Indications and limitations of the use of subjective global assessment in clinical practice: an update

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Purpose of review

Subjective global assessment is a clinical tool for assessing nutritional status that merges alterations in body composition and physiological function. Although it was first described almost two decades ago, many studies using this method have been published during the past few years. This review describes recent findings from such studies.

Recent findings

Subjective global assessment has proved to be a good nutritional assessment and prognostic indicator in several clinical situations. Agreement between subjective global assessment and newer screening methods is not always acceptable, and it has not been validated with respect to clinical outcome. Some modifications have been suggested that may increase the sensitivity of subjective global assessment as a screening tool. A scored version of subjective global assessment for cancer patients is now being validated for use in other patient groups. This could increase its utility in nutritional intervention studies if it can be demonstrated that subtle changes in nutritional status are reflected by numerical scores in patient-generated subjective global assessment.

Summary

Subjective global assessment represents a good option for assessing nutritional status in various clinical situations. As a screening tool, it better identifies established malnutrition than nutritional risk but its sensitivity is suboptimal. The scored version of subjective global assessment may have advantages and extend the usefulness of this tool even further.

Keywords

malnutrition, nutritional assessment, nutritional screening, prognostic factors, subjective global assessment

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Abbreviations

LOS	length of stay
MNA	Mini Nutritional Assessment
MUST	Malnutrition Universal Screening Tool
NRI	Nutritional Risk Index
NRS	Nutritional Risk Score
SGA	subjective global assessment

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Introduction

Subjective global assessment (SGA) is a well validated tool for assessment of nutritional status developed by Detsky *et al.* [1], which is based on components of the medical history (changes in weight, dietary intake and functional capacity, gastrointestinal symptoms with nutritional impact, and metabolic stress of present disease) and a brief physical examination, and seeks to identify loss of subcutaneous fat, muscle wasting and ankle/sacral oedema [1]. After the assessment the patient is classified as category A (well nourished), B (moderately or suspected of being malnourished), or C (severely malnourished). Stress of present disease is not always assessed [2], and both versions of the method are used in the studies reviewed here. SGA differs from other nutritional assessment methods in that it is the only one that evaluates functional capacity.

SGA is simple, safe and inexpensive, which renders it a universal tool for nutritional assessment, allowing comparison of the prevalence of malnutrition in various regions in addition to North America and Europe [3,4•,5•,6–10] and making several multicentre studies feasible [5•,11••,12,13••]. These studies showed that the prevalence of hospital malnutrition is high all over the world.

One of the major criticisms of the method is that its accuracy depends on the observer's experience [14,15]. Despite this, Duerksen [16] showed that, after teaching medical students, they could identify malnourished (SGA categories B and C) from normal patients correctly, although they had more difficulty discriminating between moderate and severe malnutrition.

SGA has become a very popular method in recent years; the most recent findings are reviewed here.

Is this patient malnourished?

Malnutrition presents on a continuum. Alteration in nutritional status begins with lack of nutrients, producing a series of functional changes in early stages that only later manifest as anthropometric changes [17]. Thus, the ideal method for nutritional assessment should take into account the patient's physiological requirements and nutritional intake, functional status and body composition [18••]. In the absence of a 'gold standard' method that incorporates all of these features, any new nutritional

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assessment method must be compared with other, more established tools. The initial studies compared SGA with objective measures such as anthropometric and biochemical parameters (convergent validity) [14]. SGA has gained acceptance among investigators and it is now used as a benchmark to validate new assessment methods, such as bioelectrical impedance analysis [19] and mid-upper arm anthropometry [20•].

Malnutrition, as identified using SGA, correlated with impaired pulmonary function in patients with chronic kidney disease [21] and with significant lower handgrip strength in clinical and surgical patients [22,23••]. The combination of these functional methods with SGA could facilitate early detection of the effects of nutritional interventions, because function is restored before body composition.

SGA is recommended in North American and European clinical nutrition guidelines as the method of choice for assessing nutritional status in end-stage renal failure. Studies conducted in haemodialysis [24], predialysis [25] and general medical patients [26] found that SGA did not agree well with anthropometrical measures. In another study, conducted in patients with chronic kidney disease, Suliman *et al.* [27•] showed that inflammation (C-reactive protein), but not malnutrition (SGA), was an independent predictor of low plasma amino acid concentrations. In this setting, C-reactive protein is an early marker of malnutrition because it represents decreased available protein.

Although SGA was not developed specifically for use in geriatric patients, it has been used in this population – hospitalized or community based – to guide intervention studies [28,29•]. Beck and Ovesen [30] suggested that weight loss of more than 5% during the preceding 1–6 months should be considered significant in SGA in elderly patients.

