# MODULE TWO

## Defining and Measuring Acute Malnutrition

| LEARNING OBJECTIVES | HANDOUTS AND EXERCISES |
|---|---|
| 1. Discuss Causes and Consequences of Undernutrition and Undernutrition Terminology | Handout 2.1 Causal Framework of Undernutrition<br><br>Handout 2.2 Undernutrition Definitions, Indices, Indicators and Indicator Cutoffs |
| 2. Identify the Clinical Signs of Acute Malnutrition | Handout 2.3 Clinical Manifestations of Acute Malnutrition |
| 3. Measure, Calculate and Classify Acute Malnutrition | Handout 2.4 Assessing Age, Bilateral Pitting Edema, MUAC, Weight and Height<br><br>Handout 2.5 Weight-for-Height Tables for Field Use<br><br>Exercise 2.1 Grades of Bilateral Pitting Edema<br><br>Exercise 2.2 Calculating WFH and Classifying Acute Malnutrition |
| Wrap-Up and Module Evaluation | |

# HANDOUT 2.1
## CAUSAL FRAMEWORK OF UNDERNUTRITION

### Causes of Undernutrition

The United Nations Children's Fund (UNICEF) has developed a framework showing the immediate, underlying and basic causes of undernutrition and how they contribute to and influence one another. The framework can be used at national, district and local levels for assessment and analysis to gain a better understanding of causes of undernutrition. This can help improve nutrition and reduce child mortality and disability.
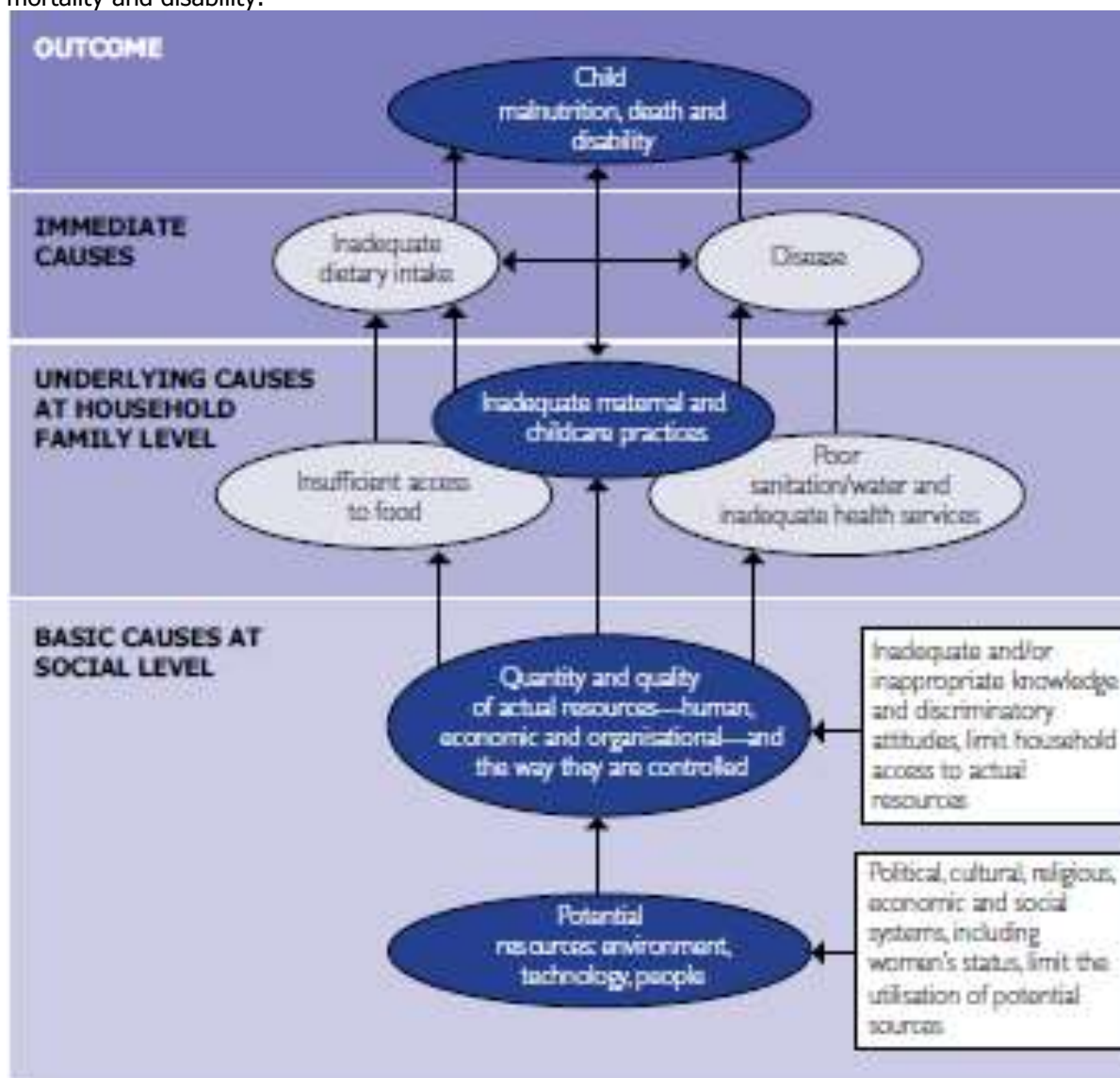


Adapted from UNICEF 1990

# HANDOUT 2.2
## UNDERNUTRITION DEFINITIONS, INDICES, INDICATORS AND INDICATOR CUTOFFS

## UNDERNUTRITION

There are four forms of undernutrition:

- Acute malnutrition
- Stunting
- Underweight
- Micronutrient deficiency

Undernutrition is defined based on anthropometric indicators, clinical signs and clinical tests. The four forms often overlap in one child or in a population. The focus of these training modules is on acute malnutrition.

## ACUTE MALNUTRITION

Acute malnutrition is caused by a decrease in food consumption and/or illness resulting in bilateral pitting edema or sudden weight loss. It is defined by the presence of bilateral pitting edema or by wasting.

a. **Severe acute malnutrition (SAM)** is defined by the presence of bilateral pitting edema or severe wasting. A child with SAM is highly vulnerable and has a high mortality risk.

Note: SAM can also be used as a population-based indicator defined by the prevalence of bilateral pitting edema and severe wasting (based on the weight-for-height [WFH] indicator using the World Health Organization [WHO] standards or the National Centre for Health Statistics [NCHS] references). The prevalence of wasting based on mid-upper arm circumference (MUAC) is useful for estimating case load.

b. **Moderate acute malnutrition (MAM)** is defined by moderate wasting.

Note: MAM can also be used as a population-level indicator defined by moderate wasting (based on the WFH indicator using the WHO standards or the NCHS references).

### indices

When body measurements are compared to a reference value, they are called nutrition indices. Three commonly used nutrition indices are WFH which is used to assess wasting, height-for-age (HFA) which is used to assess stunting, and weight-for-age (WFA) which is used to assess underweight.

**The WFH index** is used to assess wasting, a clinical manifestation of acute malnutrition. It shows how a child's weight compares to the weight of a child of the same height and sex in the WHO standard or NCHS reference populations. The index reflects a child's current nutritional status.

### indicators

Nutrition indicators are an interpretation of nutrition indices based on cutoff points. Nutrition indicators measure the clinical phenomena of malnutrition and are used for making a judgement or assessment.

A good nutrition indicator detects as many people at risk as possible (sensitivity) without including too many people who are not at risk (specificity). A good nutrition indicator should also be functionally meaningful (i.e., related to the risk of morbidity and mortality), and be sensitive to change.

Standard cutoff points are used internationally to define undernutrition in children ages 6-59 months. The cutoff points for nutrition indicators are derived from the WHO child growth standard population (WHO standards) or NCHS reference population (NCHS references).

Note: Cutoffs may vary according to the context, agency and national guidelines.

### bilateral Pitting Edema

Bilateral pitting edema is a clinical manifestation of acute malnutrition caused by an abnormal infiltration and excess accumulation of serous fluid in connective tissue or in a serous cavity. Bilateral pitting edema (also called kwashiorkor) is verified when thumb pressure applied on top of both feet for three seconds leaves a pit (indentation) in the foot after the thumb is lifted.

