Government of Malawi
Ministry of Health

Training Course on

INPATIENT MANAGEMENT OF SEVERE ACUTE MALNUTRITION

Module 2. Principles of Care

SEPTEMBER 2017

Contents

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Preface

The *Malawi Inpatient Management of Severe Acute Malnutrition Training Package* includes training modules, training guides, training aids, training planning tools, and job aids. The training package is based on the 2002 World Health Organisation (WHO) Training Course on the Management of Severe Malnutrition (SAM) and has been updated to include the 2013 WHO update on management of SAM in infants and children. The training package guides participants in applying the National Guidelines for the Community-based Management of Acute Malnutrition (CMAM), 2016.

This *Module* is one of a set of training guides and modules for conducting the *Training Course on Inpatient Management of Severe Acute Malnutrition:*

Guides
Facilitator Guide
Clinical Instructor Guide
Course Director Guide

Modules
Module 1—Introduction
Module 2—Principles of Care
Module 3—Initial Management
Module 4—Feeding
Module 5—Daily Care
Module 6—Monitoring, Problem Solving and Reporting
Module 7—Involving Mothers in Care

Acronyms and Abbreviations

AM	Acute Malnutrition
AWG	Average Daily Weight Gain
BMI	Body Mass Index
CHW	Community Health Worker
cm	Centimetre(s)
CMAM	Community-Based Management of Acute Malnutrition
CMV	Combined Mineral and Vitamin Mix
CSB	Corn-Soya Blend
dl	Decilitre(s)
ETAT	Emergency Triage Assessment and Treatment
g	Gram(s)
GAM	Global Acute Malnutrition
HDU	High Dependency Unit
Hg	Haemoglobin
HFA	Height-for-Age
HIV	Human Immunodeficiency Virus
IgA	Immunoglobulin A
IGF	Insulin Growth Factor
IM	Intramuscular
IMCI	Integrated Management of Childhood Illness
IU	International Unit(s)
IV	Intravenous
IYCF	Infant and Young Child Feeding
kcal	Kilocalorie(s)
kg	Kilogram(s)
L	Litre(s)
LA	Lumefantrine–Artemether
LFA	Length-for-Age
LOS	Length of Stay
LRTI	Lower Respiratory Tract Infection
M&R	Monitoring and Reporting
MAM	Moderate Acute Malnutrition
mg	Milligram(s)
ml	Millilitre(s)
mm	Millimetre(s)
mmol	Millimoles
MOH	Ministry of Health
MUAC	Mid-Upper Arm Circumference
NG	Nasogastric
NGO	Nongovernmental Organisation

NRU	Nutrition Rehabilitation Unit
OPD	Outpatient Department
ORS	Oral Rehydration Solution
OTP	Outpatient Therapy
PCR	Polymerase Chain Reaction
PCV	Packed Cell Volume
QI	Quality Improvement
RDT	Rapid Diagnostic Test
ReSoMal	Rehydration Solution for Malnutrition
RUTF	Ready-to-Use Therapeutic Food
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SFP	Supplementary Feeding Programme
TB	Tuberculosis
WFA	Weight-for-Age
WFH	Weight-for-Height
WFL	Weight-for-Length
WFP	World Food Programme
WHO	World Health Organisation
µg	Microgram(s)

Introduction

This module describes how to recognise a child with severe acute malnutrition (SAM) and outlines the essential components of care. A child with SAM has a disturbed metabolism and is likely to have many serious health problems. In many cases, these problems may not be clinically apparent. In some cases, the usual treatment for a health problem may be harmful or even fatal for a child with SAM. This module describes how the physiology of a child with SAM is different from a child without SAM, and how these differences affect care.

Learning Objectives

This module describes how and allows you to practise the skills needed to identify children with SAM. By the end of the module, you will be able to:

- Define SAM
- Recognise clinical signs of SAM
- Weigh and measure a child
    - Measure mid-upper arm circumference (MUAC)
    - Measure weight
    - Measure height or length
- Identify a child with SAM
    - Presence of oedema
    - Severe wasting based on MUAC
    - Severe wasting based on low weight-for-height[1] (WFH) z-score
- Understand the criteria for admission
- Understand how the physiology of SAM affects care of a child
    - What is reductive adaptation?
    - How does reductive adaptation affect care of the child?
- List the essential components of care
    - Procedures for successful inpatient management of SAM
    - Feeding—recipes for F-75, F-100 and composition of ready-to-use therapeutic food (RUTF)
    - Mineral and vitamin mix
    - Important things NOT to do and why
- Understand the procedures for discharge, transfer and end of treatment
    - Discharge from hospital after stabilisation and transfer to outpatient care
    - Discharge from hospital at the end of treatment at full recovery, where early discharge to OTP is not possible

[1] Although the terms ‘length’ and ‘height’ are often used interchangeably in the text of these modules, it should be understood that, if a child is less than 2 years of age (or if a child’s age is not known and he or she is less than 87 cm tall), recumbent length is measured. If a child is 2 years or older (or if a child’s age is not known and he or she is 87 cm tall or taller), standing height is measured. If a child 2 years or older or 87 cm tall or taller is unable to stand, measure recumbent length and subtract 0.7 cm from the length to arrive at a comparable height.

