

Module 3.4

Nutritional Evaluation of the Hospitalized Children

Olivier Goulet

Learning objectives

- To be aware of how malnutrition presents and how to screen, assess, and monitor patients for nutritional risk and for response to nutritional support;
- To be aware of the importance of the routine screening all patients for malnutrition and of the continued monitoring of those at risk;
- To appreciate the value of such diagnostic methods combined with measures of growth and development to indicate the presence of underlying disease as well as guiding nutritional management;
- To appreciate the value and place of investigative methods such as DEXA, Biochemistry etc.;
- To be aware of the value of an expert Nutrition Team in all major Paediatric centres.

Contents

1. Introduction
2. Goals of nutritional assessment
 - 2.1. Confirmation of normal growth
 - 2.2. Detection of chronic disease
 - 2.3. Follow up of nutritional intervention or acute situations
 - 2.4. Analysis of acute situations
3. Evaluation of nutritional status
4. Nutritional Risk Score
5. Summary

Key messages

- The practical assessment of nutritional status must be based on a clinical approach associated with simple and reproducible methods for the assessment of growth and body composition;
- Analysis of growth (weight gain and growth velocity) using growth curves remains the simplest tool for assessing changes in nutritional status in children;
- Biological assessment is designed for specific situations and is not part of systematic follow up;
- Supplements of minerals, trace elements, and vitamins may be necessary in situations where deficits are likely, on clinical grounds, but are not given routinely in most cases;
- Among the new technologies, DEXA is one of the most useful for measuring bone density and body composition;
- Nutritional screening and assessment methods should not only be able to detect current malnutrition but be able to give some prediction of future changes in nutritional risk, using a nutritional risk score;
- Nutritional assessment allows nutritional support to be introduced in a timely fashion, thereby reducing morbidity and mortality, and limiting the long-term impact of malnutrition on growth and development.

1. Introduction

The first goal of nutritional assessment of neonates, infants and children, both in the hospital setting and in the field, is to confirm normal growth and development. Several classifications of malnutrition using height and weight are available (Fig. 1 and Fig. 2).

Assessment of nutritional status	
Gomez classification	
Weight for age (%)	Malnutrition
91 - 100	Normal
76 - 90	1° degree
61 - 75	2° degree
< 60	3° degree

Fig 1

Figure 1 Degree of malnutrition in children (Gomez classification)

Assessment of nutritional status				
Waterlow classification				
	Malnutrition			
	Normal	Mild	Moderate	Severe
Height for age (S)	95	90-95	85-90	85
Weight for age(W)	90	80-90	70-80	70

Fig 2

Figure 2 Degree of malnutrition in children (Waterlow classification)

In spite of their sophistication, techniques for nutritional assessment cannot identify all the potential causes of impaired nutritional status or forecast all the possible risks of developing malnutrition, although, combined with competent clinical assessment and subsequent monitoring, they are an effective guide to treatment. Many diseases have nutritional consequences. The detection of malnutrition may therefore be an important clue to the presence of underlying disease as well as quantifying malnutrition, assessing future risk and guiding appropriate nutritional treatment.

2. Goals of Nutritional Assessment

Various clinical situations may justify nutritional assessment: a full assessment may also be indicated when simple screening methods have revealed significant nutritional risk.

2.1 Confirmation of Normal Growth

Confirmation of normal growth is the cornerstone of all physical examinations in paediatric practice. Failure to thrive may be the presenting symptom in certain diseases. Thus, inadequate weight gain and/or low growth velocity for age should be considered as an early disease symptom in an otherwise apparently healthy child.

In the case of a clinically evident disease process such as protracted diarrhoea, enteric stenosis or fistula, or an inflammatory condition increasing nutritional requirements, nutritional status may determine the most appropriate clinical management. For example, the diagnosis of malnutrition may indicate the postponement of surgery if prior nutritional therapy is likely to improve post-surgical outcome.

2.2 Detection of Chronic Disease

All chronic diseases, regardless of whether or not they have a gastrointestinal component, carry a risk of protein-energy malnutrition (PEM) through such factors as inflammation, metabolic disorders, loss of appetite, trace element deficiency or drug interaction. Nutritional findings in patients at high risk of PEM may indicate changes in clinical management and/or specific nutritional therapy. Nutritional assessment is particularly useful before liver or heart-lung transplantation, for example, and in cancer management.

2.3 Follow up of Nutritional Intervention or Acute Situations

- Regular nutritional monitoring can identify negative induced by treatment (e.g. steroids) as well as positive changes (e.g. after liver transplantation);
- Whenever nutritional treatment is given, monitoring the effectiveness of treatment is vital, whatever the route of administration (oral, enteral or parenteral).

