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DIAGNOSIS OF MALNUTRITION AND THE APPLICATION OF GLIM CRITERIA: A LITERATURE REVIEW

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ABSTRACT

Malnutrition is a significant public health problem that affects individuals of all ages, particularly the elderly and those with chronic illnesses. According to the definition of the European Society for Clinical Nutrition and Metabolism (ESPEN), malnutrition is a state resulting from inadequate intake or absorption of nutrients, leading to changes in body composition and impaired function. This article provides a comprehensive overview of methods for assessing malnutrition, highlighting the urgent need for early diagnosis and intervention. It includes screening methods, nutritional assessment, and the tools that facilitate these processes, with a particular focus on the GLIM (Global Leadership Initiative on Malnutrition) criteria. The article presents the advantages of these criteria in terms of standardizing malnutrition diagnosis and facilitating global comparisons of intervention outcomes, which can result in the establishment of international standards of care and improved treatment for patients.

Keywords: malnutrition, GLIM criteria, nutritional screening, nutritional assessment

INTRODUCTION

Malnutrition can be defined in various ways, but in the medical practice, the clinical aspect of malnutrition is the most important one. According to the ESPEN guidelines, the definition of malnutrition encompasses both the physical changes in body composition and the consequences of these changes in terms of the functional and clinical outcomes.[20] At first glance, malnutrition may be mistakenly associated with improper nutrition and deficits, both caloric and in the specific nutrients in the human diet. However, in the clinical practice, much more significance is placed on the increased consumption of nutrients during the catabolic phases, such as in the course of an inflammation or post-traumatic conditions. Nonetheless, the nutritional therapy has a tangible impact on many processes occurring in the human body, and thus on the course of the treatment. Moreover, addressing malnutrition has economic implications, such as reducing treatment costs, shortening hospital stays, and lessening the patients' social isolation.[18]

The process of diagnosing malnutrition begins with a screening test, which allows to identify patients at risk and thus initiate further detailed diagnostics. The vast number of screening tests and methods for assessing the nutritional status worldwide has led to many difficulties in comparing malnutrition prevalence, compiling

recommendations, and monitoring the outcomes. To standardize malnutrition assessment criteria, the GLIM initiative was formed, which included ESPEN, ASPEN, PENSA, and FELANPE. As a result of their work, new diagnostic criteria for malnutrition were published in 2019.[9,21]

METHODS

This paper was written after a thorough analysis of the available articles and specialist literature on malnutrition and the criteria used in its assessment. In addition to drawing attention to the problem of malnutrition among patients, the aim of the paper is to promote its evaluation, with particular emphasis on the GLIM criteria.

RESULT AND DISCUSSION

Malnutrition is a public health issue in both the developing and developed countries. It can be related to the economic factors as well as the social ones, particularly among the elderly, who are often isolated from the society. Malnutrition is especially common among people who are ill. It can be a cause of a poor health and a consequence of an ongoing disease. While there is no universally agreed-upon definition, according to the ESPEN, malnutrition can be defined as "a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat-free mass) and body cell mass, leading to diminished physical and mental function and impaired clinical outcomes from disease"[19,20]. In many cases, malnutrition in adults is a result of the disease. It may be caused by:

- reduced dietary intake,
- reduced absorption of macro- and/or micronutrients,
- increased losses or altered requirements,
- increased energy expenditure (in specific disease processes).[17]

Malnutrition affects many biological systems in the human body. It impairs mental function, contributing to anxiety and depressive states. It weakens muscle cells, including cardiomyocytes, leading to a decreased stroke volume, bradycardia, and low blood pressure. It can even result in a heart failure. The functioning of respiratory muscles also deteriorates, which can cause a hypoxia and morphological changes in the lung parenchyma. Paradoxically, malnourished individuals often experience malabsorption and frequent diarrhea, which exacerbate the malnourished state. Processes responsible for maintaining homeostasis in the body, such as wound healing and thermoregulation, are also disrupted. The body's immune defense mechanisms are weakened due to impaired cellular immunity. As a result, malnutrition is not only a risk factor in many diseases but also contributes to an increased mortality among malnourished patients, both children and adults. This is why the early diagnosis of malnutrition in patients and the implementation of treatment are so important.[18,19]

