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Assessment of nutritional status in the healthcare setting in Spain

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Abstract

Early identification of undernourished patients in the healthcare setting, and their nutritional treatment, are essential if the harmful effects of poor nourishment are to be avoided and care costs kept down.

The aim of assessing nutritional status is to determine the general health of a patient from a nutritional viewpoint. All hospitalised patients should undergo nutritional screening within 24-48 h of admission, as should any patient who shows signs of being malnourished when visiting any healthcare centre. The infrastructure and resources available, the possibilities of automisation, and the healthcare setting in which such assessment must be performed, etc., determine which method can be used. The European Society of Parenteral and Enteral Nutrition (ESPEN) recommends the use of the Nutritional Risk Screening–2002 (NRS-2002) method for hospitalised patients, the Malnutrition Universal Screening Tool (MUST) in the community healthcare setting, and the first part of the Mini-Nutritional Assessment (MNA) for elderly patients. In centres where screening can be computerised, the CONUT® or INFORNUT® methods can be used.

A nutritional diagnosis is arrived at using the patient's medical history, a physical examination (including anthropometric assessment), biochemical analysis, and functional tests. No single variable allows a diagnosis to be made. The Subjective Global Assessment (SGA) and MNA tests are useful in nutritional assessment, but they are not universally regarded as the gold standard. At our hospital, and at many other centres in the Spanish health system, the Nutritional Status Assessment (NSA) method (in Spanish Valoración del Estado Nutricional) is used, which involves the SGA method, the taking of anthropometric measurements, and biochemical analysis.

After making a nutritional diagnosis, which should be included in the patient's medical history adhering to International Classification of Diseases code 9 (ICD-9), and prescribing a nutritional treatment, the patient should be followed up. No single marker can be used to monitor progress; interpretations will once again require examination of the patient's medical history, the taking of anthropometric measurements and laboratory tests. Depending on whether a patient is ambulatory or hos-

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VALORACIÓN DEL ESTADO NUTRICIONAL EN EL ENTORNO ASISTENCIAL EN ESPAÑA

Resumen

La identificación precoz del paciente malnutrido en el entorno asistencial y su abordaje nutricional es esencial para minimizar los efectos deletéreos de la desnutrición así como para disminuir el gasto sanitario.

La valoración nutricional tiene como objetivo determinar el grado de salud desde el punto de vista de la nutrición y debe realizarse en todo paciente hospitalizado en las primeras 24-48 horas, y en el ámbito ambulatorio, ante cualquier paciente que presente sospecha de desnutrición. La elección del método de cribaje depende de la infraestructura y recursos disponibles, posibilidad de automatización y ámbito asistencial, entre otros. Así, la European Society of Parenteral and Enteral Nutrition (ESPEN) recomienda el uso del *Nutritional Risk Screening–2002* (NRS-2002) en el paciente hospitalizado, el *Malnutrition Universal Screening Tool* (MUST) a nivel comunitario y la primera parte del *Mini-Nutritional Assessment* (MNA) en población anciana. En aquellos centros en los que exista posibilidad de informatizar el screening pueden implantarse el CONUT® (Control Nutricional) o el INFORNUT®.

El diagnóstico nutricional se realiza a través de la historia clínica y dietética, exploración física que incluya antropometría, análisis bioquímico y pruebas funcionales. No existe un único parámetro que per sé, que permita el diagnóstico nutricional. La *Valoración Global Subjetiva* (VGS) y el MNA son herramientas útiles para la valoración nutricional, aunque no se cuenta con ellas como el "gold estándar" de forma universal. En algunos de nuestros centros (e.j. el Hospital La Paz) y en muchos otros, nos servimos de lo que llamamos "Valoración del Estado Nutricional", que resulta de la integración de la VGS, antropometría y bioquímica.

Tras un adecuado diagnóstico nutricional, que, idealmente, debería recogerse en la historia según la codificación CIE-9, y una vez hecha la prescripción nutricional, se es necesario un seguimiento para evaluar la adecuación de la misma. Tampoco en el seguimiento nutricional existe un marcador único, basándose de nuevo en la interpretación de un conjunto de datos de historia clínica, antropometría y laboratorio. Según el entorno asistencial en el que nos encontremos (ambulante u hospitalario)

pitalised, the follow-up assessment times and variables measured will differ.

