Chapter

Undernutrition Risk Assessment in Elderly People: Available Tools in Clinical Practice

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Abstract

Undernutrition is a public health problem all over the world. More than 30 million people are currently affected by undernutrition in Europe, mainly hospitalized or elderly people. Undernutrition has several medical consequences and in the elderly can be associated with adverse clinical symptoms, contributing to frailty, morbidity, hospitalization, and mortality. These medical situations highlight the importance of an early detection and diagnosis, the objective being to prevent or treat undernutrition. This is why the implementation of a complete nutritional assessment in clinical practice is important. Nutritional screenings are essential tools to identify patients that will likely benefit from nutrition therapy. There are currently several screening methods to identify nutritional risk or malnutrition. However, the lack of a standard has aroused controversy about the best tool to use. Our objective is to describe the screening tools available for the elderly.

Keywords: elderly, undernutrition, malnutrition assessment, malnutrition biomarkers

1. Introduction

Scientific evidence suggests that nutritional status has a great impact on the health and functional status of older people. In addition, during the aging process there are a series of changes that can have a negative impact on nutritional status. These biological, physiological, social, and psychological changes, together with a higher prevalence of morbidities, further increase the susceptibility of the elderly to malnourishment [1].

The etiology of malnutrition is multifactorial in the elderly. The literature indicates that the elderly are at risk of nutritional deficiencies due to changes in body composition, the digestive system, and the regulation of fluids and electrolytes, sensory alterations, increased likelihood of chronic diseases, poly medication, and hospitalization. But also, social changes—such as retirement, less family responsibility, loneliness, widowhood, or lower purchasing power—increase the risk of inadequate nutrition. Although certain autonomy is maintained, the functional capacity is modified, which makes the daily tasks of life—such as shopping,

preparing food, or moving from one place to another—difficult. In addition, the coexistence of physical and mental illnesses may increase or decrease nutritional requirements or may limit the individual's ability to obtain adequate nutrition, thereby increasing the risk of malnutrition [2, 3].

This is why the evaluation of the nutritional risk in this type of population is of the utmost importance.

2. Nutritional parameters related to undernutrition

The assessment of the nutritional status is the step previous to dietary-nutritional treatment [4]. It is a global evaluation that includes the nutritional status of the individual as well as the severity of the underlying disease, due to the relationship between them. It establishes a methodology to obtain information about the current and past situation of the elderly person in relation to their diet, body composition, and functional and health status [5, 6]. In addition, it will help in the detection of nutritional risk or malnutrition. Two steps can be established in this assessment process: a first step of screening the nutritional risk or malnutrition, and a second step of complete nutritional assessment to identify the causes and consequences of malnutrition. The second step would be carried out when a nutritional risk or malnutrition has been detected [4, 5, 7].

As there is no single marker or nutritional tool that is useful for all types of individuals or physiological or pathological situations and is easily reproducible, predictable, and reliable, correct nutritional assessment involves the use of different nutritional parameters in order to perform an evaluation of the nutritional status that is as complete as possible, according to the subject with which we are dealing; in this case, the geriatric population. In addition, the social and cultural aspects of the patient must also be taken into account, because these data provide information on their resources and ability to prepare food, as well as sociocultural, religious, or personal nutritional habits that may affect the intake and nutritional status. Among the different factors or parameters related to malnutrition that can be assessed in the elderly, we find health status, social and clinical conditions, anthropometry, dietary habits and dietary intake, lifestyle, blood biochemistry, etc. [5, 6]. These factors or parameters and their relationship with malnutrition are described below.

2.1 General health status self-assessment

Perceived health status is one of the most consolidated indicators and is easy to enquire about in health surveys. It is a feasible tool and has been studied in recent years because it is useful as a global indicator of the level of population health. Some of the factors that lead to a poor self-perception of the state of health in the elderly are age, female sex, comorbidity, not receiving treatments, and little accessibility to other health services [8].

2.2 Social condition

Many aspects of the individual's life are covered here. Some of the causes that can lead to an inadequate consumption of food and, therefore, to malnutrition, are isolation, the loss of loved ones in charge of organizing meals, difficulties in buying or cooking, poor pensions, or changes in feeding when moving to a geriatric residence. It is important to know where the individual lives and with whom, the main career's situation, characteristics of the home, the level of income, their leisure activities, etc. [9].