In severely ill patients the use of biochemical and anthropometric parameters for assessment of nutritional status can be very difficult. SGA can be used in these patients at least as an initial evaluation, but it has no usefulness during the follow-up period [31•]. In cirrhotic patients, in whom most nutritional variables are modified by the liver disease, SGA was shown to be a good option for nutritional assessment [32,33].

In conclusion, SGA is now used to assess nutritional status in several clinical setting, and sometimes it is employed as a 'gold standard' method against which new nutritional assessment methods are validated. SGA and objective methods do not always yield similar results. This is probably because SGA could detect malnutrition earlier, before body composition had changed.

Subjective global assessment as a prognostic method

Although SGA is considered a clinical method for evaluating nutritional status, it was developed to identify patients with poorer outcomes following surgery (i.e. those who would suffer so-called nutrition-associated complications). Baker *et al.* [34] showed that patients classified as 'malnourished' suffered more infections, had increased use of antibiotics and longer hospital length of stay (LOS). A recent review [14] showed that several other studies have confirmed the predictive validity of the tool.

Most studies correlated malnutrition, as identified using SGA, with adverse outcomes. In a small group of patients, Humphreys *at al.* [22] found that SGA, handgrip strength and fat mass on admission were independent predictors for loss of functional status during hospitalization. Compared with anthropometric measurements, SGA was superior in identifying patients who had longer LOS and needed nonelective readmission [26]. Similar results were found in a paediatric population, in which SGA evaluation was more sensitive than anthropometry in detecting risk for infectious complications and longer LOS [8]. Using bioelectrical impedance analysis to estimate body composition at hospital admission, Pichard *et al.* [35] showed that depletion of lean body mass and malnutrition, as identified using SGA, were more associated with increased LOS than were weight loss in excess of 10% or body mass index below 20 kg/m^2. They concluded that body composition from bioelectrical impedance analysis could complement SGA information better than weight loss or body mass index.

Several studies have shown the association between malnutrition as identified using SGA and increased morbidity in both clinical and surgical patients. Pham *et al.* [6] found a five times higher incidence of infectious complications in patients classified as SGA category C (severely malnourished) compared with those classified as SGA category A (well nourished). Sungurtekin *et al.* [36] also reported a three to four times higher incidence of postoperative complications in patients who were malnourished according to SGA following major intra-abdominal surgery. Using a combination of SGA and other nutritional methods, Schnelldorfer *et al.* [37•] found an association between malnutrition and a higher incidence of postoperative complications after surgery for chronic pancreatitis. In contrast, in a very small sample of patients with chagasic mega-oesophagus, Penhavel *et al.* [38] failed to find an association between SGA evaluation and postoperative complications and mortality. One possible explanation could be the lack of power because only 27 patients were studied. In cirrhotic patients it was demonstrated that handgrip strength, but not SGA, was predictive of major complications after 1 year [39•]. One

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explanation for this finding is that functional assessment as assessed by handgrip strength could be more sensitive than SGA in detecting loss of muscle mass [17].

Various non-nutritional factors (e.g. age, presence of cancer and other comorbidities) may bias the effect attributed to malnutrition as assessed by SGA. Only a multivariate analysis, controlling for these factors, can show the real effect of malnutrition. Using this approach, Perman *et al.* [40] showed that malnutrition as assessed by SGA was a strong predictor of complications, independent of age, sex and the presence of infection, cancer, or surgery. In a similar study, SGA was not a significant predictor of postoperative complications after adjusting for other confounding factors, although it was shown to be a strong predictor in univariate analysis [4•]. This suggests that part of the risk attributed to malnutrition in these patients, in fact, resulted from their older age and the number of cancer diagnoses.

With mortality being the outcome of interest, SGA was also found to be an independent predictor of survival after stroke [41], colorectal cancer [42•] and chronic renal disease [43,44] after controlling for potential confounders.

In conclusion, malnutrition as assessed by SGA was found to predict morbidity and mortality in several clinical settings. More sophisticated statistical analyses could be used to show whether SGA provides a global index of 'sickness' or really is a nutritional assessment tool [17].

Subjective global assessment as a screening method

Nutritional screening tools, by definition, are designed not just to detect malnutrition but also to anticipate any depletion in nutritional status caused by the disease process [30]. Their use should be rapid and simple, they should have high sensitivity, and they should aim to classify patients as being at nutritional risk or not, and so indicate whether referral for more detailed nutritional assessment is needed [45].