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Palabras clave: *Cribado nutricional. Valoración Global Subjetiva (VSG). Valoración del Estado Nutricional (VEN). Desnutrición.*

ABBREVIATIONS

AC: Arm circumference.
APACHE II: Acute Physiology and Chronic Health Evaluation II.
ASPEN: American Society of Parenteral and Enteral Nutrition.
BAPEN: British Association of Parenteral and Enteral Nutrition.
BEI: Bioelectrical impedance.
CONUT®: *Control Nutricional* (Nutritional Control).
CRP: C-reactive protein.
DXA: Dual X-ray absorptiometry.
ESPEN: European Society of Parenteral and Enteral Nutrition.
EWGSOP: European Working Group on Sarcopenia in Older People.
FAACT: Functional Assessment of Anorexia/Cachexia Therapy.
FM: Fat mass.
FFM: Fat free mass.
GNRI: Geriatric Nutritional Risk Index.
ICD: International classification of Diseases.
IL-6: Interleukin 6.
MNA: Mini-Nutritional Assessment.
MQ-SGA: Modified Quantitative Subjective Global Assessment.
MR: Magnetic Resonance.
MST: Malnutrition Screening Tool.
MUST: Malnutrition Universal Screening Tool.
ND: Nutritional diagnosis.
NRI: Nutritional Risk Index.
NRS-2002: Nutritional Risk Screening - 2002.
NSA: Nutritional Status Assessment.
PG-SGA: Patient-Generated Subjective Global Assessment.
RBP: Retinol binding protein.
SGA: Subjective Global Assessment.
SOFA-score: Sequential Organ Failure Assessment score.
TST: triceps skin fold thickness.

Introduction

Undernourishment in the healthcare setting is a serious problem that affects some 30-50% of all hospitalised patients at the time of admission. It has a negative influence on their progress and is associated with an increased number of hospital-acquired infections, a longer hospital stay, and a higher rate of mortality[1]. The early identification of undernourished patients, and their correct nutritional treatment, are essential if the harmful effects of poor nourishment are to be avoided and care costs kept down[2].

The aim of a nutritional diagnosis (ND) is to determine the general health of the patient from a nutritional viewpoint. This allows the identification of those who are undernourished, or who, because of their medical condition or associated treatment, are at risk of becoming undernourished; appropriate treatment can then be prescribed and follow-up initiated[2,3].

Nutritional screening methods

Nutritional screening allows the identification of subjects at risk of undernutrition, as well as those who need a more exhaustive study and an ND. The guides produced by the European Society of Parenteral and Enteral Nutrition (ESPEN) refer to nutritional risk as a situation in which the outcome is related to nutritional factors, and which is improvable by nutritional intervention[4].

Nutritional screening should be included in the initial assessment of all hospitalised patients, thus allowing the early detection of those at risk[3,5]; it should be performed within 24-48 of admission[6]. Nutritional assessment should also be performed in the ambulatory setting whenever a patient presents with anorexia, weight loss, persistent vomiting or diarrhoea, dysphagia, loss of muscle mass, or loss of subcutaneous fat, etc.[6].

Several validated screening methods can be used, the choice of which will depend on the type of population in question, the availability of personnel trained in nutrition, and the possibility of automisation, etc. The most commonly used include the **Malnutrition Screening Tool** (MST), the **Nutritional Risk Screening** (NRS-2002) method, the **Malnutrition Universal Screening Tool** (MUST), and the first part of the **Mini-Nutritional Assessment** (MNA) method. The guides produced by the ESPEN recommend the NRS-2002 method for use with hospitalised patients, MUST in the community healthcare setting, and the MNA method when dealing with elderly people[7]. In the Spanish region of Andalusia, MUST is regularly used.

In recent years, two automated methods were developed and validated in Spain: the **CONUT®**[8] and **INFORNUT®** methods[9]. The CONUT® method can

Table I
Comparison of nutritional assessment with different tools for screening at hospital admission: NRI, MUST, NRS-2002 and CONUT

Tool (N)	*NRI (237)*	*MUST (995)*	*NRS-2002 (995)*	*CONUT-1 (161)*
Sensitivity	43.1	61,2	62,0	78,26
Specificity	89.3	78,6	93,1	89,13
Positive predictive value	76.2	64,6	85,1	84,38
Negative predictive value	66.3	76,1	79,4	84,54
Kappa index	0.24	0.26	0.48	0.680

Gómez-Candela C. et al. Complete process of implantation of a nutritional risk screening system in the University Hospital La Paz, Madrid. Nutr Hosp. 2013.

be used to identify undernourished/at risk patients whose routine blood analyses include serum albumin, total cholesterol and total lymphocytes values. Using information available in the hospital database, and depending on the values of the aforementioned variables, patients receive a risk of undernutrition alert classification of either "low", "moderate" or "high"[8]. Our hospital (*Hospital La Paz*, Madrid) has over five years experience of fully automated nutritional screening using the CONUT® method, covering nearly all our hospitalised patients[10]. Table I compares the sensitivity and specificity of the Nutritional Risk Index (NRI), MUST, NRS-2002 and CONUT® and Subjective Global Assessment (SGA) methods[10].

The recently developed NUTRIC-score method, which determines the nutritional risk of critically ill patients, also deserves mention. This method takes into account the patient's age, the number of comorbidities present, the number of days hospitalised before being sent to the intensive care unit, the patient's SOFA-score and APACHE II results, and plasma interleukin 6 (IL-6) concentration. The latter value is not always available and is not essential to the calculation of the NUTRIC-score, although it does modify the cut-off point for nutritional risk[11].