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**MUAC indicator**

Low MUAC is an indicator for wasting, to be used for a child age 6-59 month. The indicator is relatively easy to measure; it involves measuring the circumference of a child's left mid-upper arm. MUAC < 115 mm for children ages 6-59 months indicates SAM (cutoff being debated). MUAC ≥ 115 mm and < 125 mm for children ages 6-59 months indicates MAM (cutoffs being debated). MUAC is a better indicator of mortality risk associated with acute malnutrition than WFH z-score (WHO) or WFH as a percentage of the median (NCHS).

**WFH indicator**

Low WFH is an indicator for wasting. A WFH standard deviation (SD) below -2 z-score of the median (WFH < -2 z-score) of the WHO standards or a WFH < 80% of the median (WFH < 80%) of the NCHS references indicate wasting. Severe wasting is indicated by a WFH < -3 z-score (WHO standards) or a WFH < 70% of the median (NCHS references). Moderate wasting is indicated by a WFH ≥ -3 and < -2 z-score (WHO standards) or a WFH ≥ 70% and < 80% (NCHS references).

SUMMARY TABLE: INDICATORS OF ACUTE MALNUTRITION WITH CUTOFF FOR SAM AND MAM

|  | **bilateral Pitting Edema** | **MUAC*** | **WFH z-score** (WHO standards or NCHS references) | **WFH as a percentage of the median** (NCHS references) |
|---|---|---|---|---|
| **SAM:** | Present | < 115 mm* or red | < -3 | < 70% |
| **MAM:** | Not present | > 115 mm* and < 125 mm* or yellow | ≥ -3 and < -2 | ≥ 70% and < 80% |

*cutoffs being debated

**note on the WHO child growth standards and NCHS child growth references:**

The NCHS child growth references were developed in 1978 from a cohort of American children and used as an international reference until 2006. The WHO 2006 Child Growth Standards were developed from a multicenter growth reference study that followed optimal child growth of a cohort of children in Oman, Norway, Ghana, India and the United States. The principal measures used in CTC/CMAM services are bilateral pitting edema and MUAC. A measure commonly used in therapeutic and supplementary feeding is WFH as a percentage of the median based on the NCHS references. A transition to using WFH z-score of the median of the WHO standards was recommended but not yet accomplished before this document was published.

# HANDOUT 2.3
## CLINICAL MANIFESTATIONS OF ACUTE MALNUTRITION

Acute malnutrition is defined by the presence of **bilateral pitting edema and wasting (defined by low mid-upper arm circumference [MUAC] or weight-for-height [WFH])**. Acute malnutrition is caused by a decrease in food consumption and/or illness.

- The following terms are used to describe the clinical manifestations of severe acute malnutrition (SAM):
  - Marasmus (severe wasting)
  - Kwashiorkor (bilateral pitting edema)
  - Marasmic kwashiorkor (bilateral pitting edema and severe wasting)

- Familiarity with these clinical signs will help health care providers triage cases efficiently – even before measurements are made.

- In most cases the anthropometric measurements will confirm these clinical diagnoses, but in a few cases there might be clinical but no anthropometric confirmation (e.g., observing that the skin on the buttocks has a "baggy pants" look.)

## TABLE OF CLINICAL MANIFESTATIONS OF ACUTE MALNUTRITION

### CLINICAL SIGNS OF MARASMUS

A child with marasmus might have these characteristics:

- Thin appearance, "old man" face
- Apathy: the child is very quiet and does not cry
- The ribs and bones are easily seen
- The skin under the upper arms appears loose
- On the back, the ribs and shoulder bones are easily seen
- In extreme cases of wasting, the skin on the buttocks has a "baggy pants" look
- No bilateral pitting edema

These children have lost fat and muscle and will weigh less than other children of similar height.

### INDICATOR

Severe wasting :

MUAC < 115 mm
Z-score < -3 (WHO)
WFH < 70% of median (NCHS)

Picture



### CLINICAL SIGNS OF KWASHIORKOR (BILATERAL PITTING OEDEMA)

A child with kwashiorkor (bilateral pitting edema) might have these characteristics:
- "Moon face"
- Dermatosis: flaky skin or patches of abnormally light or dark skin (in severe cases)
- Apathy, little energy
- Loss of appetite
- Hair changes
- Irritable, cries easily

### INDICATOR
Bilateral pitting edema

Picture

## CLINICAL SIGNS OF MARASMIC KWASHIORKOR

A child with Marasmic kwashiorkor has these characteristics:

- Bilateral pitting edema
- Severe wasting

**Picture**



**Indicator**

Bilateral pitting edema
**and**
Severe Wasting

MUAC < 115 mm
Z-score < -3 (WHO)
WFH < 70% of median (NCHS)

**2.3**

CLINICAL SIGNS OF MARASMIC KWASHIORKOR

Indicator

Bilateral pitting edema

Severe wasting

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# HANDOUT 2.4
## ASSESSING AGE, BILATERAL PITTING OEDEMA, MUAC, WEIGHT AND HEIGHT

### 1. AGE

In CMAM, estimating a child's age is relevant for a number of reasons. CMAM outpatient care targets children between 6-59 months. A child under 6 months with severe acute malnutrition (SAM) and no medical complications are not eligible for outpatient care as older children would be. Mid-upper arm circumference (MUAC) is only used for children 6-59 months. And measuring height for WFH calculations is carried out differently for children under the age of two.

If birth dates are not recorded on a child health card (CHC) or immunization card and it is necessary to determine the age, the recall of the mother/caregiver is used to estimate the child's age.

Age is easy to estimate for younger children but is often difficult to determine for older children. The mother/caregiver's recall is valid for assessing the age of a young infant in case of absence of proof. Otherwise, the child's ability to swallow semi-solids will be tested using ready-to-use therapeutic food (RUTF). If the child eats the RUTF (passes the appetite test) then the child is considered to be 6 months and the MUAC measurement is valid as an admission criterion for CMAM.

Other methods of estimating age include:

· Asking the mother/caregiver if the child was born before or after certain major local events until a fairly accurate age is pinpointed. It might be helpful to develop a local event calendar. The World Health Organization (WHO) Child Age Calculator, a rotating disk mounted on a calendar, has been developed as a job aid for health workers to calculate a child's age. The calculators might be available at regional WHO offices. Also, the Food and Agriculture Organization of the United Nations (FAO) has developed guidelines to estimate the month and year of birth (Draft, 2008).

· Estimating age based on height. The standard international height proxy for children 59 months is 115 cm. Note that while the standard international height proxy for children 6 months is 65 cm, it is not recommended to use this height cutoff in stunted populations. The mother/caregiver's recall is much more accurate in these cases.

### 2. BILATERAL PITTING OEDEMA

Bilateral pitting edema, or kwashiorkor, can be verified when thumb pressure applied on top of both feet for three seconds leave a pit (indentation) in the foot after the thumb is lifted. The pit will remain in both feet for several seconds. Bilateral pitting edema usually starts in the feet and ankles. It is important to test both feet; if the pitting is not bilateral, the edema is not of nutritional origin. The presence of bilateral pitting edema should be confirmed by a second person who repeats the test.

There are three grades of bilateral pitting edema. When there is no bilateral pitting edema, the grade is "absent." Grades of bilateral pitting edema are classified by plus signs.

| grades of bilateral pitting edema | Definition |
|---|---|
| Absent | Absent |
| Grade + | Mild: Both feet/ankles |
| Grade ++ | Moderate: Both feet, plus lower legs, hands or lower arms |
| Grade +++ | Severe: Generalized bilateral pitting edema, including both feet, legs, arms and face |

2.4

## 3. MUAC

MUAC is used for children age 6-59 months (see **age** section above).

MUAC should be measured on the left upper arm while the arm is hanging down the side of the body and relaxed. The tape should be placed at the midpoint between the shoulder and the tip of the elbow. It is recommended to use a string instead of the MUAC tape to find the midpoint.