2.4 Analysis of Acute Situations

Nutritional assessment and monitoring is of particular importance in critically ill patients since catabolic stimuli such as sepsis, severe trauma or extensive burns have rapid and dramatic consequences on metabolism and nutritional status, with rapid loss of lean mass.

3. Evaluation of Nutritional Status

Whatever the context or aim, nutritional status is assessed through a simple, mainly clinical approach, based on the past history, dietary intake, auxological (skeletal growth) analysis, anthropometric measurements, as well as body compartment and biological parameters. It should be remembered that evaluation is in two stages; firstly Screening, which is a rapid process carried out on hospital attendance or admission, suitable for use by busy staff; secondly Assessment which is a more detailed and prolonged process carried out by staff expert in clinical nutrition on patients who have been detected as 'at risk' by screening or by the judgement of the responsible clinician. As described below, although this distinction between Screening and Assessment is fairly clear in adults, it may not be quite so straightforward in children. Accurate techniques for measuring body compartments are available in children e.g. dual-energy X-ray absorptiometry to assess fat body mass or bioelectrical impedance analysis for body water and lean body mass (Fig.3 and Fig. 4)

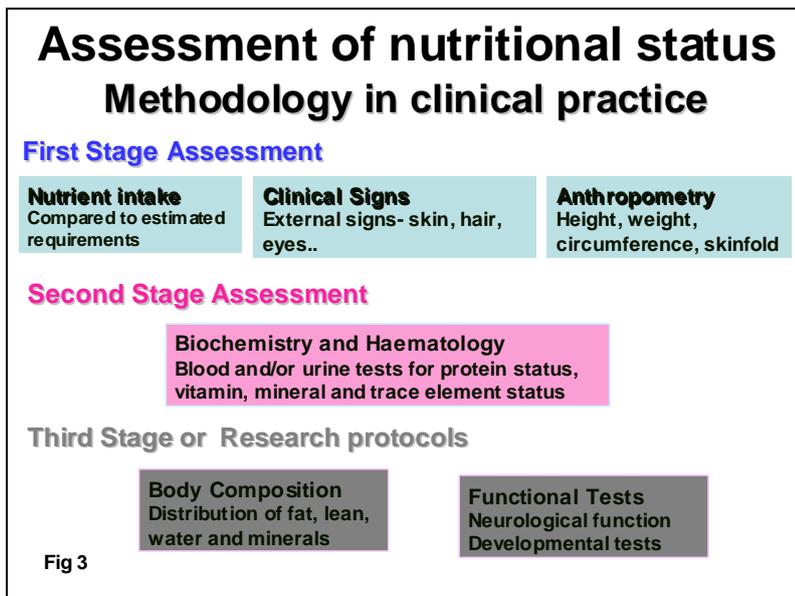


Figure 3 Steps for nutritional assessment in children

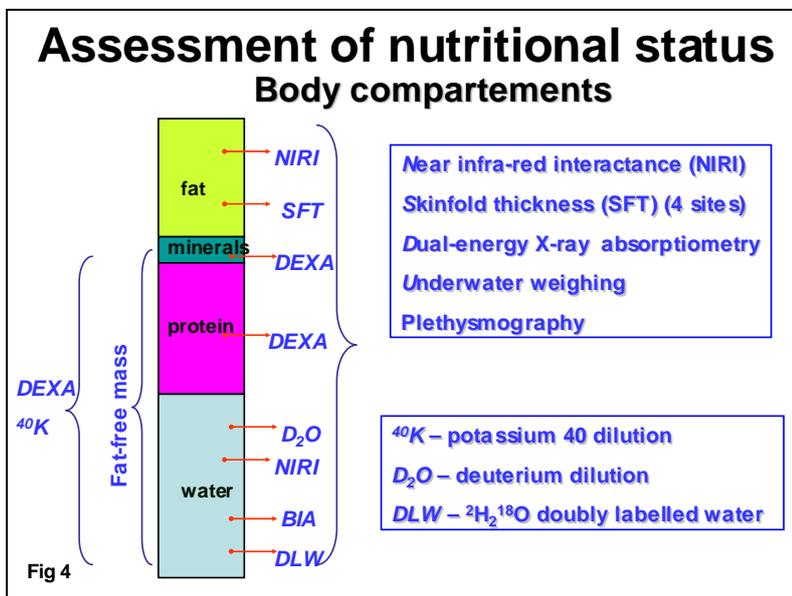


Figure 4 Measurements of body compartments

Measuring energy expenditure allows for a more accurate monitoring of the patient's energy needs and decreases the risks associated with underfeeding or overfeeding (See for review reference 1).