In their first paper, the SGA creators recommended that most emphasis should be be given to the items weight loss, and poor dietary and physical examination findings (i.e. loss of subcutaneous fat and muscle wasting), and omitted the item 'metabolic demand' from the questionnaire [2]. The result should be more specific for diagnosis of malnutrition. With this original approach, SGA cannot be considered a good nutritional screening method because it focuses more on chronic than on acute nutritional changes; it enhances specificity at the expense of sensitivity [9], and is more useful in detecting established malnutrition [46••]. As a nutritional assessment tool, SGA is used to identify and encode malnourishment as a comorbidity in the Diagnosis Related Group system for adequate reimbursement [7,47•].

When the objective is to detect acute changes in nutritional status, the method should be sensitive and should not require one to await physical signs before a nutritional intervention can be performed. Changes in dietary intake and metabolic stress are of greater value in this setting. Table 1 presents some suggestions of how the sensitivity of SGA could be enhanced. Using this approach, malnutrition and its risks could be identified even in the presence of obesity in surgical patients [48].

Several new nutritional screening methods have been evaluated over recent years. Three of them – the Malnutrition Universal Screening Tool (MUST), Nutritional Risk Screening (NRS 2002) and Mini Nutritional Assessment (MNA) – were recommended in the most recent guidelines from the European Society for Clinical Nutrition and Metabolism [45]. They include only a few questions and can be applied in various settings. SGA was compared with these new tools in some studies. When SGA and NRS 2002 were compared in hospitalized patients, Valero *et al.* [49•] concluded that both methods could be used to identify patients at nutritional risk because the results were similar [SGA category C (severely malnourished) versus NRS $\geq$ 3: 40.7% versus 45.1%], but no κ test was applied to evaluate the concordance between the two methods. The comparison of the two tools with respect to nutritional risk requires that SGA categories B and C be considered together, yielding 63%, which is quite different from the 45.1% identified by NRS 2002. A possible explanation for this finding is the overestimation of severe malnutrition by SGA. Detsky *et al.* [2] gave a very good description of patients who should be considered severely malnourished; this picture included obvious physical signs of severe subcutaneous loss and muscle wasting in addition to significant weight loss, decreased nutritional intake and, almost always, functional impairment. A severely malnourished

Table 1 Variables in subjective global assessment that are more valuable in diagnosing or screening for malnourishment

Variable	Diagnosis[a]	Screening[b]
Weight loss	+++	
Decrease in dietary intake	+++	+++
Gastrointestinal symptoms		
Impaired function		+++
Metabolic stress		+++
Subcutaneous fat mass	+++	
Muscle wasting	+++	
Oedema		+++

[a]As suggested by Detsky *et al.* [2].
[b]As suggested by the authors of the present review. In this approach, classification should be according to nutritional risk rather than nutritional status: A, without nutritional risk; B, suspicious or moderate nutritional risk; and C, high nutritional risk.

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patient (SGA category C), in most situations, represents a case of chronic starvation (months) with or without metabolic stress (acute or chronic). Moderate or suspected malnourishment (SGA category B) involves acute deprivation (days or weeks) combined with moderate-to-severe stress. Table 2 shows the results from SGA and NRS 2002 can be related to each other with respect to nutritional status and severity of illness. SGA categories B and C can be considered at 'nutritional risk' (NSR ≥ 3). There is agreement on the diagnosis of nutritional risk in almost all situations except one.

Nursal *et al.* [50] compared the performance of several screening tools with SGA. They concluded (not surprisingly) that unintentional weight loss and loss of subcutaneous fat combined have the best accuracy (93%), better than that of MNA or MUST, when compared with SGA. Another study [51] showed fair to good agreement among SGA, NRS 2002, MUST and other methods ($\kappa = 0.39$–0.94). Kyle *et al.* [52] reported a significant association between LOS and nutritional status or risk as evaluated by SGA, NRS 2002, MUST and Nutritional Risk Index (NRI). NRS 2002 showed the higher agreement ($\kappa = 0.48$, $P < 0.001$), sensitivity and specificity when compared with SGA. Comparing MUST with several screening tools in a hospitalized population, Stratton *et al.* [53] found excellent agreement with NRS and SGA ($\kappa > 0.75$), suggesting that it could also be used in this population. These findings confirm that, in most studies, weight loss and physical findings are the most decisive items in SGA assessment.

In a comparison of MNA, SGA and NRS 2002 conducted in geriatric hospital patients [54•], only patients identified as at risk or malnourished by MNA had significant association with longer LOS, and it was recommended that NRS 2002 be used when MNA could not be applied. In a study conducted in elderly outpatients that compared SGA with MNA [55], the authors concluded that SGA was better able to detect established malnutrition whereas MNA detected risk for malnutrition. Barone *et al.* [56] also found that more geriatric patients were classified as malnourished by MNA than by SGA. Christensson *et al.* [57] identified a significantly greater health problem in elderly patients considered malnourished by SGA, even if they had normal anthropometric and biochemical parameters.