2.3 Clinical condition

This is data from the clinical evaluation performed by a medical professional. It will be necessary to know if the individual suffers or has suffered from any disease, as well as the drugs he or she has taken or is taking for said disease(s). Regarding the intake of drugs, it is important to gather information about the dosage and interactions between food and drugs [5].

2.4 Anthropometry

Anthropometric measurements provide information about the morphological dimensions of individuals. It is a non-invasive, low cost, and portable method, when compared to techniques requiring more complex devices. The anthropometric parameters include weight, height, skin folds, diameters, lengths, and girth. Some of these have been related to malnutrition: specifically, weight loss in a short period of time (1–6 months) with respect to usual weight, low percentile of the triceps skin fold, and decrease in body mass index (BMI) [6, 9].

2.5 Dietary intake and eating attitudes

Food intake is a process that varies according to the day of the week, month, or season of the year. Other factors that influence food intake are food preferences and aversions, the person preparing the meals, feeling full (before and during meals), and the ease or difficulty of food intake and/or food preparation, among others. Information concerning these factors is relevant to evaluate food intake [6].

To determine the intake of food and liquids, methods that give similar results if they are repeated in the same situation are required; that is, instruments that offer better reproducibility or precision (agreement of results when the same dietary evaluation method is administered more than once, and on different occasions, to the same individual or group). Currently, there are prospective or retrospective methods, such as the dietary diary, 24-hour recall, and food consumption frequency questionnaire (CFCA), among others. The use of two or more methods can give a better and more accurate estimate of the habitual diet of the individual who has been interviewed, since the disadvantages of one method are offset by the advantages of the other. In addition, it is necessary to use a food composition database to obtain information on energy and nutritional intake (macro and micronutrients), thereby allowing comparison with the recommendations for the intake of energy, carbohydrates, proteins, lipids, and micronutrients [5, 6, 10].

2.6 Blood biochemistry

Some of the blood biochemical parameters are biomarkers related to nutritional status. In spite of the fact that most nutritional risk screenings aimed at the elderly population do not contemplate biochemical parameters, they are included in the screening of hospitalized patients. Decreases in the values of some of these biochemical parameters (albumin, lymphocytes, cholesterol, etc.) are important in the detection and assessment of protein malnutrition [6, 9–11]. These parameters are described below:

- Albumin: this protein is easily determined due to its long half-life (20 days), but has limitations as a nutritional marker. Changes in blood volume, different pathological situations, or any degree of aggression can produce a decrease in its plasma values, although its decrease is related to an increase in the occurrence of complications and mortality [6, 10].

- Prealbumin: this is a protein with a half-life of 2 days that decreases in some situations of malnutrition, infection, or liver failure and increases upon renal failure. It should be interpreted with caution if used as a nutritional marker; despite this, it is considered a good indicator for assessing acute nutritional changes [9].

- Protein binding retinol: this is a protein with a half-life of 10 hours, whose levels increase with vitamin A intake or renal failure, and are decreased by liver disease, infection, or severe stress. Due to its sensitivity to stress and renal function, it is considered of little clinical use [9].

- Lymphocytes: these are related to immunity and nutritional status. Total lymphocytes are related to protein depletion and loss of immune defenses as a result of malnutrition [10, 11].

- Total cholesterol: in malnourished patients with renal and kidney failure and malabsorption syndrome, low cholesterol levels are associated with an increase in mortality. A decrease in their values to below 150 mg/dl is related to malnutrition [10, 11].

3. Nutritional screening tools available for elderly people

A wide range of nutritional screening tools have been developed.