In clinical practice, the analysis should be longitudinal and take situations carrying a risk of malnutrition into account. Preventive use of nutritional assessment allows nutritional support to be introduced in timely fashion, thereby avoiding morbidity/mortality and limiting the long-term impact of malnutrition on growth and development.

4. Nutritional Risk Score

Although hospitalized children are at risk of malnutrition, routine screening of nutritional status has been hindered by lack of a nutritional assessment tool validated for use in children. Indeed, precise assessment of nutritional status is difficult and no single indicator can be used in isolation although serial measurements of a number of parameters backed by clinical experience usually form a reasonable basis for clinical decision making. In addition, measuring the patient's current nutritional status only identifies those who have already become undernourished. To prevent a deterioration in the nutritional status of currently moderately or well-nourished patients, an assessment of future nutritional risk is required. Assessment and screening methods have been developed but are generally too complex and time

consuming, or too specialised for implementation on a hospital-wide basis for use by nursing staff. Reilly et al (2) developed a Nutritional Risk Score (NRS) by incorporating the following commonly used parameters: weight loss (amount and duration); Body Mass Index for adults (weight in kg/height in m²) and percentile charts for children; food intake (appetite and ability to eat and retain food); "stress factors" (effect of medical condition on nutritional requirements). The scoring system was designed to be convenient to use, to reflect the risk of undernutrition, and to be reproducible and applicable to all patients. The score was used to screen for risk of undernutrition in 153 consecutive admissions to medical and surgical specialities. Patients were categorised as at low (50%), moderate (24%) or high risk (26%). Evaluation of measures to prevent nutritional depletion revealed that no action was taken in 64% (23/36) of moderate risk and in 30% (12/40) of high risk patients. The NRS was shown to be easy to use, applicable to all patient categories and ages, and correlated well with a validated Nutrition Risk Index ($r = 0.68$, $p < 0.001$) and clinical impression ($r = 0.83$, $p < 0.001$). Reproducible scores were obtained between dietitians ($r = 0.91$, $p < 0.001$) and between dietitians and nursing staff ($r = 0.80$, $p < 0.001$). The NRS also aimed to provide guidance for relevant action.

A one-day cross-sectional using Reilly score survey was performed recently to assess nutritional status and protein-energy intake in hospitalized children (3). This study included every child older than six months, hospitalized in medicine or surgery for more than 48 hours and free of nutritional support (enteral, parenteral or special regimen). Fifty-eight children among the 183 present the day of the study met the inclusion criteria and were included in the statistical analysis. Median age was 9.4 years (range 6 months-18.5 years) and sex ratio 50%. They were hospitalized in medicine (48%), psychiatry (31% including 6 patients with anorexia nervosa) and surgery (21%). The body mass index (BMI) was below -2 standard deviations (SD) in 21% of these children. By excluding patients with anorexia nervosa, BMI was below 2SD, above +2SD, or in between these limits in respectively 12, 14 and 74%. Energy intake measured at the hospital was below 75% of the recommended dietary allowances in two-thirds of the children whether malnourished or not.

More recently Sermet-Gaudelus et al validated a Paediatric Nutritional Risk Score (PNRS) that can be used on 1 admission to identify children at risk of PEM during hospitalization (Fig. 5) (4).

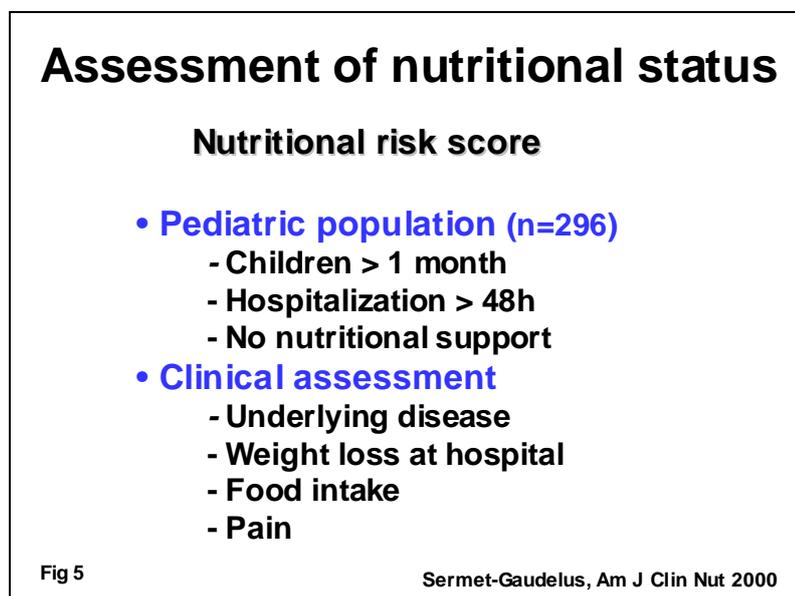


Figure 5 Nutritional risk score (4)