1.0 Defining SAM

Nutrition is a broad term for processes involved in eating, digestion and utilisation of food by the body for growth and development, reproduction, physical activity and maintenance of health.

Malnutrition occurs when an individual's dietary intake is not balanced with his or her nutritional needs, harming health, well-being and/or productivity. Malnutrition includes **undernutrition** and **overnutrition.** Undernutrition is defined as a lack of nutrients caused by inadequate dietary intake and/or disease. It encompasses a range of conditions, including acute malnutrition, chronic malnutrition or stunting[2], a mixed form of acute and chronic malnutrition or underweight[3], and deficiencies of micronutrients, such as vitamin A, iron, iodine and zinc. Overnutrition occurs when the body takes in more nutrients than required for normal growth, leading to excessive fat accumulation, presenting a risk to health. Overnutrition conditions include overweight and obesity.

These training modules focus on severe acute malnutrition (SAM), which is a nutritional condition defined by severe wasting (thinness) and/or presence of bilateral pitting oedema. The milder form of acute malnutrition, moderate acute malnutrition (MAM), is defined by moderate wasting.

SAM in children 6–59 months is defined by the presence of bilateral pitting oedema or severe wasting based on a mid-upper arm circumference (MUAC) less than 11.5 cm or a weight-for-height (WFH) < −3 z-score. SAM in infants less than 6 months is defined by the presence of bilateral pitting oedema or severe wasting based on a weight-for-length (WFL) < −3 z-score.

A child with SAM is vulnerable and at high risk of mortality. A child with SAM presenting with medical complications has increased risk of death and requires specialised hospital care which differs from the standard treatment of children who do not have SAM. Children with SAM without medical complications and who have a good appetite have less severe metabolic disturbances and can be managed successfully as outpatients.

[2] Stunting is inadequate height-for-age (HFA) or length-for-age (LFA), often due to chronic malnutrition. Stunted children should be managed in the community through appropriate infant and young child feeding (IYCF) and care practices for the prevention of malnutrition.

[3] Underweight is inadequate weight-for-age (WFA), often due to a mixed form of acute and chronic malnutrition. An underweight child may be adequate in WFH but low in HFA (short but not thin), or adequate in HFA but low in WFH (thin but not short), or low in both (short and thin), as is very common. Infants and young children should be regularly monitored in the community for growth, and those with signs of growth failure should be identified early and referred for further investigation and support.

2.0 Recognising Clinical Signs of SAM

Clinical signs and anthropometric indicators are used to determine whether or not a child has SAM, while the child's appetite and medical condition will guide the decision making whether the child should be treated as an inpatient or outpatient.

The presence of integrated management of childhood illness (IMCI) danger signs; emergency signs identified based on emergency triage assessment and treatment (ETAT) protocols; and subsequent full assessment will guide the treatment plan for a SAM child in outpatient care or the inpatient care.

We will first learn about the clinical signs and subsequently about the anthropometric indicators.

2.1 Visible Severe Wasting

A child with severe wasting has lost fat and muscle. A clinical term used for this condition is 'marasmus'.

To look for severe wasting, remove the child's clothes. Look at the front view of the child:

- Is the outline of the child's ribs easily seen?
- Does the skin of the upper arms look loose?
- Does the skin of the thighs look loose?

Look at the back view of the child:

- Are the ribs and shoulder bones easily seen?
- Is flesh missing from the buttocks?

When wasting is extreme, there are folds of skin on the buttocks and thighs that look like 'baggy pants'. Because a wasted child has lost fat and muscle, the child's MUAC reading will be low, and he or she will weigh less than healthy children of the same height, thus will have a low WFH. MUAC or WFH will be checked to confirm severe wasting.