Methods for assessing nutritional status

An ND requires the following be taken into consideration.

Medical history

Examination of the patient's medical history allows risk factors for undernutrition to be detected. These include chronic disease such as HIV/AIDS, cirrhosis and chronic respiratory failure, and problems such as gastrointestinal disease, cancer, the use of anorexigenic medication, difficulty with chewing, dysphagia, allergies, food intolerances, alcoholism, drug abuse, anxiety, depression, and processes that increase energy requirements (sepsis, trauma, cancer, burns, pregnancy) or nutrient loss (diarrhoea, vomiting, fistulas and malabsorption).

Involuntary weight loss, which is considered clinically relevant when more than 5% of body weight is lost within six months, is a strong predictor of undernutrition both in ambulatory and hospitalised patients[12,13]. In patients with cancer it is also a marker of disease progress and of a poorer prognosis[14].

It is important that medical histories include demographic and socioeconomic data that might influence the nutritional status of a patient, e.g., family structure, educational level, marginalisation, beliefs and lifestyle. Information on the patient's physical activity (type, frequency and duration) is also necessary, as is the type work undertaken (sedentary, physically demanding etc.). Together, these data allow the patient's daily energy needs to be calculated.

A good medical history is so important that two of the six criteria proposed for identifying undernourishment cited in the 2012 ASPEN consensus are based on this[15] (Table II).

Table II
Criteria proposed by A.S.P.E.N consensus for identifying undernourishment

The identification of 2 or more of the following 6 characteristics is recommended for diagnosis of malnutrition:
Insufficient energy intake
Weight loss
Loss of muscle mass
Loss of subcutaneous fat
Localized or generalized fluid accumulation that may sometimes mask weight loss
Diminished functional status as measured by hand-grip strength

Characteristics recommended for the identification of adult malnutrition. JPEN 2012.

Physical examination

A physical examination should pay special attention to signs that indicate a nutritional deficit, e.g., muscular atrophy (the deltoid and quadriceps should be inspected for this), a loss of subcutaneous fat (checked by 'pinching' the skin of the upper torso), the state of hydration, the existence of oedema, and the presence of conjunctival xerosis, Bitot's spots, dry and scaly skin, stomatitis, glositis, discoloured hair, and follicular hyperkeratosis, etc.

Dietary history

This requires qualitative and qualitative information be gathered via questioning regarding the patient's normal food intake. It allows an idea to be formed of the patient's energy intake, and the detection of dietary imbalances. Patients commonly overestimate their food intake[16]. Information should be collected on the type of food consumed, meal frequency, anomalies in nutritional behaviour, problems in chewing or swallowing, and level of autonomy in terms of buying, cooking and eating food. When putting together a dietary history, patients should be asked about their eating patterns for (normally) the past month, along with their intake for the last three days, and the frequency with which they take different foods[16]. In the hospital setting it is very useful to reflect the patient's food intake in the previous 24 h as a percentage of the food provided (<25%, about 50%, about 75% or 100%).

Anthropometric measurements

Such measurements allow body size and proportions to be determined easily and non-invasively. The results are easily reproducible by trained personnel. They allow the comparison with standard figures for the population and can detect changes over time in the same individual.

The anthropometric measurements of greatest use in the assessment of nutritional status are:

Height. This is obtained either directly using a height meter and with the patient standing, or indirectly via, for example, the measurement of the leg or the outstretched arms. The British Association of Parenteral and Enteral Nutrition (BAPEN) recommends measuring the ulna for estimating the height of adults[17].

Body weight. This should be measured using a calibrated balance. The presence of factors that might affect the result, e.g., ascites or oedema, should be taken into account. The following weight-associated variables may need to be determined or calculated:

- Current body weight or weight at the time of assessment.
- Normal body weight or healthy body weight.
- Ideal body weight, calculated taking into account age, sex and patient constitution. Reference can be made to standard tables.
- Adjusted weight. This is the intermediate weight between the real and the ideal weight. It can be useful for calculating energy requirements in obese and in very undernourished patients: adjusted weight = [(real weight – ideal weight) x correction factor] + ideal weight. The correction factor is 0.25 for grade or I or II obesity, and 0.5 for grade III; no correction factor is used when the patient is undernourished.
- Percentage weight loss. This is the variation in body weight with respect to the normal body weight and time. A 2% loss per week is considered serious, as is a 5% loss in one month, 7.5% in three months, or 10% in six months. The greater the weight loss, and the shorter the time within which this occurs, the more severe a situation[16].

Body mass index (BMI). This is a ratio between weight and body height squared. For the non-elderly population, a normal BMI lies between 18.5 and 25 kg/m^2. In adults, a BMI of <16 kg/m^2 is associated with increased mortality, while in elderly people a BMI of <25 kg/m^2 is associated with increased mortality[18].

