MODULE 6

Measuring malnutrition: Individual assessment

PART 1: FACT SHEET

The fact sheet is the first of four parts contained in this module. It provides an overview of how acute malnutrition can be measured in individuals using *anthropometry* (body measurements) and *clinical signs* (e.g. *visible wasting* and *bilateral oedema*) in emergencies. The basic principles of anthropometric assessment are also applicable in non-emergency contexts and preventive programmes.[1] Detailed technical information is covered in Part 2. Assessment of micronutrient malnutrition is not included as it is covered in Module 4. Words in italics are defined in the glossary.

Anthropometry

Nutritional status cannot be observed directly so *proxy* (observable) indicators are used instead. There are four methods to assess an individual's nutritional status; anthropometry, biochemical assessment, clinical assessment and dietary intake. Anthropometry is the method most commonly used in emergencies, in combination with clinical assessment of *visible wasting* and *bilateral oedema*.

Anthropometry can be defined as the measurement of physical dimensions and gross composition of the body (height (or length in children under 24 months or under 87cm in height), weight, *MUAC* (mid-upper arm circumference), age, sex[2]. The information is used to generate *nutritional indices*. The degree of malnutrition is defined by *cut-off points*, in other words individuals falling below a specific cut-off point are classified with a specific degree of malnutrition.

Most nutritional indices are compared to expected anthropometric values for an individual of the same sex and age, e.g. a *growth standard or growth reference*. A standard is based on prescriptive criteria and involves value or normative judgments. In contrast, a reference reflects the expected values in a reference population. Some nutritional indices for acute malnutrition, (e.g. MUAC and Body Mass Index (BMI), are interpreted directly with cut-off points, without comparison to a growth standard or reference.

Measuring malnutrition in infants younger than 6 months

Infants less than 6 months old are usually not measured anthropometrically, with the exception of assessment of birthweight which is not a reflection of acute malnutrition. Assessment of nutritional status of infants less than 6 months of age for admission into selective feeding programmes has relied primarily on clinical signs (e.g. oedema, visible wasting, too weak to suckle, not gaining weight despite feeding) and risk factors (e.g. insufficient breastmilk, absence of mother). Research is ongoing to develop the evidence base needed to define protocols and cut-off points for anthropometric assessment of infants less than 6 months.

Measuring malnutrition in children 6-60 months

The nutritional indices commonly calculated for children 6-60 months are:

- *Weight-for-height* (WFH) – a measure of *wasting* or *acute malnutrition*
- *Height-for-age* (HFA) – a measure of *stunting* or chronic undernutrition
- *Weight-for-age* (WFA) – a measure of *underweight* or wasting and stunting combined
- MUAC – a measure of wasting or acute malnutrition

Each form of growth failure reflects a different condition. It is important to note that one individual can be classified with more than one form of growth failure at the same time. A child that is suffering from severe acute malnutrition may be both severely wasted and stunted. In emergencies, the main focus is on wasting, due to its link to morbidity and mortality.

[1] While obesity is acknowledged to be an issue of increasing importance globally, it is not addressed in this module because during an emergency, the focus is on acute malnutrition.

[2] Jelliffe, DB (1966). *The assessment of the nutritional status of the community*. WHO Monograph No. 53. Geneva. WHO.

The prevalence (rate) of acute malnutrition (defined by weight-for-height and bilateral oedema) in children 6-59 months is frequently assessed in emergencies and used to determine response and to identify target groups and geographical areas at risk. It reflects recent changes in dietary intake and infection and acts as a proxy for the nutritional status of the entire population. The concern, however, is not just for the children who are classified with moderate or severe acute malnutrition, but for the entire population whose nutritional status is sub-optimal.

Prior to 2006, the internationally accepted reference population for calculating nutrition indices among children 0-60 months was the 1978 National Center for Health Statistics (NCHS) international reference. In 2006, the World Health Organisation (WHO) introduced a new growth standard (WHO GS) for children 0-60 months of age, which was endorsed in 2009 by WHO and UNICEF for use in the identification of severe acute malnutrition.[3] Cut-off points used to classify the severity of malnutrition are presented as Z-scores (also called *standard deviation* (SD) scores), in line with global recommendations. In 2009, WHO and UNICEF also endorsed the cut-off point of MUAC less than 115 mm/11.5cm (previously the cut-off was 110 mm/11.0cm) as an independent admission criterion for the treatment of *severe acute malnutrition* (SAM). A child with bilateral oedema is always classified with SAM.