The screening tools used most commonly, have been developed in several countries specifically for elderly people, are Australian Nutrition Screening Initiative (ANSI) [12], Ayrshire Nutrition Screening Tool (ANST) [13], Canadian Nutrition Screening Tool (CNST) [14], Chinese Nutrition Screen (CNS) [15], Council of Nutrition Appetite Questionnaire (CNAQ) [16], Simplified Nutritional Appetite Questionnaire (SNAQ) [16], Short Nutritional Assessment Questionnaire (SNAQ) [17], Short Nutritional Assessment Questionnaire for the Residential Care (SNAQ RC) [18], Malaysian Tool (MT) [19], Malnutrition Risk Screening Tool-Hospital (MRSTH) [20], Mini Nutritional Assessment (MNA) [21], Mini Nutritional Assessment Short Form (MNA-SF) [22], Minimal Eating Observation and Nutrition Form Version II (MEONF-II) [23], Nursing Nutrition Screening Assessment (NNSA) [24], Nursing Nutritional Assessment (NNA) [25], Nutrition Screening Initiative (NSI "DETERMINE") [26], Nutritional Form for the Elderly (NUFFE) [27], Nutritional Risk Assessment Tool (NRAT) [28], Seniors in the Community Version I (SCREEN I) [29], Seniors in the Community Version II (SCREEN II) [30], South African Screening Tool (SAST) [31], The Burton Score (TBS) [32] and Geriatric Nutrition Risk Index (GNRI-NRI) [33] (**Table 1**). All of them contain several domains, and the parameters included most frequently are those concerning anthropometry, dietary intake, and clinical condition. Among the anthropometric parameters, the most used value is weight change, being the only anthropometric item reported in some of the protocols. Dietary intake comprises information about the quantity and the quality of the food consumed by the patient and, in particular, regarding their appetite and frequency of meals. Some of the instruments also include an item about fluid intake, which is an important aspect to be considered in elderly people. Aspects related to diseases and functional status are the items included most frequently in the clinical condition domain.

Concerning the clinical setting used to develop and/or validate the instrument, the three main contexts found are community, hospital, and long-term care

Parameter	Definition	Range	Equation
% Habitual weight loss	Weight variation with respect to the usual weight	Mild: 85–95% Moderate: 75–84% Severe: <75%	% Habitual weight loss = (actual weight (kg)/habitual weight (kg)) × 100
Body mass index (BMI)	Relationship between weight and height	Mild: 17–18.4 kg/m^2 Moderate: 16–16.9 kg/m^2 Severe: <16 kg/m^2	BMI = weight (kg)/height (m^2)
Triceps skinfold	Vertical skinfold in the middle back of the arm	Mild: percentile 10–15 Moderate: percentile 5–10 Severe: percentile <5	Review percentiles of the population of origin

Table 1.
Anthropometric parameters related to malnutrition.

facilities (including nursing homes and residential facilities). Among these settings, the self-administration form is used only in the community or in long-term care facilities. However, in hospitals the administration form used most frequently is filled in by qualified health personnel. The number of items comprising the presented tools ranges from 2 (CNST) to 18 (MNA). Taking into account that the respondents are elderly people, the interviews performed by health professionals seem to be the best option, as well as tools with a low number of items, to minimize the burden of the interviewee.

In order to have the appropriate arguments for using one or other of the screening methods, the main psychometric parameters that should be considered are the sensitivity and specificity of the test. Among the selected tools the sensitivities ranged from 0.32 for the ANSI [34] to 99% for the MNA [22] and the specificities of the tools ranged from 0.38% for the SCREEN I [29] to 0.96% for the MRSTH [20]. Only for five of these instruments Receiver Operating Characteristic (ROC) curves, as a combined measure of sensitivity and specificity, has been informed [16, 17, 22, 29, 30]. The tool which has shown the best values for both, sensitivity and specificity is MNA and its short form (MNA-SF) and, consequently are the nutritional screening tests most commonly used (**Table 2**).

4. Characteristics of nutritional screening: advantages and limitations

All the screening tools described here were designed specifically for elderly people; however, there is a set of screenings developed for other populations, mainly adults, which could be used also for aged people. This supposes an advantage if different populations need to be compared. Nevertheless, these instruments could lose content validity in comparison with specific aged-population tools.

Among the different forms of data collection, face to face interview has been demonstrated to be the most suitable form for this age group. A low number of items are also recommended in order to reduce the burden of the respondent [35]. The domains included in each tool can influence the validity of the evaluations. The use of parameters that examine aspects related to the patient's perception could be less appropriate for elderly patients. The frequent sensorial and cognitive problems of these patients make the collection of accurate data more difficult [36].