For the numbered tapes, feed the end of the tape down through the first opening and up through the third opening. The measurement is read from the middle window where the arrows point inward. MUAC can be recorded with a precision of 1 mm. Read the number in the box that is completely visible in the middle window. For the example below, it is 124 mm.
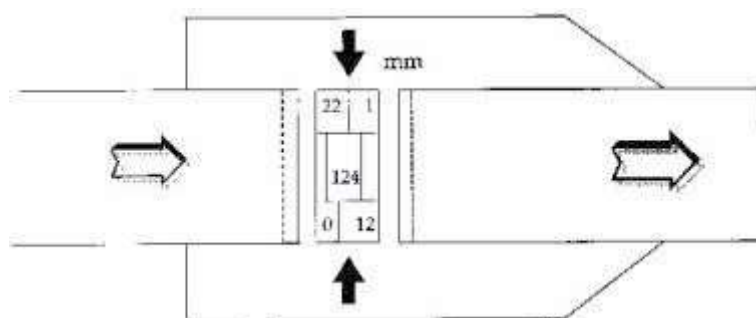


For the simple three-color tape (red, yellow, green), slide the end through the first opening and then through the second opening. Read the color that shows through the window at the point the two arrows indicate.



Photo Credit: WHO-Tanzania, training on the management of SEVERE ACUTE MALNUTRITION, SEPTEMBER 2006 (VALID INTERNATIONAL)

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## 4. WEIGHT

To increase accuracy and precision, two people are always needed to measure weight. Weight may be measured using a Salter-type hanging spring scale (as is commonly found in the field) or an electronic scale such as the United Nations Children's Fund (UNICEF) UNISCALE, which is more precise and allows a child to be measured in the mother/caregiver's arms.

### hanging spring (salter) scale

A 25-kg hanging spring scale, graduated by 0.100 kg, is most commonly used. In the field setting, the scale is hooked to a tree, a tripod or a stick held by two people. In a clinic, it is attached to the ceiling or a stand.

Weighing pants (or a weighing hammock for smaller infants) are attached to the scale. However, culturally adapted solutions, such as a mother's wrap, basin or grass basket, are preferable to use to weigh the child; these are suspended from the lower hook of the scale, and the scale is readjusted to zero. The child's clothes are removed, and the child is placed in the weighing pants (or alternative). The scale should be read at eye level.

Considerations:

- Make sure the child is safely in the weighing pants or hammock with one arm in front and one arm behind to help maintain balance.

- In cold climates or in certain cultures, it might be impossible or impractical to undress a child completely. The average weight of the clothes should be estimated and deducted from the measure. It is helpful to retain similar clothing for girls and boys during weighing to help to standardize the weight deductions.

- When the child is steady and settled, the weight is recorded to the nearest 100 grams. If the child is moving and the needle does not stabilize, the weight should be estimated by recording the value at the midpoint of the range of oscillations. The measurer announces the value read from the scale, the assistant repeats it for verification and records it on the clinic form or CHC. The child is then dressed.

- The scale should be checked daily against a known weight. To do this, set the scale to zero and weigh objects of known weight (e.g., 5, 10 or 15 kg). If the measure does not match the weight to within 10 grams, the scale should be replaced or the springs must be changed.

### Electronic scale (e.g., UNISCALE)

The UNISCALE, which is very precise, is powered by a lithium battery good for one million weighings and a solar switch that turns the device on in daylight or a normally lit room. It is designed to allow a mother/caregiver to hold the child while the child is being weighed. The scale comes with instructions.

To use the UNISCALE:

- Place the scale on a flat surface in a well-lit area, making sure that all four of the scale's feet are on the ground.

- Remove as much clothing as possible from the child.

- Wave a hand over the solar switch to turn on the scale. The scale indicates that it is ready to weigh an adult. (A picture of an adult is shown.)

- The mother/caregiver stands on the scale first, without the child. The weight is shown. The adult remains on the scale. The scale stores this weight in its memory.

- Wave a hand over the solar switch again. The scale indicates that it is ready to weigh an adult with a child. (A picture of an adult holding a child is shown.)

- Pass the child to be weighed to the adult on the scale (the adult should remain still).

- The scale indicates the child's weight.

**note**: Infants under 6 months with SAM are referred to inpatient care for SAM with medical complications where specific infant scales with a precision of **10 g or 20 g** should be available.

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## 5. LENGTH AND HEIGHT

To increase accuracy and precision, two people are always needed to measure length and height.

Children age 2 or older are measured standing up, while those under 2 are measured lying down. If the age is difficult to assess, children at least 85 cm (National Centre for Health Statistics [NCHS] references) or 87 cm tall (WHO standards) are measured standing, and those under 85 cm (NCHS) or 87 cm (WHO) are measured lying down. If children age 2 or older or at least 85 cm (NCHS) or 87 cm tall (WHO) are measured lying down, 0.5 cm is subtracted from the measurement.

**for children age 2 or older or with a height of 85 cm (NCHS) / 87 cm (WHO) or more:**

The child's shoes are removed. The child is placed on the height board, standing upright in the middle of the board. The child's ankles and knees should be firmly pressed against the board by the assistant while the measurer positions the head and the sliding board. The child's head, shoulders, buttocks and heels should be touching the board. The measurer reads out loud the measurement to the nearest 0.1 cm. The assistant repeats the measurement for verification and records it on the anthropometric form or health card. A height stick or tape secured against a wall also can be used to quickly measure a child's length or height.

**for children under age 2 or with a height below 85 cm (NCHS) / 87 cm (WHO):**

The height board is placed on the ground. The child's shoes are removed. The child is gently placed on his/her back on the middle of the board. The assistant holds the sides of the child's head and positions the head touching the board. The measurer places his/her hands on the child's ankles or knees. While positioning the child's legs, the measurer positions the sliding board up against the bottom of the child's feet, which should be at right angles. The measurer reads the measurement to the nearest 0.1 cm out loud. The assistant repeats the measurement for verification and records it on the anthropometric form or health card.

# HANDOUT 2.5 WEIGHT-FOR-HEIGHT TAB LES FOR-FIELD US

## WHO SEX-SPECIFIC CHILD GROWTH STANDARDS (2006), EXPRESSED AS Z-SCORE (SD) ASSESSED SUPINE UP TO 86.9 CM (LENGTH) AND STANDING FROM 87.0 CM (HEIGHT)

Length is measured for children below 87 cm. For children 87 cm or more, height is measured. Recumbent length is on average 0.5 cm greater than standing height, although the difference is of no importance to individual children, a correction may be made by subtracting 0.5 cm from all lengths above 86.9 cm if standing height cannot be measured.