Unfortunately, despite the ongoing advancements in medicine, undiagnosed and untreated malnutrition is still observed among many hospitalized patients. This may result from a lack of awareness among staff, as well as the absence of appropriate protocols for screening, nutritional assessment, and intervention.[19]

NUTRITIONAL SCREENING TOOLS

The purpose of malnutrition screening, as defined by the American Society of Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN), is to identify individuals who are malnourished or at risk of malnutrition and to carry out a further in-depth diagnosis if necessary. Screening should be simple, quick, affordable, and accessible to the medical staff. It should also be highly sensitive to detect as many patients with nutritional disorders as possible. An important aspect of screening is the ability to present results in numerical form, which allows outcome tracking and determines the appropriate management for patients with specific results. Most screening tools consider the four key factors: unintentional weight loss, inadequate nutrition, the individual’s functional capacity, and the presence of disease-associated metabolic stress. ESPEN recommends using the Nutrition Risk Screening-2002 (NRS-2002) and the Malnutrition Universal Screening Tool (MUST). For older adults, ESPEN suggests using the Mini Nutritional Assessment (MNA) in its full or short form (MNA-SF). These tools rely on various combinations of indicators, such as BMI, weight loss, food intake, disease severity, and age. Other frequently used, validated tools include the Malnutrition Screening Tool (MST) and the Short Nutritional Assessment Questionnaire (SNAQ).[10,14,18]

MINI NUTRITIONAL ASSESSMENT SHORT FORM (MNA-SF)

This screening test is primarily used in the older adults. "The MNA-SF can identify individuals with undernutrition and can be used in a two-step screening process, where those identified as 'at risk' by the MNA-SF undergo additional assessment to confirm the diagnosis and plan the interventions." The test

should be conducted annually for the elderly or every three months for the hospitalized patients. It is very simple, quick, and requires no specialized knowledge. It consists of questions regarding food intake issues, weight loss, mobility, presence of an acute disease, neuropsychological stress, and BMI. A score below 12 indicates a risk of malnutrition, while a score below 8 indicates malnutrition. In both cases, protocol dictates that further, more thorough malnutrition assessment must be conducted.[16]

MALNUTRITION UNIVERSAL SCREENING TEST (MUST)

This is a screening test widely used among the adults. It allows for the identification of individuals who are malnourished, at risk of malnutrition, or obese. It classifies patients into malnutrition risk levels based on BMI, weight loss, and likelihood of future weight loss due to an acute illness, especially if the food intake has been absent for more than five days. The test provides a maximum score of 5 points, categorized as follows: 0 - low risk, 1 - medium risk and observation, 2 or more - high risk and initiation of treatment. Studies indicate that MUST appears to be the most valid tool for assessing malnutrition risk in the elderly patients upon hospital admission.[6]

SHORT NUTRITIONAL ASSESSMENT QUESTIONNAIRE (SNAQ)

The SNAQ (Short Nutritional Assessment Questionnaire) is a simple and quick screening test used for assessing the risk of malnutrition in patients, particularly in hospital and clinical settings. It consists of three key questions regarding: weight loss in the past six months, appetite over the past month, and the need for supplemental nutrition. Based on the patient's responses, points are assigned that classify them as low, moderate, or at high risk for malnutrition. For the patients at higher risk, further assessment and nutritional interventions are recommended. [12]

NUTRITIONAL RISK SCREENING 2002 (NRS 2002)

Table 1. Initial screening

1	Is BMI <20.5?	Yes	No
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed. No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 2. Final screening

Impaired nutritional status		Severity of disease	
Absent Score 0	Normal nutritional status	Absent Score 0	Normal nutritional requirements
Mild Score 1	Wt loss >5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild Score 1	Hip fracture, Chronic patients, in particular with acute complications: cirrhosis, COPD. *Chronic hemodialysis, diabetes, oncology*
Moderate Score 2	Wt loss >5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in	Moderate Score 2	Major abdominal surgery, Stroke. *Severe pneumonia, hematologic malignancy*

	preceding week		
Severe Score 3	Wt loss >5% in 1 mth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe Score 3	Head injury, Bone marrow transplantation. *Intensive care patients (APACHE>10).*
Score:	+	Score:	=Total score
Age	if ≥70 years: add 1 to total score above	=age-adjusted total score	
Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated Score <3: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

