THE PATIENT'S ASSESSMENT

Nutritional status is the result of the balance between the supply of nutrients on the one hand and energy expenditure on the other. It can be classified as normal when there is a balance between actions, or at risk of malnutrition when there is undernutrition or overnutrition. (Fig. 1)

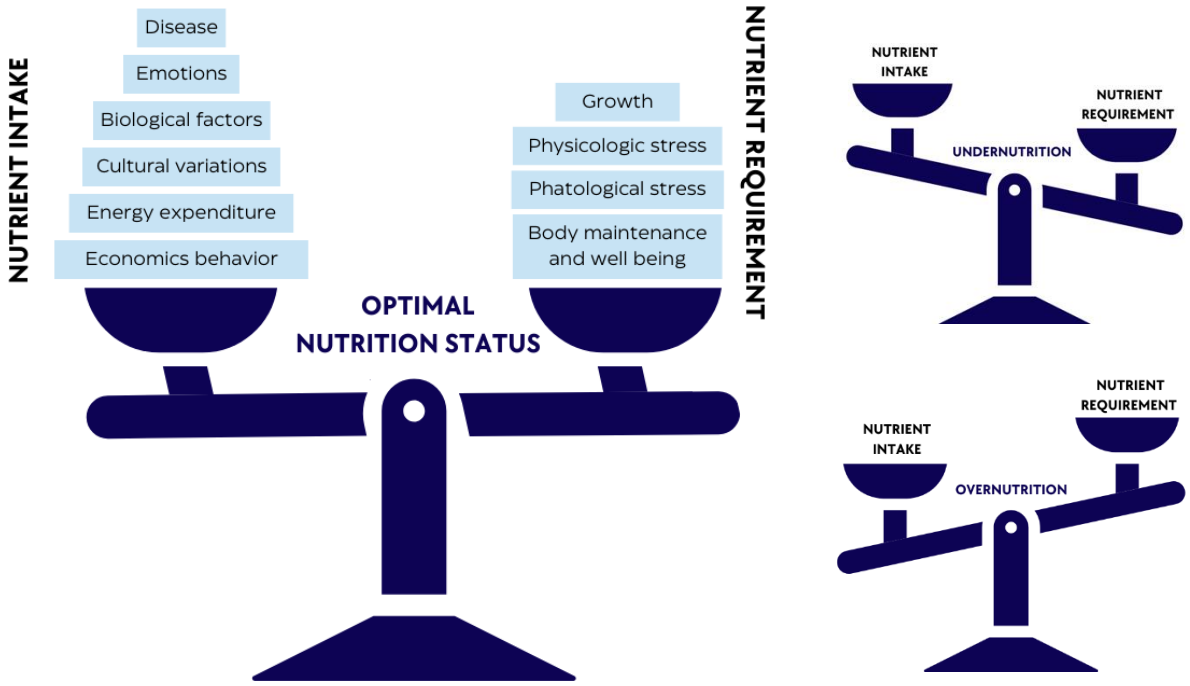

Figure 1. Nutritional Status

The assessment of nutrition status is a detailed procedure that must be performed by trained and experienced professionals. It should be structured and standardized. Generally, follow the ABCD methods:

- **A**nthropometry
- **B**iochemical
- **C**linical
- **D**ietary

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ANTHROPOMETRY ASSESSMENT

Anthropometry is the external measurement of the human body and reflects the health and nutritional status of individuals and groups. These measures are applicable in every phase of life, and the most used are body weight, height, skinfold thickness, circumferences, and body composition. Accurate assessment depends on operator experience and equipment quality.

Body weight

It is a measure of total body mass. Excess or deficit adversely influences morbidity and mortality.

When it is not possible to measure a patient's weight, it can be estimated using alternative methods or formulas.