| BOYS' WEIGHT (kg) | | | | | | GIRLS' WEIGHT (kg) | | | | |
| -4 SD | -3 SD | -2 SD | -1 SD | Median | LENGTH (cm) | Median | -1 SD | -2 SD | -3 SD | -4 SD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.7 | 1.9 | 2.0 | 2.2 | 2.4 | **45.0** | 2.5 | 2.3 | 2.1 | 1.9 | 1.7 |
| 1.8 | 2.0 | 2.2 | 2.4 | 2.6 | **46.0** | 2.6 | 2.4 | 2.2 | 2.0 | 1.9 |
| 2.0 | 2.1 | 2.3 | 2.5 | 2.8 | **47.0** | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 |
| 2.1 | 2.3 | 2.5 | 2.7 | 2.9 | **48.0** | 3.0 | 2.7 | 2.5 | 2.3 | 2.1 |
| 2.2 | 2.4 | 2.6 | 2.9 | 3.1 | **49.0** | 3.2 | 2.9 | 2.6 | 2.4 | 2.2 |
| 2.4 | 2.6 | 2.8 | 3.0 | 3.3 | **50.0** | 3.4 | 3.1 | 2.8 | 2.6 | 2.4 |
| 2.5 | 2.7 | 3.0 | 3.2 | 3.5 | **51.0** | 3.6 | 3.3 | 3.0 | 2.8 | 2.5 |
| 2.7 | 2.9 | 3.2 | 3.5 | 3.8 | **52.0** | 3.8 | 3.5 | 3.2 | 2.9 | 2.7 |
| 2.9 | 3.1 | 3.4 | 3.7 | 4.0 | **53.0** | 4.0 | 3.7 | 3.4 | 3.1 | 2.8 |
| 3.1 | 3.3 | 3.6 | 3.9 | 4.3 | **54.0** | 4.3 | 3.9 | 3.6 | 3.3 | 3.0 |
| 3.3 | 3.6 | 3.8 | 4.2 | 4.5 | **55.0** | 4.5 | 4.2 | 3.8 | 3.5 | 3.2 |
| 3.5 | 3.8 | 4.1 | 4.4 | 4.8 | **56.0** | 4.8 | 4.4 | 4.0 | 3.7 | 3.4 |
| 3.7 | 4.0 | 4.3 | 4.7 | 5.1 | **57.0** | 5.1 | 4.6 | 4.3 | 3.9 | 3.6 |
| 3.9 | 4.3 | 4.6 | 5.0 | 5.4 | **58.0** | 5.4 | 4.9 | 4.5 | 4.1 | 3.8 |
| 4.1 | 4.5 | 4.8 | 5.3 | 5.7 | **59.0** | 5.6 | 5.1 | 4.7 | 4.3 | 3.9 |
| 4.3 | 4.7 | 5.1 | 5.5 | 6.0 | **60.0** | 5.9 | 5.4 | 4.9 | 4.5 | 4.1 |
| 4.5 | 4.9 | 5.3 | 5.8 | 6.3 | **61.0** | 6.1 | 5.6 | 5.1 | 4.7 | 4.3 |
| 4.7 | 5.1 | 5.6 | 6.0 | 6.5 | **62.0** | 6.4 | 5.8 | 5.3 | 4.9 | 4.5 |
| 4.9 | 5.3 | 5.8 | 6.2 | 6.8 | **63.0** | 6.6 | 6.0 | 5.5 | 5.1 | 4.7 |
| 5.1 | 5.5 | 6.0 | 6.5 | 7.0 | **64.0** | 6.9 | 6.3 | 5.7 | 5.3 | 4.8 |
| 5.3 | 5.7 | 6.2 | 6.7 | 7.3 | **65.0** | 7.1 | 6.5 | 5.9 | 5.5 | 5.0 |
| 5.5 | 5.9 | 6.4 | 6.9 | 7.5 | **66.0** | 7.3 | 6.7 | 6.1 | 5.6 | 5.1 |
| 5.6 | 6.1 | 6.6 | 7.1 | 7.7 | **67.0** | 7.5 | 6.9 | 6.3 | 5.8 | 5.3 |
| 5.8 | 6.3 | 6.8 | 7.3 | 8.0 | **68.0** | 7.7 | 7.1 | 6.5 | 6.0 | 5.5 |
| 6.0 | 6.5 | 7.0 | 7.6 | 8.2 | **69.0** | 8.0 | 7.3 | 6.7 | 6.1 | 5.6 |
| 6.1 | 6.6 | 7.2 | 7.8 | 8.4 | **70.0** | 8.2 | 7.5 | 6.9 | 6.3 | 5.8 |
| 6.3 | 6.8 | 7.4 | 8.0 | 8.6 | **71.0** | 8.4 | 7.7 | 7.0 | 6.5 | 5.9 |
| 6.4 | 7.0 | 7.6 | 8.2 | 8.9 | **72.0** | 8.6 | 7.8 | 7.2 | 6.6 | 6.0 |
| 6.6 | 7.2 | 7.7 | 8.4 | 9.1 | **73.0** | 8.8 | 8.0 | 7.4 | 6.8 | 6.2 |
| 6.7 | 7.3 | 7.9 | 8.6 | 9.3 | **74.0** | 9.0 | 8.2 | 7.5 | 6.9 | 6.3 |
| 6.9 | 7.5 | 8.1 | 8.8 | 9.5 | **75.0** | 9.1 | 8.4 | 7.7 | 7.1 | 6.5 |
| 7.0 | 7.6 | 8.3 | 8.9 | 9.7 | **76.0** | 9.3 | 8.5 | 7.8 | 7.2 | 6.6 |
| 7.2 | 7.8 | 8.4 | 9.1 | 9.9 | **77.0** | 9.5 | 8.7 | 8.0 | 7.4 | 6.7 |
| 7.3 | 7.9 | 8.6 | 9.3 | 10.1 | **78.0** | 9.7 | 8.9 | 8.2 | 7.5 | 6.9 |
| 7.4 | 8.1 | 8.7 | 9.5 | 10.3 | **79.0** | 9.9 | 9.1 | 8.3 | 7.7 | 7.0 |
| 7.6 | 8.2 | 8.9 | 9.6 | 10.4 | **80.0** | 10.1 | 9.2 | 8.5 | 7.8 | 7.1 |
| 7.7 | 8.4 | 9.1 | 9.8 | 10.6 | **81.0** | 10.3 | 9.4 | 8.7 | 8.0 | 7.3 |
| 7.9 | 8.5 | 9.2 | 10.0 | 10.8 | **82.0** | 10.5 | 9.6 | 8.8 | 8.1 | 7.5 |
| 8.0 | 8.7 | 9.4 | 10.2 | 11.0 | **83.0** | 10.7 | 9.8 | 9.0 | 8.3 | 7.6 |
| 8.2 | 8.9 | 9.6 | 10.4 | 11.3 | **84.0** | 11.0 | 10.1 | 9.2 | 8.5 | 7.8 |
| 8.4 | 9.1 | 9.8 | 10.6 | 11.5 | **85.0** | 11.2 | 10.3 | 9.4 | 8.7 | 8.0 |
| 8.6 | 9.3 | 10.0 | 10.8 | 11.7 | **86.0** | 11.5 | 10.5 | 9.7 | 8.9 | 8.1 |
| 8.7 | 9.5 | 10.2 | 11.1 | 12.0 | **87.0** | 11.7 | 10.7 | 9.9 | 9.1 | 8.3 |
| 8.9 | 9.7 | 10.5 | 11.3 | 12.2 | **88.0** | 12.0 | 11.0 | 10.1 | 9.3 | 8.5 |
| 9.1 | 9.9 | 10.7 | 11.5 | 12.5 | **89.0** | 12.2 | 11.2 | 10.3 | 9.5 | 8.7 |
| 9.3 | 10.1 | 10.9 | 11.8 | 12.7 | **90.0** | 12.5 | 11.4 | 10.5 | 9.7 | 8.8 |
| 9.5 | 10.3 | 11.1 | 12.0 | 13.0 | **91.0** | 12.7 | 11.7 | 10.7 | 9.9 | 9.0 |
| 9.7 | 10.5 | 11.3 | 12.2 | 13.2 | **92.0** | 13.0 | 11.9 | 10.9 | 10.1 | 9.2 |
| 9.8 | 10.7 | 11.5 | 12.4 | 13.4 | **93.0** | 13.2 | 12.1 | 11.1 | 10.2 | 9.4 |
| 10.0 | 10.8 | 11.7 | 12.6 | 13.7 | **94.0** | 13.5 | 12.3 | 11.3 | 10.4 | 9.5 |
| 10.2 | 11.0 | 11.9 | 12.8 | 13.9 | **95.0** | 13.7 | 12.6 | 11.5 | 10.6 | 9.7 |
| 10.3 | 11.2 | 12.1 | 13.1 | 14.1 | **96.0** | 14.0 | 12.8 | 11.7 | 10.8 | 9.9 |
| 10.5 | 11.4 | 12.3 | 13.3 | 14.4 | **97.0** | 14.2 | 13.0 | 12.0 | 11.0 | 10.1 |
| 10.7 | 11.6 | 12.5 | 13.5 | 14.6 | **98.0** | 14.5 | 13.3 | 12.2 | 11.2 | 10.2 |
| 10.8 | 11.8 | 12.7 | 13.7 | 14.9 | **99.0** | 14.8 | 13.5 | 12.4 | 11.4 | 10.4 |
| 11.0 | 12.0 | 12.9 | 14.0 | 15.2 | **100.0** | 15.0 | 13.7 | 12.6 | 11.6 | 10.6 |