MALNUTRITION SCREENING TOOL (MST)

This is a simple, two-question screening test designed to assess the risk of malnutrition, especially in the older adults. The MST assesses malnutrition risk based on two questions: 1. Has the patient lost weight in the past six months without trying to diet? 2. Has the patient eaten less due to a reduced appetite? Points are assigned to each question, totaling a maximum of five. A score of 0-1 indicates a low risk of malnutrition, 2 – moderate risk, and 3-5 – high risk.[18]

NUTRITION RISK IN THE CRITICALLY ILL (NUTRIC SCORE)

It is the first nutritional risk assessment tool specifically designed for the ICU patients. It identifies those most at risk of adverse outcomes from malnutrition, considering variables such as age, disease severity (APACHE II, SOFA), comorbidities, and length of the hospital stay. A modified version excludes IL-6, simplifying its use. The score emphasizes the role of inflammation and illness severity in malnutrition risk, correlating with outcomes like mortality and longer hospital stays. In a recent study with the critical COVID-19 patients, this score successfully identified patients at high-nutritional risk.[8,11,15]

NUTRITIONAL ASSESSMENT

According to ESPEN, the assessment of nutritional status is fundamental in diagnostic decisions and subsequent nutritional treatment. This assessment should be conducted for all patients in the at-risk groups identified through screening tests. Tools like the Subjective Global Assessment (SGA), Patient-Generated Subjective Global Assessment (PG-SGA), and Mini Nutritional Assessment (MNA) are very useful, as they facilitate the procedure. The assessment of nutritional status includes information on body weight, height, body mass index (kg/m²), body composition, and biochemical indicators.[20]

This assessment of malnutrition is much more precise. In addition to assessing the severity of malnutrition, it allows for the evaluation of changes in the degree of malnutrition and thus the response to treatment. According to ESPEN, the goals of assessing malnutrition are:

1. Gathering medical history, physical examinations, and biochemical analyses to identify diseases or conditions that may lead to malnutrition.
2. Conducting a social and psychological interview to assess the impact of living conditions, loneliness, and depression.
3. Evaluating dietary history, including restrictions in food intake.
4. Determining energy and fluid requirements through indirect calorimetry or calculations.
5. Assessing protein needs (0.8-1.5 g/kg/day) based on age and disease.
6. Establishing micronutrient needs according to guidelines and clinical status.[4,20]

Additionally, at the stage of detailed malnutrition assessment, other methods such as anthropometry, body composition analysis, functional assessments, and laboratory indicators are also used. Anthropometry is an inexpensive and non-invasive method that allows for the examination of anatomical changes associated with

malnutrition. The core elements of anthropometry include height, weight, head circumference, body mass index (BMI), body circumferences to assess adiposity (waist, hip, and limbs), and skinfold thickness. A more precise examination than anthropometry is body composition analysis, which assesses various components in the body, such as fat mass, lean mass, muscle mass, and bone mineral mass. This is achieved using various imaging techniques, such as CT or MRI, or bioelectrical impedance spectroscopy, which is based on the differences in conductivity properties of various tissues.[2,7,19]

When it comes to functional assessment, it is commonly used in monitoring the treatment. The first nutritional assessment tool that included functional evaluation was the SGA, which will be discussed further. The last method is performing the laboratory tests, including the use of albumin. The advantage of these tests is their objectivity and the ability to detect malnutrition earlier.[19]

METHODS OF NUTRITION SCREENING AND ASSESSMENT.