*NOTE: **MUAC** correlates well with muscle mass and, hence, with body nutritional reserves. Evidence suggests that MUAC correlates better with risk of death than **weight for height.***

2.2 Bilateral Pitting Oedema

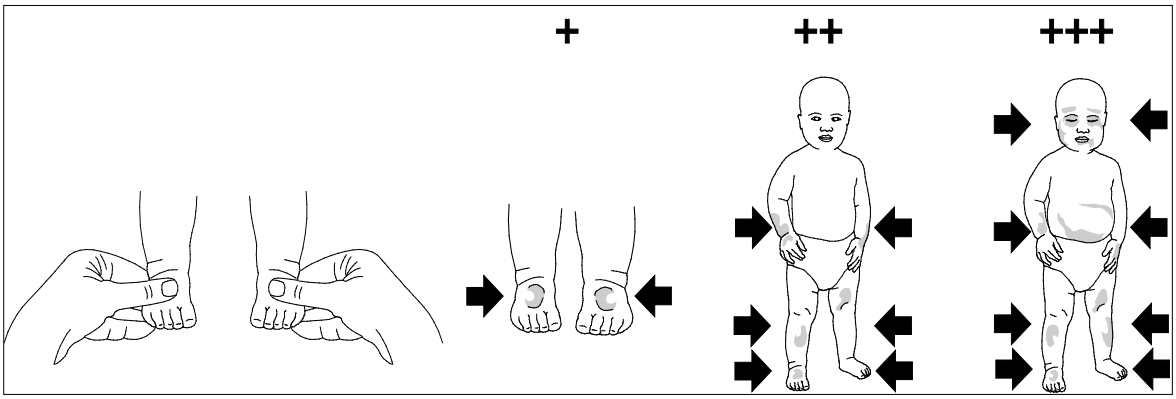
Oedema is an accumulation of fluid in the tissues. Oedema of nutritional origin is characterised by being bilateral and pitting, seen in the feet, lower legs and arms. In severe cases, it may also be seen in the upper limbs and face.

To check for oedema, grasp both feet so that they rest in your hands with your thumbs on top of the feet. Press your thumbs gently for a few seconds (count one hundred one, one hundred two, one hundred three). The child has bilateral pitting oedema if a pit (dent) remains in both feet when you lift your thumbs. To be considered a sign of SAM, oedema must appear in both feet. If the swelling is in only one foot, it may just be sore or infection in the affected foot. The extent of oedema is commonly graded in the following way:

+ mild: oedema in both feet

++ moderate: oedema in both feet, plus lower legs, hands or lower arms

+++ severe: generalised oedema, including both feet, legs, hands, arms and face



Pictures of Bilateral Pitting Oedema

Mild (Grade +)
This child has mild, grade + bilateral pitting oedema. However, the child might have grade ++ or +++, so legs and face will also need to be checked.

Moderate (Grade ++)
In this child both feet plus the lower legs, hands and lower arms are swollen. This is moderate or grade ++ bilateral pitting oedema.

Severe (Grade +++)
This child has grade +++ or severe bilateral pitting oedema. It is generalised, including feet, legs, arms, hands and face.

NOTE: BILATERAL PITTING OEDEMA IS ALSO PRESENT IN CHILDREN WITH NEPHROTIC SYNDROME. CONDUCT URINE DIPSTICK TEST FOR EVERY CHILD PRESENTING WITH BILATERAL PITTING OEDEMA TO RULE OUT NEPHROTIC SYNDROME.

2.3 Dermatosis

Dermatosis is a condition of the skin. In children with SAM, it is more common in those presenting with bilateral pitting oedema than in severely wasted children. A child with dermatosis may have patches of skin that are abnormally light or dark in colour, shedding of skin in scales or sheets and ulceration of the skin of the perineum, groin, limbs, behind the ears and in the armpits. There may be weeping lesions. There may be a severe rash in the nappy area. Any break in the skin can let dangerous bacteria into the body. When the skin is raw and weeping, this risk is very high.

The extent of dermatosis is described in the following way:

+ mild: discolouration or a few rough patches of skin

++ moderate: multiple patches on skin of arms and/or legs

+++ severe: flaking skin, raw skin, fissures (openings in the skin)