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## WHO SEX-SPECIFIC CHILD GROWTH STANDARDS (2006), EXPRESSED AS Z-SCORE (SD) ASSESSED SUPINE UP TO 86.9 CM (LENGTH) AND STANDING FROM 87.0 CM (HEIGHT)

length is measured for children below 87 cm. for children 87 cm or more, height is measured. recumbent length is on average 0.5 cm greater than standing height, although the difference is of no importance to individual children, a correction may be made by subtracting 0.5 cm from all lengths above 86.9 cm if standing height can not be measured

2.5

| | | BOYS' WEIGHT (kg) | | | | | | GIRLS' WEIGHT (kg) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| -4 SD | -3 SD | -2 SD | -1 SD | Median | HEIGHT (cm) | Median | -1 SD | -2 SD | -3 SD | -4 SD |
| 5.4 | 5.9 | 6.3 | 6.9 | 7.4 | **65.0** | 7.2 | 6.6 | 6.1 | 5.6 | 5.1 |
| 5.6 | 6.1 | 6.5 | 7.1 | 7.7 | **66.0** | 7.5 | 6.8 | 6.3 | 5.8 | 5.3 |
| 5.7 | 6.2 | 6.7 | 7.3 | 7.9 | **67.0** | 7.7 | 7.0 | 6.4 | 5.9 | 5.4 |
| 5.9 | 6.4 | 6.9 | 7.5 | 8.1 | **68.0** | 7.9 | 7.2 | 6.6 | 6.1 | 5.6 |
| 6.1 | 6.6 | 7.1 | 7.7 | 8.4 | **69.0** | 8.1 | 7.4 | 6.8 | 6.3 | 5.7 |
| 6.2 | 6.8 | 7.3 | 7.9 | 8.6 | **70.0** | 8.3 | 7.6 | 7.0 | 6.4 | 5.9 |
| 6.4 | 6.9 | 7.5 | 8.1 | 8.8 | **71.0** | 8.5 | 7.8 | 7.1 | 6.6 | 6.0 |
| 6.5 | 7.1 | 7.7 | 8.3 | 9.0 | **72.0** | 8.7 | 8.0 | 7.3 | 6.7 | 6.1 |
| 6.7 | 7.3 | 7.9 | 8.5 | 9.2 | **73.0** | 8.9 | 8.1 | 7.5 | 6.9 | 6.3 |
| 6.8 | 7.4 | 8.0 | 8.7 | 9.4 | **74.0** | 9.1 | 8.3 | 7.6 | 7.0 | 6.4 |
| 7.0 | 7.6 | 8.2 | 8.9 | 9.6 | **75.0** | 9.3 | 8.5 | 7.8 | 7.2 | 6.6 |
| 7.1 | 7.7 | 8.4 | 9.1 | 9.8 | **76.0** | 9.5 | 8.7 | 8.0 | 7.3 | 6.7 |
| 7.3 | 7.9 | 8.5 | 9.2 | 10.0 | **77.0** | 9.6 | 8.8 | 8.1 | 7.5 | 6.8 |
| 7.4 | 8.0 | 8.7 | 9.4 | 10.2 | **78.0** | 9.8 | 9.0 | 8.3 | 7.6 | 7.0 |
| 7.5 | 8.2 | 8.8 | 9.6 | 10.4 | **79.0** | 10.0 | 9.2 | 8.4 | 7.8 | 7.1 |
| 7.7 | 8.3 | 9.0 | 9.7 | 10.6 | **80.0** | 10.2 | 9.4 | 8.6 | 7.9 | 7.2 |
| 7.8 | 8.5 | 9.2 | 9.9 | 10.8 | **81.0** | 10.4 | 9.6 | 8.8 | 8.1 | 7.4 |
| 8.0 | 8.7 | 9.3 | 10.1 | 11.0 | **82.0** | 10.7 | 9.8 | 9.0 | 8.3 | 7.6 |
| 8.1 | 8.8 | 9.5 | 10.3 | 11.2 | **83.0** | 10.9 | 10.0 | 9.2 | 8.5 | 7.7 |
| 8.3 | 9.0 | 9.7 | 10.5 | 11.4 | **84.0** | 11.1 | 10.2 | 9.4 | 8.6 | 7.9 |
| 8.5 | 9.2 | 10.0 | 10.8 | 11.7 | **85.0** | 11.4 | 10.4 | 9.6 | 8.8 | 8.1 |
| 8.7 | 9.4 | 10.2 | 11.0 | 11.9 | **86.0** | 11.6 | 10.7 | 9.8 | 9.0 | 8.3 |
| 8.9 | 9.6 | 10.4 | 11.2 | 12.2 | **87.0** | 11.9 | 10.9 | 10.0 | 9.2 | 8.4 |
| 9.1 | 9.8 | 10.6 | 11.5 | 12.4 | **88.0** | 12.1 | 11.1 | 10.2 | 9.4 | 8.6 |
| 9.3 | 10.0 | 10.8 | 11.7 | 12.6 | **89.0** | 12.4 | 11.4 | 10.4 | 9.6 | 8.8 |
| 9.4 | 10.2 | 11.0 | 11.9 | 12.9 | **90.0** | 12.6 | 11.6 | 10.6 | 9.8 | 9.0 |
| 9.6 | 10.4 | 11.2 | 12.1 | 13.1 | **91.0** | 12.9 | 11.8 | 10.9 | 10.0 | 9.1 |
| 9.8 | 10.6 | 11.4 | 12.3 | 13.4 | **92.0** | 13.1 | 12.0 | 11.1 | 10.2 | 9.3 |
| 9.9 | 10.8 | 11.6 | 12.6 | 13.6 | **93.0** | 13.4 | 12.3 | 11.3 | 10.4 | 9.5 |
| 10.1 | 11.0 | 11.8 | 12.8 | 13.8 | **94.0** | 13.6 | 12.5 | 11.5 | 10.6 | 9.7 |
| 10.3 | 11.1 | 12.0 | 13.0 | 14.1 | **95.0** | 13.9 | 12.7 | 11.7 | 10.8 | 9.8 |
| 10.4 | 11.3 | 12.2 | 13.2 | 14.3 | **96.0** | 14.1 | 12.9 | 11.9 | 10.9 | 10.0 |
| 10.6 | 11.5 | 12.4 | 13.4 | 14.6 | **97.0** | 14.4 | 13.2 | 12.1 | 11.1 | 10.2 |
| 10.8 | 11.7 | 12.6 | 13.7 | 14.8 | **98.0** | 14.7 | 13.4 | 12.3 | 11.3 | 10.4 |
| 11.0 | 11.9 | 12.9 | 13.9 | 15.1 | **99.0** | 14.9 | 13.7 | 12.5 | 11.5 | 10.5 |
| 11.2 | 12.1 | 13.1 | 14.2 | 15.4 | **100.0** | 15.2 | 13.9 | 12.8 | 11.7 | 10.7 |
| 11.3 | 12.3 | 13.3 | 14.4 | 15.6 | **101.0** | 15.5 | 14.2 | 13.0 | 12.0 | 10.9 |
| 11.5 | 12.5 | 13.6 | 14.7 | 15.9 | **102.0** | 15.8 | 14.5 | 13.3 | 12.2 | 11.1 |
| 11.7 | 12.8 | 13.8 | 14.9 | 16.2 | **103.0** | 16.1 | 14.7 | 13.5 | 12.4 | 11.3 |
| 11.9 | 13.0 | 14.0 | 15.2 | 16.5 | **104.0** | 16.4 | 15.0 | 13.8 | 12.6 | 11.5 |
| 12.1 | 13.2 | 14.3 | 15.5 | 16.8 | **105.0** | 16.8 | 15.3 | 14.0 | 12.9 | 11.8 |
| 12.3 | 13.4 | 14.5 | 15.8 | 17.2 | **106.0** | 17.1 | 15.6 | 14.3 | 13.1 | 12.0 |
| 12.5 | 13.7 | 14.8 | 16.1 | 17.5 | **107.0** | 17.5 | 15.9 | 14.6 | 13.4 | 12.2 |
| 12.7 | 13.9 | 15.1 | 16.4 | 17.8 | **108.0** | 17.8 | 16.3 | 14.9 | 13.7 | 12.4 |
| 12.9 | 14.1 | 15.3 | 16.7 | 18.2 | **109.0** | 18.2 | 16.6 | 15.2 | 13.9 | 12.7 |
| 13.2 | 14.4 | 15.6 | 17.0 | 18.5 | **110.0** | 18.6 | 17.0 | 15.5 | 14.2 | 12.9 |
| 13.4 | 14.6 | 15.9 | 17.3 | 18.9 | **111.0** | 19.0 | 17.3 | 15.8 | 14.5 | 13.2 |
| 13.6 | 14.9 | 16.2 | 17.6 | 19.2 | **112.0** | 19.4 | 17.7 | 16.2 | 14.8 | 13.5 |
| 13.8 | 15.2 | 16.5 | 18.0 | 19.6 | **113.0** | 19.8 | 18.0 | 16.5 | 15.1 | 13.7 |
| 14.1 | 15.4 | 16.8 | 18.3 | 20.0 | **114.0** | 20.2 | 18.4 | 16.8 | 15.4 | 14.0 |
| 14.3 | 15.7 | 17.1 | 18.6 | 20.4 | **115.0** | 20.7 | 18.8 | 17.2 | 15.7 | 14.3 |
| 14.6 | 16.0 | 17.4 | 19.0 | 20.8 | **116.0** | 21.1 | 19.2 | 17.5 | 16.0 | 14.5 |
| 14.8 | 16.2 | 17.7 | 19.3 | 21.2 | **117.0** | 21.5 | 19.6 | 17.8 | 16.3 | 14.8 |
| 15.0 | 16.5 | 18.0 | 19.7 | 21.6 | **118.0** | 22.0 | 19.9 | 18.2 | 16.6 | 15.1 |
| 15.3 | 16.8 | 18.3 | 20.0 | 22.0 | **119.0** | 22.4 | 20.3 | 18.5 | 16.9 | 15.4 |
| 15.5 | 17.1 | 18.6 | 20.4 | 22.4 | **120.0** | 22.8 | 20.7 | 18.9 | 17.3 | 15.6 |