Body composition analysis

The body composition is the sum of the different tissues and systems that form the human organism. There are two models of body composition: the bicompartmental and multicompartmental models. The former is the most commonly used in clinical practice. This divides the body into fat mass (FM) and fat-free mass (FFM). About 50% of the FM is subcutaneous; it can therefore easily be determined by measuring skin fold thickness. Different skin fold thicknesses can be measured, e.g., the triceps (TST), subscapular, bicipital, and abdominal skin fold thicknesses. The TST is perhaps the most useful given its accessibility and its good relationship with the FM. It is measured on the back of the non-dominant arm midway between the acromion and olecranon processes, with the outstretched arm relaxed, using a Lange- or Harpenden-type lipocaliper. The mean of three consecutive measurements (mm) is taken and compared against normal reference values according to the patient's age and sex.

The somatic protein component of the body is normally measured via the muscular circumference of the arm (MCA), which is determined from the TST and the arm circumference (AC) measured in centimetres midway between the acromion and olecranon processes: CMB MCA = AC - (TST x 0.314). Its value is related to the quantity of muscular protein possessed; values below the 5th percentile represent severe undernourishment.

Body composition can also be determined using more complex (though not always available) techniques such

as bioelectrical impedance (BEI), dual X-ray absorptiometry (DXA) or magnetic resonance (MR). Although DXA provides quite accurate estimates of the FM, FFM and bone mass, it exposes patients to X-rays; it cannot, therefore, be repeatedly used. In contrast, BEI is cheap, innocuous, and can be repeated over and again without harm to the patient. It is based on the resistance of body tissues to the passage of an electrical current. The FFM offer little resistance compared to the FM. It can be used with both healthy persons and patients who are stably hydrated, and its use in the assessment of sarcopenia has been evaluated[19]. However, BEI is not recommended when patients are at the extreme of the BMI range or when they show oedema[20].

Biochemical variables

The plasma concentrations of different protein, vitamin and trace element markers are measured.

Plasma proteins reflect the visceral protein condition. They are synthesised in the liver, and from a clinical standpoint are differentiated according to their half life. They behave as inverse acute phase reactants; their concentration can therefore be reduced independent of the nutritional status if the patient has suffered some severe aggression[21,22]. It can therefore also be important to determine the C-reactive protein (CRP) concentration so that the inflammatory status is known and can be taken into account. The most common plasma proteins analysed are:

– *Albumin*. This is the main protein synthesised in the liver. It has a half life of about 21 days. The body has a large functional reserve of this protein. Low albumin is a good predictor of mortality in hospitalised patients[23], but it is not very useful for monitoring nutritional status. In addition, hypoalbuminaemia can affect plasma calcium, zinc and magnesium levels; this should be taken into account when treating possible deficits[24].
– *Transferrin*. This protein transports iron in the plasma and has a half life of 8-10 days. Its plasma concentration is strongly associated with liver function and the presence of anaemia or infections[25]. Its usefulness is therefore reduced.
– *Prealbumin*. This has a half life of two days. It transports thyroid hormone and, like other plasma proteins, its concentration is conditioned by infections, and other disease processes[26]. However, it is the best protein marker of nutritional status[16]. Unlike albumin, prealbumin is not affected by the state of hydration. High concentrations of prealbumin can be encountered in patients suffering from acute alcohol poisoning and those being treated with corticoids[27].
– *Retinol binding protein* (RBP). This has a half life of just 10 h. Like prealbumin, it can therefore rapidly reflect changes in nutritional status. However, its level is frequently affected by kidney function, or in patients showing signs of stress (it is, therefore, not so useful in hospitalised patients).

A low cholesterol level is a classic sign of undernutrition and is taken into account by automatic screening methods such as CONUT®. However, given the extended use of cholesterol-lowering drugs, even by elderly people, its interpretation in arriving at an ND is limited.

Serum vitamin and mineral concentrations can also provide clues on nutritional status. Concentrations should always be determined when deficits are suspected, and should always be tested in patients with moderate to severe undernutrition.

The creatinine-height index

The creatinine height index is used to assess somatic protein levels and requires all urine be collected over a 24 h period. The values obtained can be affected by kidney failure.

Nitrogenated balance

The nitrogenated balance measures the relationship between the nitrogen provided and that catabolised. The first is determined from the quantity of protein taken in, and the second from the amount of urea excreted at 24 h, the loss of nitrogen in the faeces and sweat, and losses through aspiration tubes, drainages and fistulas.

Functional tests

The functional tests most commonly used in nutritional status testing are dynamometry and immune system function studies.

Undernutrition leads to a fall in the number of T lymphocytes, and counting these cells provides a relatively cheap way of examining nutritional status. Immune function can also be measured via delayed hypersensitivity tests[22]. However, since immune function can be altered by drugs (e.g., corticoids, chemotherapeutic agents, etc.), surgery, or advanced age, it is not always a useful marker, especially in the elderly[28].