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
ANSI [12]	Anthropometry	Weight change	12	Community	Self-administered Administered by family members or caregivers	Range: 0–29 0–3: good 4–5: moderate nutritional risk 6 or more: high nutritional risk
	Social condition	Loneliness Food access				
	Clinical condition	Functional status Disease Oral problems Drugs				
	Dietary intake	Frequency of meals and food intake Fluid intake				
	Life style	Alcohol intake				
ANST [13]	Anthropometry	Weight change	6	Hospital	Nursing staff	Range: 0–18 6 or less: moderate risk 7 or more: high risk
	Clinical condition	Disease				
	Dietary intake	Frequency of meals Fluid intake Appetite				
CNST [14]	Anthropometry	Weight change	2	Hospital	Dietitians	Range: 0–2 0–1: no risk 2: nutrition risk
	Dietary intake	Food frequency intake				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
CNS [15]	Anthropometry	Weight change	16	Hospital Long-term care facilities	Professional not indicated	Range: 0–32 ≤16: malnourished 17–19: risk >19: normal
	Social condition	Loneliness				
	Clinical condition	Functional status Disease Drugs Skin status				
	Dietary intake	Appetite Food intake Frequency of meals Fluid intake				
	Emotional status	Happiness				
	Self-assessment	Health status				
CNAQ [16]	Dietary intake	Frequency of meals Appetite	8	Long-term care facilities Community	Self-administered	Range: 8–40 ≤28: significant risk of at least 5% weight loss within 6 months
	Emotional status	Sadness				
	Eating attitudes	Food tastes Feel full, hungry or nauseated				
SNAQ [16]	Dietary intake	Frequency of meals Appetite	4	Long-term care facilities Community	Self-administered	Range: 4–20 ≤14: significant risk of at least 5% weight loss within 6 months
	Eating attitudes	Food tastes Feeling of fullness				
SNAQ [17]	Anthropometry	Weight change	3	Hospital	Nursing staff Dietitians	Range: 0–5 ≥2: moderate malnourishment ≥3: severe malnourishment
	Dietary intake	Appetite Supplemental drinks or tube feeding				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
SNAQRC [18]	Anthropometry	Weight change BMI	3 + 1 (BMI)	Long-term care facilities	Self-administered Administered by family members or care workers Trained care works for anthropometric measures	Traffic light system Red score: high risk of undernourishment Orange score: moderate risk of undernourishment Green score: no risk
	Clinical condition	Functional status				
	Dietary intake	Appetite				
MT [19]	Anthropometry	Weight change	11	Rural community	Interviewer (professional not indicated)	Two sections: A (range: 0–7): undernutrition: ≥4 high risk of undernutrition B (range: 0–5): dietary inadequacy: ≥2 high risk of consuming an inadequate diet
	Social condition	Food access				
	Clinical condition	Functional status Disease Oral problems				
	Dietary intake	Frequency of meals and food intake Appetite				
	Life style	Smoking				
MRSTH [20]	Anthropometry	Weight change Arm circumference Calf circumference	5	Hospital	Health care professionals	Range: 0–8 ≥5: high risk of malnutrition
	Social condition	Food access				
	Clinical condition	Functional status				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
MNA [21]	Anthropometry	Weight change BMI Arm circumference Calf circumference	18	Long-term care facilities Community Hospital	Health care professionals	Range: 0–30 ≥24: well nourished 17–23: at risk of malnutrition <17: malnourished
	Clinical condition	Functional status Disease				
	Dietary intake	Frequency of meals and food intake Fluid intake Appetite				
	Self-assessment	Nutritional problems Health status				
MNA-SF [22]	Anthropometry	Weight change BMI	6	Long-term care facilities Community Hospital	Health care professionals	Range: 0–14 ≥12: normal-no need for further assessment ≤11: possible malnutrition-continue assessment
	Clinical condition	Functional status Disease				
	Dietary intake	Appetite				
MEONF-II [23]	Anthropometry	Weight change BMI (or calf circumference)	6	Hospital	Nursing staff	Range: 0–8 0–2: low risk of undernutrition 3–4: moderate risk of undernutrition ≥5: high risk of undernutrition
	Clinical condition	Functional status Oral problems Clinical signs				
	Dietary intake	Appetite				
NNSA [24]	Anthropometry	Weight change	5	Hospital	Nursing staff Dietitians	Range: 0–100 <65: high risk 65–79: moderate risk 80–100: minimal risk
	Clinical condition	Functional status Disease				
	Dietary intake	Frequency of meals and food intake				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
NNA [25]	Anthropometry	Weight change	9	Hospital	Nursing staff Dietitians	Range: 9–36 <18: low risk 19–27: moderate risk 28–36: high risk
	Clinical condition	Functional status Disease				
	Dietary intake	Appetite Frequency of meals				
NSI "DETERMINE" [26]	Anthropometry	Weight change	10	Community	Self-administered Administered by family members or caregivers	Range: 0–21 0–2: good 3–5: moderate nutritional risk 6 or more: high nutritional risk
	Social condition	Loneliness Food access				
	Clinical condition	Functional status Disease Oral problems Drugs				
	Dietary intake	Frequency of meals and food intake				
	Life style	Alcohol intake				
NUFFE [27]	Anthropometry	Weight change	15	Long-term care facilities	Nursing staff	Range: 0–30 Norwegian version cut-offs: <6: low risk 6–10: medium risk ≥11: high risk
	Social condition	Loneliness Food access				
	Clinical condition	Functional status Disease Oral problems Drugs				
	Dietary intake	Frequency of meals and food intake Appetite Dietary intake changes Portion size				
	Self-assessment	Health status				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
NRAT [28]	Anthropometry	Weight change	9	Community	Nursing staff Dietitians	Range: 0–26 0–6: little or no risk 7–16: probable risk ≥17: malnourished
	Clinical condition	Functional status Oral problems				
	Dietary intake	Frequency of meals Appetite				
	Eating attitudes	Feeling of fullness				
	Self-assessment	Health status Thinness				
SCREEN I [29]	Anthropometry	Weight change	15	Community	Self-administered Interviewer (professional not indicated)	Not specified
	Social condition	Food access Loneliness				
	Clinical condition	Functional status Oral problems				
	Dietary intake	Frequency of meals and food intake Fluid intake Appetite Supplemental drinks Dietary intake changes				
SCREEN II [30]	Anthropometry	Weight change	17	Community	Self-administered Dietitians	Range: 0–64 Cut-offs not specified
	Social condition	Food access Loneliness				
	Clinical condition	Functional status Oral problems				
	Dietary intake	Frequency of meals and food intake Fluid intake Appetite Supplemental drinks Dietary intake changes Quality of meals				