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**HANDOUTS & EXERCISES**

NCHS/CDC/WHO SEX-COMBINED CHILD GROWTH REFERENCES (1982), WEIGHT FOR HEIGHT INDEX EXPRESSED AS A PERCENTAGE OF THE MEDIAN WITH HEIGHT ASSESSED SUPINE UP TO 84.5 CM (LENGTH) AND STANDING FROM 85.0 CM (HEIGHT )

| Height in cm | 100% in Kg | 85% in Kg | 80% in Kg | MALNUTRITION Moderate 75% in Kg | 70% in Kg | Severe 60% in Kg |
|---|---|---|---|---|---|---|
| 49,0 | 3,2 | 2,7 | 2,6 | 2,4 | 2,2 | 1,8 |
| 49,5 | 3,3 | 2,8 | 2,6 | 2,5 | 2,3 | 2,0 |
| 50,0 | 3,4 | 2,9 | 2,7 | 2,6 | 2,4 | 2,0 |
| 50,5 | 3,4 | 2,9 | 2,7 | 2,6 | 2,4 | 2,0 |
| 51,0 | 3,5 | 3,0 | 2,8 | 2,6 | 2,5 | 2,1 |
| 51,5 | 3,6 | 3,1 | 2,9 | 2,7 | 2,5 | 2,2 |
| 52,0 | 3,7 | 3,1 | 3,0 | 2,8 | 2,6 | 2,2 |
| 52,5 | 3,8 | 3,2 | 3,0 | 2,9 | 2,7 | 2,3 |
| 53,0 | 3,9 | 3,3 | 3,1 | 2,9 | 2,7 | 2,3 |
| 53,5 | 4,0 | 3,4 | 3,2 | 3,0 | 2,8 | 2,4 |
| 54,0 | 4,1 | 3,5 | 3,3 | 3,1 | 2,9 | 2,5 |
| 54,5 | 4,2 | 3,6 | 3,4 | 3,2 | 2,9 | 2,5 |
| 55,0 | 4,3 | 3,7 | 3,5 | 3,2 | 3,0 | 2,6 |
| 55,5 | 4,4 | 3,8 | 3,5 | 3,3 | 3,1 | 2,6 |
| 56,0 | 4,6 | 3,9 | 3,6 | 3,5 | 3,2 | 2,8 |
| 56,5 | 4,7 | 4,0 | 3,7 | 3,5 | 3,3 | 2,8 |
| 57,0 | 4,8 | 4,1 | 3,8 | 3,6 | 3,4 | 2,9 |
| 57,5 | 4,9 | 4,2 | 3,9 | 3,7 | 3,4 | 2,9 |
| 58,0 | 5,1 | 4,3 | 4,0 | 3,8 | 3,6 | 3,1 |
| 58,5 | 5,2 | 4,4 | 4,2 | 3,9 | 3,6 | 3,1 |
| 59,0 | 5,3 | 4,5 | 4,3 | 4,0 | 3,7 | 3,2 |
| 59,5 | 5,5 | 4,6 | 4,4 | 4,1 | 3,9 | 3,3 |
| 60,0 | 5,6 | 4,8 | 4,5 | 4,2 | 3,9 | 3,4 |
| 60,5 | 5,7 | 4,9 | 4,6 | 4,3 | 4,0 | 3,4 |
| 61,0 | 5,9 | 5,0 | 4,7 | 4,4 | 4,1 | 3,5 |
| 61,5 | 6,0 | 5,1 | 4,8 | 4,5 | 4,2 | 3,6 |
| 62,0 | 6,2 | 5,2 | 4,9 | 4,7 | 4,3 | 3,7 |
| 62,5 | 6,3 | 5,4 | 5,0 | 4,7 | 4,4 | 3,8 |
| 63,0 | 6,5 | 5,5 | 5,2 | 4,9 | 4,6 | 3,9 |
| 63,5 | 6,6 | 5,6 | 5,3 | 5,0 | 4,6 | 4,0 |
| 64,0 | 6,7 | 5,7 | 5,4 | 5,0 | 4,7 | 4,0 |
| 64,5 | 6,9 | 5,9 | 5,5 | 5,2 | 4,8 | 4,1 |
| 65,0 | 7,0 | 6,0 | 5,6 | 5,3 | 4,9 | 4,2 |
| 65,5 | 7,2 | 6,1 | 5,7 | 5,4 | 5,0 | 4,3 |
| 66,0 | 7,3 | 6,2 | 5,9 | 5,5 | 5,1 | 4,4 |
| 66,5 | 7,5 | 6,4 | 6,0 | 5,6 | 5,3 | 4,5 |
| 67,0 | 7,6 | 6,5 | 6,1 | 5,7 | 5,3 | 4,5 |
| 67,5 | 7,8 | 6,6 | 6,2 | 5,9 | 5,5 | 4,7 |
| 68,0 | 7,9 | 6,7 | 6,3 | 5,9 | 5,5 | 4,7 |
| 68,5 | 8,0 | 6,8 | 6,4 | 6,0 | 5,6 | 4,8 |
| 69,0 | 8,2 | 7,0 | 6,6 | 6,2 | 5,7 | 4,9 |
| 69,5 | 8,3 | 7,1 | 6,6 | 6,2 | 5,8 | 5,0 |
| 70,0 | 8,5 | 7,2 | 6,8 | 6,4 | 6,0 | 5,1 |
| 70,5 | 8,6 | 7,3 | 6,9 | 6,5 | 6,0 | 5,2 |
| 71,0 | 8,7 | 7,4 | 7,0 | 6,5 | 6,1 | 5,2 |
| 71,5 | 8,9 | 7,6 | 7,1 | 6,7 | 6,2 | 5,3 |
| 72,0 | 9,0 | 7,7 | 7,2 | 6,8 | 6,3 | 5,4 |
| 72,5 | 9,1 | 7,7 | 7,3 | 6,8 | 6,4 | 5,5 |
| 73,0 | 9,2 | 7,8 | 7,4 | 6,9 | 6,4 | 5,5 |
| 73,5 | 9,4 | 8,0 | 7,5 | 7,1 | 6,6 | 5,6 |
| 74,0 | 9,5 | 8,1 | 7,6 | 7,1 | 6,7 | 5,7 |
| 74,5 | 9,6 | 8,2 | 7,7 | 7,2 | 6,7 | 5,8 |
| 75,0 | 9,7 | 8,2 | 7,8 | 7,3 | 6,8 | 5,8 |
| 75,5 | 9,8 | 8,3 | 7,8 | 7,4 | 6,9 | 5,9 |
| 76,0 | 9,9 | 8,4 | 7,9 | 7,4 | 6,9 | 5,9 |
| 76,5 | 10,0 | 8,5 | 8,0 | 7,5 | 7,0 | 6,0 |
| 77,0 | 10,1 | 8,6 | 8,1 | 7,6 | 7,1 | 6,1 |
| 77,5 | 10,2 | 8,7 | 8,2 | 7,7 | 7,1 | 6,1 |
| 78,0 | 10,4 | 8,8 | 8,3 | 7,8 | 7,3 | 6,2 |
| 78,5 | 10,5 | 8,9 | 8,4 | 7,9 | 7,4 | 6,3 |
| 79,0 | 10,6 | 9,0 | 8,5 | 8,0 | 7,4 | 6,4 |
| 79,5 | 10,7 | 9,1 | 8,6 | 8,0 | 7,5 | 6,4 |
| 80,0 | 10,8 | 9,2 | 8,6 | 8,1 | 7,6 | 6,5 |
| 80,5 | 10,9 | 9,3 | 8,7 | 8,2 | 7,6 | 6,5 |
| 81,0 | 11,0 | 9,4 | 8,8 | 8,3 | 7,7 | 6,6 |
| 81,5 | 11,1 | 9,4 | 8,9 | 8,3 | 7,8 | 6,7 |
| 82,0 | 11,2 | 9,5 | 9,0 | 8,4 | 7,8 | 6,7 |
| 82,5 | 11,3 | 9,6 | 9,0 | 8,5 | 7,9 | 6,8 |
| 83,0 | 11,4 | 9,7 | 9,1 | 8,6 | 8,0 | 6,8 |
| 83,5 | 11,5 | 9,8 | 9,2 | 8,6 | 8,1 | 6,9 |
| 84,0 | 11,5 | 9,8 | 9,2 | 8,6 | 8,1 | 6,9 |
| 84,5 | 11,6 | 9,9 | 9,3 | 8,7 | 8,1 | 7,0 |