Dynamometry is widely used and has been validated for the assessment of muscular strength in the hospital setting[29]. It is a good marker of nutritional status and can be used in nutritional intervention studies[30]. Further, it is easy to perform and provides quantitative data that can be used in the diagnosis of sarcopenia; one diagnostic criterion is a manual compressive force of <30 kg in men and <20 kg in women[19]. Muscular strength is affected early by nutritional depravation, but recovers quickly with nu-

tritional restoration – much more so than muscular mass (whether measured anthropometrically or via BEI, DXA or RM). It is therefore very useful for detecting undernourishment early, and in nutritional monitoring[29]. Flood et al. report an increase in manual compressive strength just 15 days after nutritional intervention in undernourished patients[31]. The measurement of manual compressive strength is that most commonly used to determine muscular strength in clinical practice. An inverse relationship exists between the pressure that can be produced and the number of postoperative complications, the length of hospital stay, and hospital readmission rate[30]. The ASPEN consensus includes this method as a means of identifying undernutrition[15] (Table II). In healthy people, age and sex are the most useful predictors of muscular strength, with no significant differences seen between obese and normal weight subjects. This renders the measurement of this variable of interest in obese patients who become undernourished; in such patients, skin fold thickness measurements and the BMI are of little use. In patients with acute or chronic disease, who are immobilised, who need to take certain medications (corticosteroids), who have comorbidities such as fibromyalgia[30], or in elderly, the use of this variable in monitoring nutritional interventions is somewhat controversial[32].

Matos et al. performed a cross-sectional study to determine the usefulness of dynamometry, employing the manual compressive test as a nutritional screening tool. They concluded it might be of use, but that more work was needed to define cut-off points[33].

Subjective global assessment

The SGA method, which was first described by Detsky over 20 years ago, allows an ND to be arrived at via the examination and complementation of a patient's medical history and a physical examination[34].

SGA can be used with all patients and in all clinical settings. It can be performed quickly and is reproducible, and shows little inter-observer variation when performed by trained personnel[35]. It requires:

- The medical history be complemented to include information of changes in body weight, current food intake be compared to normal food intake, any digestive symptoms in the previous two weeks be recorded, and the patient's functional capacity and metabolic requirements be determined.
- A physical examination, including manual exploration of subcutaneous fat and muscle loss, and checking for oedema and ascites.

Each of the above variables is measured on a qualitative three-point scale. Using these results, patients can then be classified as "A" or well nourished, "B" showing moderate undernourishment or at risk of undernutrition, and "C" undernourished. Weight loss, a low food intake, and the loss of muscular or subcutaneous fat have a greater weighting in the final classification (Table III).

Variations of the SGA method exist, such as Patient Generated Subjective global assessment (PG-SGA), which is used in the oncological setting[36], and the Modified Quantitative Subjective Global Assessment (MQ-SGA) method, which is widely used to monitor patients undergoing dialysis[38]. Both quantify the degree of malnutrition using a points system.

Mini mutritional assessment

The MNA method is the method of choice for use with the elderly. It has been validated for use with both institutionalised[39] and hospitalised[40] elderly persons, and is especially useful for detecting risks before weight loss or hypoptreinaemia occurs. It is a simple, relatively quick test, that reflects food intake and anthropometric measurements well. The score is also correlated with the length of hospital stay and the risk of mortality[4,41,4]. Its sensitivity is 96% and its specificity 98%[41]. It can also be used for nutritional monitoring[4,43].

The method has a screening and a scoring component[4] with a total of 18 sections that cover 30 awarded points. The screening component covers six of these 18 sections, and when these return a total under 12 points the patient can be said to be at nutritional risk. When this is the case, the next 12 sections need to be taken into account. The final score of those who originally scored under 12 points in screening, suggests the type of nutritional intervention that should be followed[44].

- Over 23.5 points: patient well nourished. The MNA should be repeated in the future and nutritional education given regarding healthy eating.
- From 17 to 23.5 points: patient at risk of undernutrition. The causes of this risk should be determined and education given to enrich the diet, with supplements prescribed in some cases.
- Under 17 points: clear undernutrition. Nutritional intervention is needed, the type depending on the cause of the patient's condition.