Nutrition screening tool	Parameters	Specific	No. of items	Setting	Administration	Nutritional score
SAST [31]	Anthropometry	Arm circumference	10	Community Long-term care facilities	Trained fieldworkers	Range: 0–23 **Men** <9.5: malnourished 9.5–14.5: risk of malnutrition >14.5: well nourished **Women** <9.5: malnourished 9.5–16: risk of malnutrition >16: well nourished
	Social condition	Functional status				
	Clinical condition	Disease				
	Dietary intake	Frequency of meals and food intake				
	Self-assessment	Health status				
TBS [32]	Anthropometry	Weight change BMI	7	Hospital	Nursing staff Dietitians	Range: 6–28 0–5: well nourished 6–10: moderately nourished 11–15: poorly nourished ≥16: very poorly nourished
	Social condition	Age Sex				
	Clinical condition	Functional status Symptoms Skin risk areas				
	Dietary intake	Appetite				
GNRI-NRI [33]	Anthropometry	Knee height Usual weight	No items	Hospital	Professional not indicated	Grades of nutrition-related risk: <82: major risk 82 to <92: moderate risk 92 to ≤98: low risk >98: no risk
	Social condition	Age				
	Biochemistry	Albumin				

Table 2.
Summary of nutritional screening tools.

The inclusion of objective parameters, such as anthropometric measurements or clinical data, helps to avoid this disadvantage. However, the collection of such data, especially for parameters derived from biochemical analyses, involves a high cost and cannot be achieved in all settings.

The absence of a Gold Standard criterion to validate this kind of instrument supposes a disadvantage. This is a reason for the ongoing development of new, appropriate parameters. Although most of these tools are widely used, none of them has been compared to standard criteria used to evaluate nutritional status.

5. Conclusions

There is no single nutritional marker that can predict or diagnose malnutrition; rather, the state of health, social and clinical conditions, anthropometry, eating habits, and blood chemistry of the elderly person under consideration—in relation to their specific situation (health, illness, hospitalization, or institutionalization)—must be taken into account. Therefore, the tools described here that include various dimensions are currently the most recommended.

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