**height 100% 85% 80% in cm in Kg in Kg in Kg**

| | | | | | |
|---|---|---|---|---|---|
| 49,0 | 3,2 | | | | |
| 49,5 | 3,3 | 2,7 | 2,6 | 2,4 | |
| 50,0 | 3,4 | 2,8 | 2,6 | 2,5 | |
| 50,5 | 3,4 | 2,9 | 2,7 | 2,6 | |
| 51,0 | 3,5 | 2,9 | 2,7 | 2,6 | 3,0  2,8 |

Compiled and Edited by Dr. Abdul Rehman Pirzado pirzado@gmail.com

NCHS/CDC/WHO SEX-COMBINED CHILD GROWTH REFERENCES (1982), WEIGHT FOR HEIGHT INDEX EXPRESSED AS A PERCENTA GE OF THE MEDIAN WITH HEIGHT ASSESSED SUPINE UP TO 84.5 CM (LENGTH) AND STANDIN G FRO M 85.0 CM (HEIGHT)

| Height in cm | 100% in Kg | 85% in Kg | 80% in Kg | MALNUTRITION moderate 75% in Kg | moderate 70% in Kg | severe 60% in Kg | Height in cm | 100% in Kg | 85% in Kg | 80% in Kg | MALNUTRITION moderate 75% in Kg | moderate 70% in Kg | severe 60% in Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85,0 | 12,0 | 10,2 | 9,6 | 9,0 | 8,4 | 7,2 | 105,5 | 17,1 | 14,5 | 13,7 | 12,8 | 12,0 | 10,3 |
| 85,5 | 12,1 | 10,3 | 9,7 | 9,1 | 8,5 | 7,3 | 106,0 | 17,2 | 14,6 | 13,8 | 12,9 | 12,0 | 10,3 |
| 86,0 | 12,2 | 10,4 | 9,8 | 9,2 | 8,5 | 7,3 | 106,5 | 17,4 | 14,8 | 13,9 | 13,1 | 12,2 | 10,4 |
| 86,5 | 12,3 | 10,5 | 9,8 | 9,2 | 8,6 | 7,4 | 107,0 | 17,5 | 14,9 | 14,0 | 13,1 | 12,3 | 10,5 |
| 87,0 | 12,4 | 10,5 | 9,9 | 9,3 | 8,7 | 7,4 | 107,5 | 17,7 | 15,0 | 14,2 | 13,3 | 12,4 | 10,6 |
| 87,5 | 12,5 | 10,6 | 10,0 | 9,4 | 8,8 | 7,5 | 108,0 | 17,8 | 15,1 | 14,2 | 13,4 | 12,5 | 10,7 |
| 88,0 | 12,6 | 10,7 | 10,1 | 9,5 | 8,8 | 7,6 | 108,5 | 18,0 | 15,3 | 14,4 | 13,5 | 12,6 | 10,8 |
| 88,5 | 12,8 | 10,9 | 10,2 | 9,6 | 9,0 | 7,7 | 109,0 | 18,1 | 15,4 | 14,5 | 13,6 | 12,7 | 10,9 |
| 89,0 | 12,9 | 11,0 | 10,3 | 9,7 | 9,0 | 7,7 | 109,5 | 18,3 | 15,6 | 14,6 | 13,7 | 12,8 | 11,0 |
| 89,5 | 13,0 | 11,1 | 10,4 | 9,8 | 9,1 | 7,8 | 110,0 | 18,4 | 15,6 | 14,7 | 13,8 | 12,9 | 11,0 |
| 90,0 | 13,1 | 11,1 | 10,5 | 9,8 | 9,2 | 7,9 | 110,5 | 18,6 | 15,8 | 14,9 | 14,0 | 13,0 | 11,2 |
| 90,5 | 13,2 | 11,2 | 10,6 | 9,9 | 9,2 | 7,9 | 111,0 | 18,8 | 16,0 | 15,0 | 14,1 | 13,2 | 11,3 |
| 91,0 | 13,3 | 11,3 | 10,6 | 10,0 | 9,3 | 8,0 | 111,5 | 18,9 | 16,1 | 15,1 | 14,2 | 13,2 | 11,3 |
| 91,5 | 13,4 | 11,4 | 10,7 | 10,1 | 9,4 | 8,0 | 112,0 | 19,1 | 16,2 | 15,3 | 14,3 | 13,4 | 11,5 |
| 92,0 | 13,6 | 11,6 | 10,9 | 10,2 | 9,5 | 8,2 | 112,5 | 19,3 | 16,4 | 15,4 | 14,5 | 13,5 | 11,6 |
| 92,5 | 13,7 | 11,6 | 11,0 | 10,3 | 9,6 | 8,2 | 113,0 | 19,4 | 16,5 | 15,5 | 14,6 | 13,6 | 11,6 |
| 93,0 | 13,8 | 11,7 | 11,0 | 10,4 | 9,7 | 8,3 | 113,5 | 19,6 | 16,7 | 15,7 | 14,7 | 13,7 | 11,8 |
| 93,5 | 13,9 | 11,8 | 11,1 | 10,4 | 9,7 | 8,3 | 114,0 | 19,8 | 16,8 | 15,8 | 14,9 | 13,9 | 11,9 |
| 94,0 | 14,0 | 11,9 | 11,2 | 10,5 | 9,8 | 8,4 | 114,5 | 19,9 | 16,9 | 15,9 | 14,9 | 13,9 | 11,9 |
| 94,5 | 14,2 | 12,1 | 11,4 | 10,7 | 9,9 | 8,5 | 115,0 | 20,1 | 17,1 | 16,1 | 15,1 | 14,1 | 12,1 |
| 95,0 | 14,3 | 12,2 | 11,4 | 10,7 | 10,0 | 8,6 | 115,5 | 20,3 | 17,3 | 16,2 | 15,2 | 14,2 | 12,2 |
| 95,5 | 14,4 | 12,2 | 11,5 | 10,8 | 10,1 | 8,6 | 116,0 | 20,5 | 17,4 | 16,4 | 15,4 | 14,4 | 12,3 |
| 96,0 | 14,5 | 12,3 | 11,6 | 10,9 | 10,2 | 8,7 | 116,5 | 20,7 | 17,6 | 16,6 | 15,5 | 14,5 | 12,4 |
| 96,5 | 14,7 | 12,5 | 11,8 | 11,0 | 10,3 | 8,8 | 117,0 | 20,8 | 17,7 | 16,6 | 15,6 | 14,6 | 12,5 |
| 97,0 | 14,8 | 12,6 | 11,8 | 11,1 | 10,4 | 8,9 | 117,5 | 21,0 | 17,9 | 16,8 | 15,8 | 14,7 | 12,6 |
| 97,5 | 14,9 | 12,7 | 11,9 | 11,2 | 10,4 | 8,9 | 118,0 | 21,2 | 18,0 | 17,0 | 15,9 | 14,8 | 12,7 |
| 98,0 | 15,0 | 12,8 | 12,0 | 11,3 | 10,5 | 9,0 | 118,5 | 21,4 | 18,2 | 17,1 | 16,1 | 15,0 | 12,8 |
| 98,5 | 15,2 | 12,9 | 12,2 | 11,4 | 10,6 | 9,1 | 119,0 | 21,6 | 18,4 | 17,3 | 16,2 | 15,1 | 13,0 |
| 99,0 | 15,3 | 13,0 | 12,2 | 11,5 | 10,7 | 9,2 | 119,5 | 21,8 | 18,5 | 17,4 | 16,4 | 15,3 | 13,1 |