The MNA is of limited use in elderly persons with dementia, who are in a confused state, or who suffer aphasia or apraxia. In such patients, and when no body weight is available, the Geriatric Nutritional Risk Index (GNRI) can be used instead, or in a complementary fashion. The latter is an adaptation of the NRI, which instead of the true weight of the patient uses the ideal weight (according to the Lorenz formula). GNRI gives greater weight to the plasma albumin concentration than does the NRI, rendering the former useful

Table III
Subjective Global Assessment with laboratory parameters

	A	*B*	*C*
Changes in body weight	<5%	5-10%	>10%
Feeding*	Normal	Mild to moderate impairment	Severe impairment
Eating problems	No	Mild to moderate	Severe
Activity*	Normal	Mild to moderate impairment	Severe impairment
Age	<65	>65	>65
Ulcers	No	No	Yes
Fever/corticosteroids	No	Mild to moderate	High
Cancer treatment	Low risk	Moderate risk	High risk
Loss of subcutaneous fat	No	Mild to moderate	Severe
Loss of muscle mass	No	Mild to moderate	Severe
Edema/ascites	No	Mild to moderate	Severe
Albumin (g/dl) (Pretreatment)*	>3,5	3,5-3	<3
Prealbumin (mg/dl) (After treatment)	>18	15-18	<15

The final result is expressed by the letters A, B or C according to the predominant answer in each item. The answers that have the greatest impact are marked with*.

as a predictor of mortality. Indeed, GNRI is a good predictor of the risk of undernutrition, but does not provide a diagnosis of this[45,46].

Nutritional status assessment method

Although the SGA and MNA methods are useful in determining the nutritional status, there is no universally accepted gold standard for use in arriving at an ND. In our hospital, and in many others, the SGA is used alongside anthropometric measurements and the results of biochemical analyses. This we term the Nutritional Status Assessment (NSA) method. It is generally carried out by personnel trained in nutrition (Table IV).

Diagnosis and codification of undernutrition

The International Classification of Diseases system allows health professionals to identify diagnoses and medical procedures via a code. International classification of disease code 9 (ICD-9) is the system used in Spain. As recorded in the SENPE-SEDOM consensus document, when a diagnosis of undernutrition is reached

Table IV
Nutritional Status Assessment (NSA)

Anthropometry	• Current weight, normal weight, ideal weight and adjusted weight • Weight loss in the last 6 months (% weight loss) • Height • BMI • Triceps skin fold and upper arm muscle circumference
Physical examination	• Loss of subcutaneous fat • Loss of muscle mass • Presence of edema or ascites
Oral intake	• Changes in oral intake: increase, decrease or no change • Duration in time of changes in the oral intake • Type of Intake: fasting, low calorie liquid diet, full liquid diet, insufficient solid diet
Gastrointestinal symptoms	• Absence of symptoms • Nausea, vomiting, diarrhea, anorexia, dysphagia, other symptoms...
Stress	• No stress • Stress: mild - moderate - severe
Biochemestry	• Lymphocytes, albumin, other…
Dynamometry	• Normal values vary with age and sex (Male > 30kg, Women> 20kg)

in the hospital setting it is essential that the medical professional responsible for discharging the patient include an ND at that time, accompanied by its ICD-9 code.

The ICD-9 classification codes for undernutrition in the hospital setting are[47]:

- Energy undernutrition:
  - Mild (ICD-9: 263,1).
  - Moderate (ICD-9: 263,0).
  - Serious/severe (ICD-9: 261).
  - Not specified (ICD-9: 263,9).
- Protein undernutrition: any grade (ICD-9: 260).
- Mixed or energy-protein undernutrition:
  - Mild (ICD-9: 263,8).
  - Moderate (ICD-9: 263,8).
  - Serious/severe (ICD-9: 262).
  - Not specified (ICD-9: 263,9).
- Non-specified undernutrition:
  - Mild (ICD-9: 263,1).
  - Moderate (ICD-9: 263,0).
  - Serious/severe (ICD-9: 261).
  - Not specified (ICD-9: 263,9).
- Excess weight:
  - Overweight (ICD-9: 278.02).
  - Non-specified obesity (ICD-9: 278.00).
  - Morbid obesity (ICD-9: 278.01).

In addition, in patients who have received nutritional support, the therapy followed should receive an ICD-9 code:

- Parenteral nutrition (ICD-9: 99.15).
- Enteral nutrition at >1000 kcal/day (ICD-9: 96,6).

A more recent version of the coding system is known as ICD-10. However, its Spanish adaptation, known as ICD-10-ES, does not come into force until 2016. Until this time, ICD-9 is the accepted coding system[48].

Although sarcopenia and cachexia still have no diagnostic codes, they have an important nutritional impact. **Sarcopenia** is the progressive loss of skeletal muscle and strength, and is associated with a risk of incapacity and greater mortality[19]. Primary sarcopenia is a geriatric syndrome. Secondary sarcopenia is caused by neoplasms, immobilisation and living where there is no gravity; it can occur at any age. Its diagnosis requires a loss of muscular mass, muscular strength and/or reduced physical performance. These variables can be measured in different ways according to the possibilities of each centre (Table V). The algorithm developed by the European Working Group on Sarcopenia in Older People (EWGSOP) for the detection of the problem proposes walking speed be measured as a clinical screening method, with a risk cut-off of 0.8 m/s[19].

Cachexia is a multifactorial metabolic syndrome characterised by weight loss – mainly skeletal mass loss (with or without loss of FM) – plus increased protein catabolism, as a result of underlying disease. Indeed, the inflammation derived from that disease plays a vital part in the physiopathology of cachexia. Undernutrition can be involved, but not every undernourished patient is cachexic[49], although all patients with cachexia are undernourished.