Body weight measurement alone is not particularly useful for assessing nutritional status unless we use it to calculate Body Mass Index (BMI). However, it is useful to calculate the weight variation using the equation:

$$\%Weight\ change = \frac{(usual\ or\ previous\ weight\ (Kg) - Actual\ weight\ (Kg))}{Usual\ or\ previous\ weight\ (Kg)} * 100$$

This equation is used more often for calculating percentage weight loss than weight gain, as this is an important indicator of the risk of malnutrition. Using percentage weight loss as a guide, nutritional support should be considered when someone has experienced unintentional weight loss of more than 10% over a 3–6-month period or the patient has a BMI of <20kg/m2 and unintentional weight loss of more than 5% over a 3–6-month period.

However, significant, and rapid weight loss in obese individuals also makes them vulnerable to the morbidity associated with malnutrition. Rapid weight loss over a few days reflects changes in fluid balance, not body tissue.

Height

The measurement of the total height of the body represents the distance between the highest point of the skull and the horizontal surface where the subject has the feet supported, measured in the standing position. Height is usually measured using a stadiometer or fixed at the appropriate height to a wall. When it is not possible to measure a patient's height, it can be estimated using alternative methods such as length of the ulna, knee height, or demi-span.

Body Mass Index

BMI is a weight for height indicator that may be used to classify overweight and obesity and is calculated as:

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$$BMI = \frac{Weight\ (Kg)}{Height^2\ (m^2)}$$

A BMI above the recommended increases the risk of developing certain conditions, including type 2 diabetes, heart disease, and osteoarthritis. However, a very low BMI increases the risk of osteoporosis and complications associated with malnutrition.

Table 1. BMI classification according to WHO

Classification	BMI (kg/m2)	Risk of comorbidities
Severe thinness	<16.00	Low (but the risk of other clinical problems increased)
Moderate thinness	16.00-16.99	Low (but the risk of other clinical problems increased)
Mild thinness	17.00-18.49	Low (but the risk of other clinical problems increased)
Underweight	<18.5	Low (but the risk of other clinical problems increased)
Normal range	18.5 – 24.9	Average
Overweight	25.0 – 29.9	Increased risk
Obese Class I	30.0 – 34.9	Moderate
Obese Class II	35.0 – 39.9	Severe
Obese Class III	>40.0	Morbid obesity

Waist circumferences and waist to hip ratio

Waist circumferences are considered a more appropriate measure of obesity-related morbidity and mortality. The waist circumference is measured at the halfway point between the lowest rib and the iliac crest in the midaxillary line. The advantage of this method is that it uses a bony landmark and there is little scope for error provided that the patient can be partially undressed. Waist to hip ratio (WHR) is a useful indicator of obesity-related health risks. Table 2 shows the value of waist circumference and waist-to-hip ratio (WHR) as predictors of health.

Table 2. Classification of waist circumference and waist to hip ratio

	Men	Women
Waist circumference (cm)		
Increased risk	≥94	≥80
Substantially increased risk	≥102	≥88
Waist to hip ratio		
Increased risk	≥0.9	≥0.85

Skinfold thickness

The relationship between subcutaneous fat and total body fat can be exploited by measuring skinfold thickness at specific places to estimate adiposity. There are many equations from the

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relationship between total body fat, as measured by densitometry, and the sum of four skinfold thicknesses, which can be used to estimate total body fat.

Bioelectrical impedance analysis

Bioelectrical impedance analysis is an easy, non-invasive measure used to estimate total body water and body composition. It is based on the principle that fat does not contain water and that the water content of FFM is constant. Body fat can be determined by subtracting the estimate of fat-free mass from total body weight. An electrical current flow predominantly through tissues containing water and ions but not through fat, which is an insulator. Body resistance or impedance was originally used as an index of total body water.

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BIOCHEMICAL ASSESSMENT

Biochemical assessment means checking levels of nutrients in a person's blood, urine, or stool. Lab test results can give trained health professionals information about medical problems that may affect appetite or nutrition. The table below lists some lab tests that can identify nutrition problems, along with an interpretation of the results.