SGA

The Mini Nutritional Assessment (MNA) is a quick tool for assessing the nutritional status in elderly patients in clinics, hospitals, and nursing homes. It includes simple measurements and questions, taking about 10 minutes to complete. It is a two-step procedure that includes an initial screening (MNA-SF) and, if needed, a full assessment. The MNA is an 18-item questionnaire comprising anthropometric measurements (BMI, mid-arm and calf circumference, and weight loss) combined with a questionnaire regarding dietary intake (number of meals consumed, food and fluid intake, and feeding autonomy), a global assessment (lifestyle, medication, mobility, presence of acute stress, and presence of dementia or depression), and a self-assessment (self-perception of health and nutrition). The MNA-SF comprises 6 items from the 18. The MNA score categorizes patients as having adequate nutrition (≥24), at risk of malnutrition (17–23.5), or with protein-calorie malnutrition (<17). The tool shows high sensitivity (96%) and specificity (98%), accurately identifying those needing intervention. The MNA scores can also predict mortality, healthcare costs, and allow early identification of malnutrition risk before significant weight loss or low albumin levels appear. [1,23]

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GLIM

The multitude of both screening tests and methods for assessing nutritional status worldwide has resulted in challenges in comparing malnutrition prevalence, aligning recommendations, and monitoring outcomes. To standardize malnutrition assessment criteria, the GLIM initiative was formed, comprising ESPEN, ASPEN, PENSA, and FELANPE. As a result of their efforts, new diagnostic criteria for malnutrition were published in 2019.

Malnutrition diagnosis according to the GLIM criteria consists of two stages. The first stage is screening, allowing for the assessment of nutritional status in at-risk patient groups. For patient evaluation, any validated screening tool may be used, as GLIM guidelines do not prioritize one screening method over the others. Commonly used screenings include NRS 2002 (Nutritional Risk Score), SGA (Subjective Global Assessment), MUST (Malnutrition Universal Screening Tool), and the shortened MNA (Mini Nutritional Assessment). NRS 2002 and SGA are recommended for adult patients. Patients with positive screening results require further diagnosis.

The second stage involves assessing malnutrition severity, enabling the appropriate nutritional intervention. The criteria used to assess malnutrition are divided into two groups: phenotypic and etiologic criteria.

The phenotypic criteria include unintended weight loss, low BMI, and low muscle mass. The etiologic criteria involve reduced food intake or nutrient absorption and disease or inflammation burden. The presence of at least one phenotypic and one etiologic criterion qualifies as a diagnosis of malnutrition. The phenotypic criteria allow for assessing the severity of the patient's malnutrition, while etiologic criteria determine the

nutritional intervention standards. Based on the phenotypic criteria, two levels of malnutrition are distinguished: moderate and severe.

Table 1. Severity grading of malnutrition based on phenotypic criteria.

Severity Levels of Malnutrition Based on Phenotypic Criteria	Weight Loss(%)	Low body mass index (kg/m^2)	Reduced muscle mass
Stage 1/Moderate malnutrition	5-10% within the past 6 mo or 10-20% beyond 6 mo	<20 if < 70 yr <22 if ≥ 70 yr	Mild to moderate deficit
Stage 2/Severe Malnutrition	>10% within the past 6 mo or >20% beyond 6 mo	< 18.5 if < 70 yr <20 if ≥ 70 yr	Severe deficit

Beyond the above malnutrition criteria, malnutrition can also be classified based on its etiology, which includes:

1. Malnutrition associated with a chronic disease accompanied by inflammation,
2. Malnutrition associated with a chronic disease with minimal or no inflammation,
3. Malnutrition associated with an acute disease or an injury accompanied by severe inflammation,
4. Malnutrition associated with starvation. [9,13,21,22]

CONCLUSION

Malnutrition is a common problem among patients, one that can be solved with the implementation of an appropriate treatment. However, this is not possible without a proper assessment. There are numerous methods for assessing malnutrition. It led to the creation of the GLIM consensus to standardize malnutrition assessment worldwide. GLIM consensus uses widely recognized and commonly used assessment tools, increasing the likelihood of its acceptance. Additionally, these criteria do not require extensive knowledge or specialized laboratory tests, making them suitable for routine clinical practice. Standardizing malnutrition assessment would allow to compare the malnutrition prevalence, interventions, and outcomes globally. Such observations would enable the establishment of international standards of care and improve patient health outcomes.

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