There are several degrees of cachexia[50]:

- **Precachexia**. This requires the existence of all of the following:
  - Chronic disease.
  - Chronic or recurrent inflammatory response (raised CRP).
  - Anorexia (quantifiable via the Functional Assessment of Anorexia/Cachexia Therapy (FAACT) questionnaire).
  - An involuntary weight loss of <5% within six months.
- **Cachexia**. This requires the existence of at least one of the following:

Table V
Definition and diagnosis of Sarcopenia

Diagnosis of sarcopenia *Criterion 1 + criterion 2 or criterion 3*	*Measurement techniques available*	
	Research	*Clinical Practice*
1. Muscle mass (Essential criteria)	Computed tomography Magnetic resonance imaging BIA DXA	BIA DXA Anthropometry
2. Muscle strength	Handgrip strength Knee flexion/extension Peak expiratory flow	Handgrip strength
3. Physical performance	Short Physical Performance Battery Usual gait speed Timed get-up-and-go test Stair climb power test	Short Physical Performance Battery Usual gait speed Get-up-and-go test

Cruz- Jentof A.J, et al. Sarcopenia: European consensus on definition and diagnosis. Br Geriatr Soc.

- An involuntary weight loss of >5% within six months.
- A BMI of <20kg/m^2 and an involuntary weight loss of >2%.
- Sarcopenia and an involuntary weight loss of >2%.

– **Refractory cachexia**. This requires the existence of all of the following:
- A catabolic status.
- A lack of response to oncological treatment.
- Poor functional status (<50%).
- A life expectancy of <3 Tmonths.

A patient may have both sarcopenia and cachexia; in fact, most patients with cachexia are sarcopenic. Sometimes these conditions can be difficult to distinguish; indeed, they can be quite similar. The main feature of cachexia is sudden weight loss, in which the inflammatory and catabolic status play important roles; such patients show a weak response to nutritional support. In sarcopenia, in contrast, the loss of muscular mass and muscle function is more gradual and responds better to treatment (resistance exercise and nutritional supplementation).

Monitoring the nutritional status

Following an ND and the prescription of a nutritional treatment to follow, the patient should be followed up (Fig. 1). Ideally an easily and inexpensively measurable marker should be monitored. This should be measurable in most centres and not affected by the inflammatory status. Unfortunately, no such marker exists. Therefore, just like when arriving at the diagnosis, nutritional monitoring requires the use of the patient's medical history, anthropometric values and laboratory results. The variables followed will depend on whether the patient is being monitored in the hospital or ambulatory setting.

Once of the most important and simple tools for nutritional monitoring is following dietetic history via the 24 h recall method, but it is hardly enough on its own. The PG-SGA is useful over the long term, but not much use for short term monitoring.

Plasma prealbumin is the biochemical marker of choice for early monitoring of nutritional responses, despite its being influenced by patient inflammatory status. Theoretically, plasma prealbumin should increase by 2g/dL if nutritional support is adequate [27,51]. Indeed, if they rise at all with an intervention, one can be sure that at least 65% of protein requirements have been met. If, however, an increase of 4g/dL is not made within eight days, the treatment needs to be intensified[27].

Changes in body weight are a good means of monitoring patients in the ambulatory setting over the long – but not the short – term (changes that occur over a short period of time are more due to the amount of water in the body than the amount of lean mass).