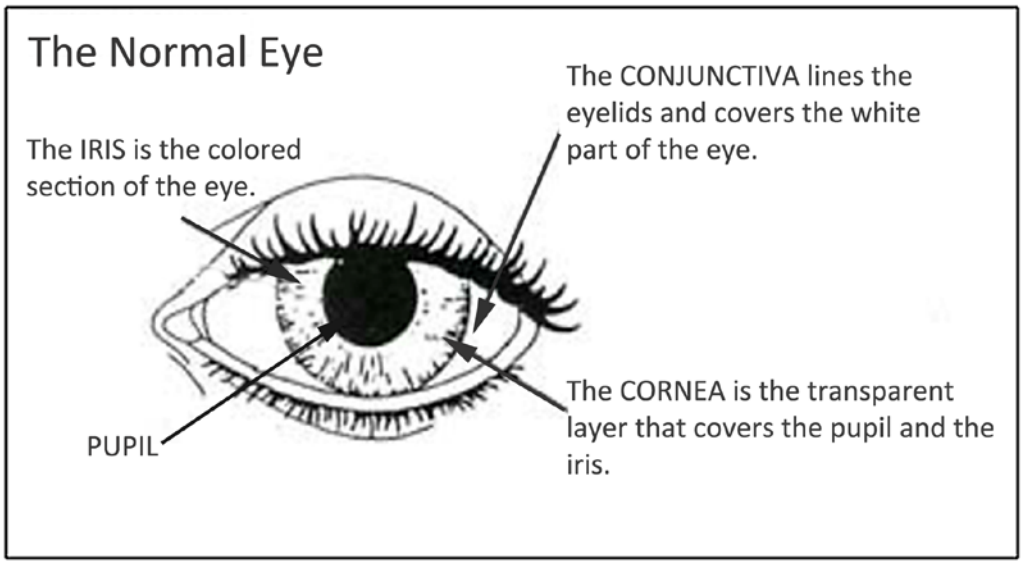
Treatment of dermatosis is discussed in **Module 5. Daily Care**.

2.4 Blinding Eye Signs

Children with SAM may have signs of eye infection and/or vitamin A deficiency.

- **Bitot's spots** are superficial foamy white spots on the conjunctiva (white part of the eye). These are associated with vitamin A deficiency.
- **Corneal clouding** is seen as an opaque appearance of the cornea (the transparent layer that covers the pupil and iris). It is a sign of severe vitamin A deficiency.
- **Corneal ulceration** is a break in the surface of the cornea. It is a sign of very severe vitamin A deficiency. If not treated, the lens of the eye may push out and cause blindness. Corneal ulceration is urgent and requires immediate treatment with vitamin A and atropine (to relax the eye).

Pus and inflammation (redness) are signs of bacterial eye infection.



Treatment of all eye signs will be discussed in **Module 3. Initial Management**, and **Module 5. Daily Care**.

2.5 Emergency Triage, Assessment and Treatment (ETAT)

SAM children with complications should be managed using the ETAT principles upon admission.

2.5.1 Triage

Triage is the process of rapidly screening sick children soon after their arrival in hospital to identify:

- Those with emergency signs, who require immediate emergency treatment
- Those with priority signs, who should be given priority in the queue so that they can be assessed and treated without delay
- Non-urgent cases, who have neither emergency nor priority signs

Emergency signs include:

- Obstructed or absent breathing
- Severe respiratory distress
- Central cyanosis
- Signs of shock (cold hands, capillary refill time longer than 3 seconds, high heart rate with weak pulse and low or unmeasurable blood pressure)
- Coma (or seriously reduced level of consciousness)
- Convulsions
- Signs of severe dehydration in a child with diarrhoea (lethargy, sunken eyes, very slow return after pinching the skin or any two of these)

Children with these signs require immediate emergency treatment to prevent death. The priority signs identify those children who are at higher risk of dying. These children should be assessed without unnecessary delay. If a child has one or more emergency signs, do not spend time looking for priority signs, *refer and treat according to the Malawi ETAT Guidelines.*

During triage, **all** children with SAM will be identified as having **priority signs**, which means that they require prompt assessment and treatment. A **few** children with SAM will be found during triage assessment to have one or some of the following **emergency signs:**

- Central cyanosis, severe respiratory distress, cough with fast breathing and chest indrawing
- Shock: cold hands with slow capillary refill and weak and fast pulse
- Anorexia, no appetite
- Intractable vomiting
- Convulsions
- Lethargy
- Unconsciousness
- Hypoglycaemia
- High fever (axillary temperature $\geq 38.5^0$ C)
- Hypothermia (axillary temperature $< 35^0$ C)
- Diarrhoea, recent sunken eyes or severe dehydration
- Severe anaemia
- Skin lesions (e.g., severe dermatosis 3+)
- Blinding eye signs of vitamin A deficiency

The following emergency signs should be assessed in three steps:

- **Step 1:** Check whether there is any airway or breathing problem; start immediate treatment to restore breathing. Manage the airway and give oxygen.
- **Step 2**. Quickly check whether the child is in shock or has diarrhoea with severe dehydration. Give oxygen and start intravenous (IV) fluid resuscitation. In trauma, if there is external bleeding, compress the wound to stop further blood loss.
- **Step 3**. Quickly determine whether the child is unconscious or convulsing. Give IV glucose for hypoglycaemia and/or an anti-convulsant for convulsing.