| 99,5 | 15,4 | 13,1 | 12,3 | 11,6 | 10,8 | 9,2 | 120,0 | 22,0 | 18,7 | 17,6 | 16,5 | 15,4 | 13,2 |
| 100,0 | 15,6 | 13,3 | 12,5 | 11,7 | 10,9 | 9,4 | 120,5 | 22,2 | 18,9 | 17,8 | 16,7 | 15,5 | 13,3 |
| 100,5 | 15,7 | 13,3 | 12,6 | 11,8 | 11,0 | 9,4 | 121,0 | 22,4 | 19,0 | 17,9 | 16,8 | 15,7 | 13,4 |
| 101,0 | 15,8 | 13,4 | 12,6 | 11,9 | 11,1 | 9,5 | 121,5 | 22,6 | 19,2 | 18,1 | 17,0 | 15,8 | 13,6 |
| 101,5 | 16,0 | 13,6 | 12,8 | 12,0 | 11,2 | 9,6 | 122,0 | 22,8 | 19,4 | 18,2 | 17,1 | 16,0 | 13,7 |
| 102,0 | 16,1 | 13,7 | 12,9 | 12,1 | 11,3 | 9,7 | 122,5 | 23,1 | 19,6 | 18,5 | 17,3 | 16,2 | 13,9 |
| 102,5 | 16,2 | 13,8 | 13,0 | 12,2 | 11,3 | 9,7 | 123,0 | 23,3 | 19,8 | 18,6 | 17,5 | 16,3 | 14,0 |
| 103,0 | 16,4 | 13,9 | 13,1 | 12,3 | 11,5 | 9,8 | 123,5 | 23,5 | 20,0 | 18,8 | 17,6 | 16,5 | 14,1 |
| 103,5 | 16,5 | 14,0 | 13,2 | 12,4 | 11,6 | 9,9 | 124,0 | 23,7 | 20,1 | 19,0 | 17,8 | 16,6 | 14,2 |
| 104,0 | 16,7 | 14,2 | 13,4 | 12,5 | 11,7 | 10,0 | 124,5 | 24,0 | 20,4 | 19,2 | 18,0 | 16,8 | 14,4 |
| 104,5 | 16,8 | 14,3 | 13,4 | 12,6 | 11,8 | 10,1 | 125,0 | 24,2 | 20,6 | 19,4 | 18,2 | 16,9 | 14,5 |
| 105,0 | 16,9 | 14,4 | 13,5 | 12,7 | 11,8 | 10,1 | 125,5 | 24,4 | 20,7 | 19,5 | 18,3 | 17,1 | 14,6 |

## EXERCISE 2.1
### GRADES OF BILATERA L PITTING OEDEMA

**PICTURE- I**

Clinical signs:

Anthropometry



**PICTURE -2**

Clinical signs:

Anthropometry



**PICTURE - 3**

Clinical signs:

Anthropometry



EXERCISE 2.1

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## EXERCISE 2.2

### CALCULATIN G WFH AND CLASSIFYING ACUTE MALNUTRITION

**bilateral Pitting Edema and Mid-Upper arm Circumference (MUAC**

| Child name | sex | age (in years unless noted) | bilateral Pitting Edema | MUAC (mm or color) | height (cm) | Weight (kg) | WFH Z-score Category | Classification |
|---|---|---|---|---|---|---|---|---|
| Child 1 | F | 3 | no | Green | 98.2 | 12.5 | | |
| Child 2 | M | 5 | no | 123 | 110.0 | 14.8 | | |
| Child 3 | M | 5 | ++ | Yellow | 102.2 | 13.5 | | |
| Child 4 | F | 4 | no | 110 | 91.1 | 9.3 | | |
| Child 5 | M | 9 months | no | 125 | 69.9 | 6.7 | | |
| Child 6 | F | 4 | +++ | Yellow | 105.2 | 18 | | |
| Child 7 | F | 8 months | + | 105 | 68.2 | 5.0 | | |
| Child 8 | M | 1 | no | Red | 84.3 | 8.9 | | |
| Child 9 | F | 2 | no | 109 | 97.2 | 11 | | |
| Child 10 | M | 1.5 | + | Green | 89.7 | 12.9 | | |

**bilateral Pitting edema, MUAC and Weight-for-height (WFH) Z-score (World health Organization)**

| Child name | age (in years unless noted) | bilateral Pitting edema | MUAC (mm or color) | Classification |
|---|---|---|---|---|
| Child 1 | 3 | no | Green | |
| Child 2 | 5 | no | 123 | |
| Child 3 | 5 | ++ | Yellow | |
| Child 4 | 4 | no | 110 | |
| Child 5 | 9 months | no | 125 | |
| Child 6 | 4 | +++ | Yellow | |
| Child 7 | 8 months | + | 105 | |
| Child 8 | 1 | no | Red | |
| Child 9 | 2 | no | 109 | |
| Child 10 | 1.5 | + | Green | |

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**bilateral Pitting edema, MUAC and WFH as a Percentage of the Median (national Centre for health statistics [NCHS])**

| Child name | age (in years unless noted) | bilateral Pitting edema | MUAC (mm or color) | height (cm) | Weight (kg) | WFH as a Percentage of the Median | Classification |
|---|---|---|---|---|---|---|---|
| Child 1 | 3 | no | Green | 98.2 | 12.5 | | |
| Child 2 | 5 | no | 123 | 110.0 | 14.8 | | |
| Child 3 | 5 | ++ | Yellow | 102.2 | 13.5 | | |
| Child 4 | 4 | no | 110 | 91.1 | 9.3 | | |
| Child 5 | 9 months | no | 125 | 69.9 | 6.7 | | |
| Child 6 | 4 | +++ | Yellow | 105.2 | 18 | | |
| Child 7 | 8 months | + | 105 | 68.2 | 5.0 | | |
| Child 8 | 1 | no | Red | 84.3 | 8.9 | | |
| Child 9 | 2 | no | 109 | 97.2 | 11 | | |
| Child 10 | 1.5 | + | Green | 89.7 | 12.9 | | |

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