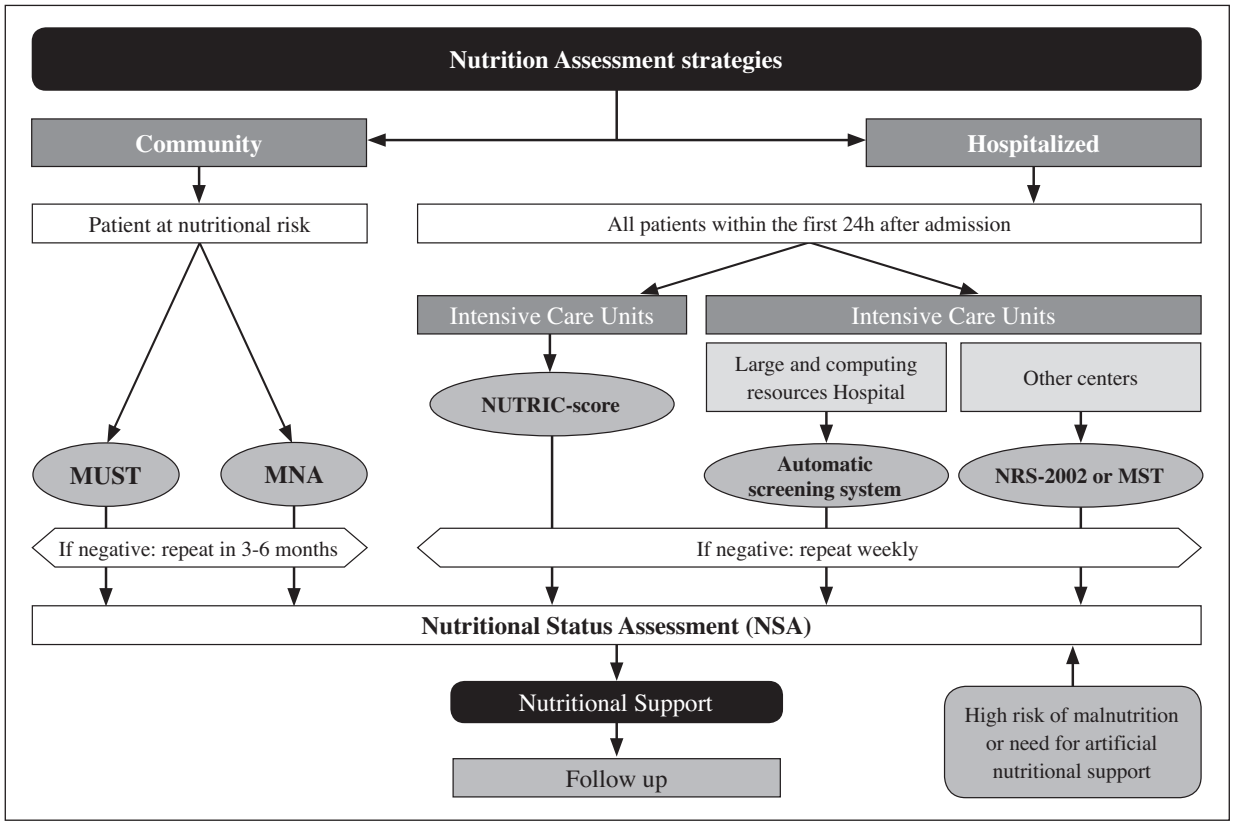

Fig. 1.—Nutritional assessment algorithm.

The MCA and TST are two classic anthropometric variables used in the measurement of nutritional status. However, their use is not without limitations, especially in hospitalised patients since the references against which the results are compared were developed with ambulatory subjects[16]. However, they are useful for monitoring changes if sufficient time is left between one measurement and another.

Recently, dynamometry has been used in the monitoring of nutritional status, but no consensus has yet been reached regarding its value[31,33].

The duration of monitoring of the response to a nutritional intervention will depend on each patient, but it would appear reasonable that weekly records be taken in the hospital setting and monthly or three-monthly records in the ambulatory setting, depending on the severity of the patient's condition and the type of nutritional support prescribed (Table VI).

Conclusion

The early identification of undernourished patients, or at risk of becoming undernourished, allows for diagnoses to be made that should be recorded in the medical history according to the ICD-9 system. There

Table VI
Monitoring of nutrition support at hospital and community

Hospitalized patient	*Screening*	*CONUT* *NRS-2002 NST* *NUTRIC-score*	*Perform to all patients within the first 24 h after admission* *If screening is positive: perform nutritional assessment (NSA)* *If screening is negative: repeat at least weekly*	
	NSA	*Initial*	*Follow-up after nutritional support*	
	Indication	If positive screening, high risk of malnutrition or artificial nutritional support	4-8 days	>15-20 days
	Symptoms (diarrhea, nausea, vomiting)	✔	✔	✔
	Diet history (intake rate)	✔	✔	✔
	Weight loss	✔	✗	✔
	Triceps skin fold + Upper arm muscle circumference	✔	✗	✔
	Dynamometry	✔	¿?	✔
	Albumin	✔	✗	✔
	Prealbumin	✗	✔	✔
	C-reactive protein	✔	✗	✗/✔
Community patient	*Screening*	*MUST* *MNA-screening*	*Perform to those patients with malnutrition risk factors* *If screening is positive: perform nutritional assessment (NSA)* *If screening is negative: repeat at least every 3-6 months*	
	NSA	*Initial*	*Follow-up after nutritional support*	
	Indication	If positive screening, high risk of malnutrition or artificial nutritional support	<1 month	>3 months
	Symptoms (diarrhea, nausea, vomiting)	✔	✔	✔
	Diet history (intake rate)	✔	✔	✔
	Weight loss	✔	✔	✔
	Triceps skin fold + Upper arm muscle circumference	✔	✔	✔
	Dynamometry	✔	✔	✔
	Albumin	✔	✗	✔
	Prealbumin	✗	✔	✔
	C-reactive protein	✗/✔	✗/✔	✗/✔

is no gold standard for assessing patients, but the NSA method may be recommendable since it integrates the SGA method, anthropometric measurements, and biochemical analyses. When a nutritional intervention is prescribed, the patient should be followed up, with monitoring performed according to the clinical setting, the means available, and the medical condition of the patient.

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