Classification of acute malnutrition in children 6-60 months

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
WFH (wasting)	≥ -3 SD & < -2 SD	< -3 SD
MUAC	≥ 115mm & < 125mm (≥ 11.5cm & < 12.5cm)	<115mm (<11.5cm)
MUAC for age/height[4]		< -3 SD
Bilateral Oedema	No	Yes

Measuring malnutrition in older children and adolescents

WHO recommends that acute malnutrition among children and adolescents 5-19 years be assessed by calculating *Body Mass Index* (BMI), and then adjusting for age to generate *BMI-for-age*. BMI is calculated based on the weight (in kg) divided by the square of the height (in m) of the individual. BMI-for-age should be presented as Z-scores based on the 2007 WHO Growth Reference (WHO GR) for children and adolescents 5 to 19 years of age.

Classification of children and adolescents 5-19 years of age

	BMI-for-age Z-score
Severe thinness:	<-3SD
Thinness:	≥ -3 SD & < -2 SD
Overweight:	>+1SD & ≤+2 SD
Obesity:	>+2SD

Measuring malnutrition in adults

Acute malnutrition in adults is assessed by BMI. BMI cannot be used for pregnant women. Sphere guidelines recommend that BMI be adjusted for the ratio of sitting height to standing height, or *Cormic Index*, though this is not often done in practice. MUAC in combination with clinical signs is often used to screen adults for admittance to feeding centres. While cut-offs have been defined for BMI in adults, there is no international consensus on the cut-off points for classifying severe malnutrition in adults using MUAC. The cut-offs shown below are commonly used during emergencies.

[3] WHO and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund*. Geneva: WHO and UNICEF.

[4] MUAC-for-age or MUAC-for-height is not generally used in practice.

Cut-off points for BMI in adults

	Well-nourished	Mild acute malnutrition	Moderate acute malnutrition	Severe acute malnutrition
BMI (WHO 1995)	≥ 18.5	<18 to ≥17	<17 to ≥16	< 16

Classification of acute malnutrition in adults with MUAC

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
MUAC (WHO 1995)	≥ 214 mm and ≤221 mm (women) ≥ 224 mm and ≤231 mm (men)	< 214 mm (women) < 224 mm (men)
MUAC (Ferro-Luzzi 1996)	< 190 mm (women) < 200 mm (men)	<160 mm (women) < 170 mm (men)
MUAC (SCN 2000)	< 185 and ≥ 160 mm plus clinical signs*	< 160 mm
Bilateral Oedema	No	Yes

* Clinical signs include inability to stand, evident dehydration and presence of oedema.

For **pregnant women of any age**, BMI is an inadequate nutritional index because body weight will be due in part to the growing foetus. MUAC is recommended as the preferred nutritional index for pregnant women, since it does not change significantly during pregnancy. The Sphere Minimum Standards recommend a cut-off point of 210 mm (21.0cm) for identification of nutritional risk in pregnant women in emergencies.

Measuring malnutrition in older people

BMI should be assessed and the same cut-off points as for adults applied. There are no global standard or reference populations for adults or the elderly at this time

Key messages

1. Anthropometry is the use of body measurements to assess and classify nutritional status in an individual.
2. Body measurements include: age, sex, weight, height (or length in children 6-23.9 months or under 87 cm in height) and mid-upper arm circumference (MUAC) for individuals 6 months and older.
3. Clinical signs of acute malnutrition include: visible wasting and bilateral oedema.
4. Acute malnutrition among infants less than 6 months of age is assessed using visible signs of wasting and bilateral oedema. Social criteria such as an absent mother or inadequacy of breastfeeding can indicate nutritional risk.
5. Acute malnutrition among children 6-60 months is assessed using the nutritional indices of weight-for-height or weight-for-length (WFH), MUAC, and signs of bilateral oedema.
6. Undernutrition among children and adolescents 5-19 years is assessed using the nutritional index of body mass index for age (BMI-for-age) and clinical signs.
7. Adult undernutrition is assessed through Body Mass Index (BMI) (either adjusted or unadjusted by Cormic index) or MUAC in addition to clinical signs. MUAC is the preferred nutritional index during pregnancy and up to 6 months postpartum.
8. There are numerous issues related to the assessment of undernutrition in the elderly, however BMI is recommended in addition to clinical signs.
9. The use of the 2006 WHO Growth Standards is now recommended over the use of the 1978 National Center for Health Statistics (NCHS) growth reference in the definition of acute malnutrition in children 6-60 months. The use of the 2007 WHO Growth References is recommended for assessment of children and adolescents 5-19 years.
10. Nutrition indices should be presented as Z-scores as opposed to percentage of the median. Percentage of the median is no longer recommended for use in classification of individual nutrition status.
11. Methodologies and protocols for the anthropometric assessment of children 6-59 months of age are more developed than for other age groups, however additional research into best practice and relationship to functional outcomes is ongoing.