PNRS was assessed prospectively in 296 hospitalized children. Anthropometric measurements, food intake, ability to eat and retain food, medical condition, and symptoms interfering with feeding (pain, dyspnoea, and depression) were evaluated within 48 h of admission. Pathology was classified as mild (grade 1), moderate (grade 2), or severe (grade 3). The risk of weight loss was investigated using stepwise logistical regression. Weight loss during hospitalization occurred in 65% of the children and was >2% of admission weight in 45% of patients. Multivariate analysis indicated that food intake <50%, pain, and grade 2 and 3 pathologic conditions ($P = 0.0001$ for all) were associated with weight losses of >2%. The PNRS ranged from 0 to 5 and was calculated by adding the values for the significant risk factors as follows: 1 for food intake

<50%, 1 for pain, 1 for grade 2 pathologic condition, and 3 for grade 3 pathologic condition. A score of 1 or 2 indicated moderate risk and a score > or = 3 indicated high risk of PEM (Fig. 4)

Assessment of nutritional status		
Nutritional risk score		
Pathology	Pain [1] Food intake <50% [1]	Score
Mild (grade 1) [0]	None	0
Mild (grade 1) [0]	One	1
Mild (grade 1) [0]	Both	2
Moderate (grade 2) [1]	None	1
Moderate (grade 2) [1]	One	2
Moderate (grade 2) [1]	Both	3
Severe (grade 3) [3]	None	3
Severe (grade 3) [3]	One	4
Severe (grade 3) [3]	Both	5

Fig 6 Sermet-Gaudelus, Am J Clin Nut 2000

Figure 6 Nutritional risk score (4)

These studies show that PEM is frequent in hospitalized children. They suggest the need for routine screening of all patients by methods such as the PNRS in order to identify children at risk of malnutrition. A Nutritional team, including physicians (nutritionist), dieticians and nurses, with responsibility for overseeing Screening and Assessment to detect Malnutrition and for supervising or conducting nutritional therapy, should be available in all children's hospital or paediatric units. Implementation of such a policy reduces hospital-acquired malnutrition and allows appropriate nutritional therapy whatever the route of administration oral, enteral or parenteral. The ability of such a team to select appropriate patients, to reduce unnecessary PN, to achieve better outcome, and to drastically reduce complications, makes it a highly cost effective investment.

5. Summary

Screening and Assessment for nutritional risk should be a routine part of the clinical process. The detection of malnutrition is an important indicator of the presence of underlying disease as well as being a guide to nutritional management. As well as the normal adult parameters, assessment of growth and development in children is a vital and sensitive measure of the presence of malnutrition as well as the response to treatment. Continued monitoring of patients at risk or undergoing nutritional treatment is important. Despite some shortcomings, practical and useful tools for nutritional screening and assessment exist and are discussed. Serial data always give a more accurate assessment by indicating the direction and degree of change over time e.g. change in growth velocity. Some useful further investigations e.g. DEXA are described. Micronutrient or mineral deficiency may be suspected from the clinical circumstances and supplements given as appropriate. Routine biochemical screening and supplementation are unnecessary in the majority of patients. All major paediatric centres should have an expert Nutrition Team For the safe and cost effective management of nutritional problems.

References

1. Goulet O. Assessment of nutritional status in clinical practice. *Baillière's Clinical Gastroenterology* 1998; 12: 647-69.
2. Reilly HM, Martineau JK, Moran A, Kennedy H. Nutritional screening - Evaluation and implementation of a simple nutrition risk score. *Clin Nutr* 1995; 14: 269-73.
3. Hankard R, Bloch J, Martin P et al. Nutritional status in hospitalized children *Arch Pediatr* 2001; 8:1203-8.

4. Sermet-Gaudelus I, Poisson-Salomon AS, Colomb V et al. Simple pediatric nutritional risk score to identify children at risk of malnutrition. *Am J Clin Nutr* 2000;72:64-70.