Table 3. Biochemical test and interpretation

Test	Normal results (Adults)	Low number	High number
Glucose	70-99 mg/dL	Hypoglycemia, liver disease, adrenal insufficiency, excess insulin	Hyperglycemia, certain types of diabetes, prediabetes, pancreatitis, hyperthyroidism
Creatinine	7-20 mg/dL	Malnutrition	Liver or kidney disease, heart failure
Calcium	8.5 – 10.9 mg/dL	Calcium, magnesium, or vitamin D deficiency, malnutrition, pancreatitis, neurological disorders	Excess vitamin D intake, kidney disease, cancer, hyperthyroidism
Protein	6.3 – 7.9 g/dL	Liver or kidney disease, malnutrition	Dehydration, liver or kidney disease, multiple myeloma
Albumin	3.9 – 5.0 g/dL	Liver or kidney disease, malnutrition	Dehydration
Hemoglobin (Hb)	Male: 13.8 – 17.2 g/dL Female: 12.1 – 15.1 g/dL	Iron, vitamin B12, or folate deficiency, bone marrow damage	Dehydration, renal problems, pulmonary or congenital heart disease
Hematocrit	Male: 40.7% - 50.3% Female: 36.1%-44.3%	Iron, vitamin B12, or folate deficiency, bone marrow damage	Dehydration, renal problems, pulmonary or congenital heart disease
Total Cholesterol	<200 mg/dL	Hypocholesterolemia (<150 mg/dL), malnutrition, kidney disease, malabsorption	Hypercholesterolemia
LDL Cholesterol	< 130 mg/dL		Dyslipidemias
HDL Cholesterol	>50 mg/dL		
Triglycerides	<200 mg/dL		Hypertriglyceridemia

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CLINICAL ASSESSMENT

Clinical assessment includes checking for visible signs of nutritional deficiencies. It also includes taking a medical history to identify comorbidities, usage of medication, food and drug interactions, and risk factors for disease. The clinical assessment should include checking for or asking clients about symptoms of infection that can increase nutrient needs (e.g., fever) and nutrient loss (e.g., diarrhea and vomiting.) Physical appearance should be noted (does the person look thin, of acceptable weight or overweight? Badly damaged nails and surrounding tissue may be an indication of self-induced vomiting in bulimia nervosa); if any physical problems affecting eating (poor dentition, dry mouth, sore or painful mouth). Examples of physical signs of nutritional problems are shown in Table 4.

Table 4. Clinical assessment and sign

Assessment	**Clinical signs**	**Possible nutrient(s)**
Hair	Thin, sparse Color change – flag sign Easily plucked	Protein and energy, zinc, copper
Skin	Dry, flaky Rough ‘sandpaper’ texture Petechiae, bruising	Essential fatty acids, B vitamins Vitamin A Vitamin C
Eyes	Pale conjunctive Xerosis, keratomalacia	Iron Vitamin A
Lips	Angular stomatitis Cheilosis	B vitamins
Tongue	Color changes	B vitamins
Teeth	Mottling of enamel	Fluorosis (excess fluoride)
Face	Thyroid enlargement	Iodine
Nails	Spoon, shape, koilonychias	Iron, zinc, copper
Muscles	Wasting	Protein, energy, zinc
Bones	Craniotabes Parietal and frontal bossing	Vitamin D

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DIETARY ASSESSMENT

There are several dietary assessment methods for measuring food consumption at the national, household, and individual levels.

Assessing food and fluid intake is an essential part of nutrition assessment. It provides information on dietary quantity and quality, changes in appetite, food allergies and intolerance, and reasons for inadequate food intake during or after the illness. The results are compared with recommended intake.

- 24-hour recall (24 HR): a trained interviewer asks the subject to recall all food and drinks taken in the previous 24 hours. It is quick, easy, and depends on short-term memory, but may not be truly representative of the person's usual intake. Can be used for group assessments but not for estimating the intake of individuals.
- Diet history: aims to discover the usual food intake pattern of individuals over a relatively long period.
- Food frequency questionnaire (FFQ): in this method the subject is given a list of food items to indicate the intake (frequency and quantity) per day, week, or month. It is inexpensive, more representative, easy to use, and useful for large sample sizes. But is a long questionnaire and should be errors with estimating serving size.
- Short frequency questionnaires: targeted to specific food types or nutrients, the administration is simple and easier than long questionnaires. Need to be developed for specific population groups to ensure questions are relevant.

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