty is data collection. To get a representative sample, data would need to be collected from all areas of the country in a random manner. This could be done in a way similar to that of Beto et al[34] in a nationally collaborative research project through the National Kidney Foundation's Council on Renal Nutrition (CRN). Using this model, registered dietitians from local CRN groups throughout the United States could randomly collect data on patients in their dialysis centers.

Many of the studies reviewed collapsed the SGA scores into 2 groups (normal and malnourished) for analyses. For instance, Julien et al,[30] Lawson et al,[27] Abdullah et al,[35] and Jones et al,[26] used the A, B, C rating system and all dichotomized the final results by merging the B and C groups together for comparison against the A-rated group. Davies et al[28] used the 7-point scale and collapsed it into 6 to 7, 3 to 5, and 1 to 2 for analysis, and then grouped those with a 5 or less into a "malnourished group" and compared those patients with the 6 to 7 group. This method of analysis substantiates the conclusion of Cooper et al,[6] who found that SGA detects the presence of malnutrition but not the degree. It is possible that the need for the collapsed groups in such studies has more to do with inadequately powered studies or analytical tools (eg, logistic regression) than the lack of detectable precision of SGA. When presenting results of SGA in aggregate, it may be useful to show them in both a full and a collapsed or aggregated format. This would highlight any linear relationships as well as show differences between those with and without malnutrition.

**Table 1.** Studies Using SGA as a Tool in Their Methodology

| First Author | Journal* | Year; Volume (No.): Page Range | Rating Method | Main Comparison Variable(s) | n | Results |
|---|---|---|---|---|---|---|
| Maiorca | Nephrol Dial Transplant | 1995;10 | ABC | Survival | 578 | No difference in survival between SGA groups |
| Cianciaruso | AJKD | 1995;26(3) | ABC | Age | 487 | Older patient ↓ SGA score |
| Maggiore A | Kidney Int | 1996;50(6) | ABC | Bioelectrical impedance analysis | 131 | SGA ↑ as phase angle ↑, not predictive in patients with worst SGA rating |
| Jones CH | Nephrol Dial Transplant | 1997 | ABC | Nutrition parameters | 76 | LBM, CrCl, BMI, MAMC, handgrip, weight ↓ in B and C groups |
| Abdullah | Miner Electrolyte Metabolism | 1997;23(3-6) | ABC | IGF-1, TNF$\alpha$ | 20 | B and C groups ↓ IGF-1 and ↑ TNF$\alpha$ |
| Noh H | Perit Dial Int | 1998;18(4) | | Mortality | 106 | |
| Kalantar-Zadeh K | AJKD | 1998;31(2) | ABC | Laboratory parameters | 59 | C group has ↓ TIBC |
| Kalantar-Zadeh K | Nephrol Dial Transplant | 1999;14(7): 1732-1738 | 5-point | Alb, TIBC, anthropometry | 41 hemodialysis | Fully quantitative SGA had good correlation with laboratory and anthropometric nutritional markers |
| Biesenbach G | Nephrol Dial Transplant | 1999;14(3) | ABC | Diabetic versus Nondiabetic | 30 | No difference between SGA groups |
| Passadakis P | Adv Perit Dial | 1999;15 | | Bioelectrical impedance analysis | 47 | Correlation between phase angle and SGA |
| Visser R | Adv Perit Dial | 1999;15: 222-225 | 7-point | BMI, anthropometry, albumin | 13 hemodialysis 9 peritoneal dialysis | 7-point SGA scale is a valid and reliable tool for assessing nutritional status among end-stage renal disease patients |
| Davies SJ | Kidney Int | 2000;57(4) | 7-point | | 141 | |
| Kalantar-Zadeh K | AJKD | 2001;38(6): 1251-1263 | 4-point, plus 3 new items | CRP, mortality, hospitalization | 83 hemodialysis | MIS predicted clinical outcome |
| Lawson J | JREN | 2001;11(1) | ABC | Mortality | 87 | ↑ mortality in B and C groups |
| Sezer S | Adv Perit Dial | 2001;17 | | Alb | 100 | Alb ↓ in malnourished patients |
| Julien J | EDTNA | 2001;27(4) | ABC | Alb, prealb | 32 | Prealb ↑ in A versus B and C groups |
| Cooper BA | AJKD | 2002;40(1): 126-132 | ABC | Total body nitrogen | 76 | SGA differentiated severely malnourished patients from those with normal nutrition, but was not a reliable predictor of degree of malnutrition |
| Caglar K | Kidney Int | 2002;62 | 7-point | Time-dependent change | 85 | SGA ↑ over 6 mo |
| Bakewell A | Q J Med | 2002;95(12) | 7-point | Incidence of malnutrition | 70 | SGA ↓ over time (NS) |
| Steiber A | JREN | 2003;13(3) | ABC | HD-PNI | 22 | HD-PNI ↓ in B and C groups (NS) |
| Kalantar-Zadeh K | Nephrol Dial Transplant | 2004;19(6): 1507-1519 | 4-point, plus 3 new items | CRP, cytokines, mortality, hospitalization | 378 hemodialysis | MIS was superior to albumin and was similar to CRP and IL-6 in predicting clinical outcome |

Abbreviations: SGA, subjective global assessment; LBM, lean body mass; CrCl, creatinine clearance; BMI, body mass index; MAMC, midarm muscle circumference; IGF-1, insulin growth factor-1; TNF$\alpha$, tumor necrosis factor alpha; TIBC, total iron-binding capacity; alb, serum albumin; prealb, serum prealbumin; HD-PNI, Hemodialysis Prognostic Nutritin Index; MIS, Malnutrition-Inflammation Score; CRP, C-reactive protein NS, not significant.
*Medline abbreviations used.

In a large study with sufficient power, SGA may be able to detect differences between all 7/5 points or A, B, and C. Similarly, a continuous score may resolve the issue independent of sample size. Theoretically, with careful methodology and statistical analysis, a large, nationally representative study could be designed to determine the validity and reliability of SGA within the diverse United States CKD population.

Until the issue of which form of SGA is best suited to the hemodialysis population is determined, clinicians who are currently using one of the forms of SGA should continue to perform SGA. SGA is without a doubt a useful tool for nutritional assessment. However, as with all of the available tools, it should be used in conjunction with anthropometric, laboratory, and dietary intake measures to form a comprehensive nutritional assessment.

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