Table 2 Comparison of subjective global assessment and Nutritional Risk Screening scores

Impaired nutritional status[a]	Severity of disease			
	0	1	2	3
0	A	A	A	B
1	A	A	B	B
2	B[b]	B	B	B
3	C	C	C	C

[a]Body mass index, food intake and/or weight loss. Subjective global assessment categories are as follows: A, well nourished (or not at nutritional risk); B, moderately or suspected of being malnourished (at nutritional risk); C, severely malnourished (at nutritional risk).
[b]Only in this situation do the methods disagree. Adapted from Kondrup *et al.* [45].

When SGA was compared with NRI (albumin and percentage actual weight loss), only a good level of agreement was achieved ($\kappa = 0.57$) [9]. Santoso *et al.* [58] failed to find good agreement when SGA was compared with the Prognostic Nutritional Index in patients with gynaecological cancer ($\kappa = 0.435$). A new screening tool based on laboratory information [CONtrolling NUTritional status (CONUT)] also exhibited fair agreement with SGA [59]. These findings confirm that factors other than nutritional ones mediate biochemical alterations and protein synthesis.

Nutritional risk should be defined as the probability of a better or worse outcome due to nutritional factors, which should be improved by nutritional intervention [45]. Although all the tools described above are defined as nutritional risk assessment methods, there are no outcome-validated studies of nutritional intervention guided by SGA or other screening system in the recent literature [60,61]. In future studies, in order for a screening method to be validated, patients identified as being at nutritional risk and undergoing a nutritional intervention should have better outcomes than patients who are also at nutritional risk but in the control group.

In conclusion, SGA lacks the sensitivity to detect acute alterations in nutritional status; it is better able to detect established malnutrition. Comparisons with new screening tools have shown different levels of agreement, depending on the variables used. There are insufficient data from intervention studies to validate SGA or the other methods mentioned above as nutritional risk assessment tools.

Subjective global assessment as an objective method

One criticism directed at SGA is that it is a subjective method with only three categories, which does not allow assessment of nutritional scale on a continuum. Some authors scored each item of the SGA evaluation and defined cutoff values for SGA categories A, B and C. This approach failed to identify malnutrition in surgical patients [3]. In another study [62] a scored SGA was superior to handgrip strength and endurance in predicting morbidity in surgical patients.

The best known scored version of SGA is the patient-generated SGA. It was developed by Ottery [63] specifically for cancer patients, including additional questions

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regarding symptoms that affect eating habits, disease category and comorbidities. The patient completes the medical history and a health professional performs the physical examination and assigns scores (0–4) to the domains. A higher score indicates greater risk for malnutrition, and appropriate nutritional intervention is established for each level [18••,64]. As a continuous measurement, patient-generated SGA can be repeated at intervals [65] and subtle changes in nutritional status in response to interventions can be evaluated [18••,66•,67,68••]. When compared with SGA, patient-generated SGA had a sensitivity of 98% and a specificity of 82% [64]. Although patient-generated SGA is a scored method, its result also depends on the observer's experience with the method [69]. Patient-generated SGA is used in several types of cancer patients as a diagnostic and prognostic method [70•,71]. The simplicity of the method permits its use in multicentre prevalence studies [72••].

Patient-generated SGA was developed for use in cancer patients, but it also had good performance in acute stroke patients, predicting a worse evolution in patients with a score of 9 or greater [73•]. When patient-generated SGA was used in haemodialysis patients, Desbrow *et al.* [74•] achieved a sensitivity of 83% and a specificity of 92% in identifying patients at risk for malnourishment or who were moderately malnourished (patient-generated SGA score $\geq$ 9 versus SGA category B). Further studies should investigate whether this modified version can be used in other clinical situations.

Conclusion

For more than two decades SGA has been used to assess malnutrition as well as to predict morbidity and mortality in several clinical and surgical settings. SGA is also considered a 'gold standard' method for validating new nutritional assessment and screening methods. Studies relying in more sophisticated statistical analyses could determine whether SGA is a global index of 'sickness' rather than a nutritional marker. As a screening method SGA lacks sensitivity to detect acute changes in nutritional status. For this reason, SGA does not agree well with new screening methods. Validation of scored patient-generated SGA could enhance its usefulness in clinical practice even further.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:
- • of special interest
- •• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 333).

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2 Detsky AS, Smalley PS, Chang J. Is this patient malnourished? JAMA 1994; 271:54–58.

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