If any emergency sign is present, the child should receive emergency treatment immediately, and a full assessment is postponed. The following should be done:

- Call for help from an experienced health professional if available, but do not delay starting treatment. Stay calm and work with other health workers who may be required to give the treatment, because a very sick child may need several treatments at once. The most experienced health professional should continue assessing the child to identify all underlying problems and prepare a treatment plan.
- Carry out emergency investigations (blood glucose, blood smear, haemoglobin [Hb]). Send blood for typing and cross-matching if the child is in shock, appears to be severely anaemic or is bleeding significantly.
- After giving emergency treatment, proceed immediately to assessing, diagnosing and treating the underlying problem.

If no emergency signs are found, check for other priority signs, apart from malnutrition:

- Tiny infant: any sick child aged < 2 months
- Temperature: child is very hot
- Trauma or other urgent surgical condition
- Pallor (severe)
- Poisoning (history of)
- Pain (severe)
- Respiratory distress
- Restless, continuously irritable or lethargic
- Referral (urgent)
- Burns (major)

If a child has priority signs move the child to the front of the queue to be assessed next. If a child has trauma or other surgical problems, get surgical help where available.

Signs and treatment of the medical emergency conditions are addressed in **Module 3. Initial Management**. The case definitions that are listed in **Table 1** are helpful to understand some terms.

Table 1. Emergency signs and main symptoms

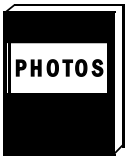
Emergency signs	Main symptoms
Anorexia, poor appetite	Child is not drinking or breastfeeding as often or as long as usual, or the child vomits everything. Child fails the observed appetite test with RUTF.
Blinding eye signs	Stages of xerophthalmia are: night blindness; conjunctival xerosis or dry, opaque and dull conjunctiva with or without Bitot's spots (foamy material on conjunctiva); corneal xerosis or corneal clouding with a dry and dull cornea; keratomalacia or corneal ulceration, necrosis, perforation of cornea leading to total blindness.
Convulsions	Child has uncontrollable movements of limbs and/or face, and/or rolling eyes and/or loss of consciousness during a convulsion.
Dehydration	Child with SAM has major fluid loss through diarrhoea or severe vomiting, with recent sunken eyes as reported by the mother.
Hyperthermia	Child has a high body temperature—axillary temperature ≥ 38.5° or rectal temperature ≥ 39° C—taking into consideration the ambient temperature.
Hypoglycaemia	There are often no clinical signs for hypoglycaemia. One sign that does occur in a child with SAM is eyelid retraction: The child sleeps with eyes slightly open.
Hypothermia	Child has a low body temperature—axillary temperature < 35° C —taking into consideration the ambient temperature.
Intractable vomiting	Child is vomiting after every oral intake.
Lethargy, not alert	Child is difficult to wake. Ask the mother if the child is drowsy, shows no interest in what is happening around him/her, does not look at the mother or watch her face when talking or is unusually sleepy.
Respiratory distress	Child has deep laboured breathing, sometimes with chest indrawings.
Severe pallor	Child has palmar pallor or unusual paleness of the skin (compare the colour of the child's palm with the palms of other children); Severe anaemia is defined as Hb < 4 grams per decilitre (g/dl) or Hb is 4–6 g/dl with respiratory distress.
Severe pneumonia	Child has cough with fast breathing, chest indrawing, high fever, coarse crackles, nasal flaring and/or grunting.
Shock	Child has cold hands with slow capillary refill (longer than 3 seconds) and/or fast and weak pulse.
Unconsciousness or coma	Child does not respond to painful stimuli.

Other medical conditions that commonly present with SAM and for which clinicians must be alerted to early diagnose and provide immediate medical attention are:

- Candidiasis
- Congestive heart failure during rehydration
- Dysentery
- Helminthiasis
- Hepatitis
- HIV
- Malaria
- Measles
- Meningitis
- Micronutrient deficiencies

- Otitis media
- Persistent diarrhoea
- Physical disability or mental disorder interfering with feeding
- Re-feeding syndrome
- Skin infections
- Tuberculosis (TB)
- Urinary tract infections
- Any other serious underlying disease

The management of the above-listed medical conditions will be discussed later and are summarised in **Module 3. Initial Management, Annex C**.



Exercise A

In this exercise, you will look at photographs of children and identify signs related to SAM.

Open your photo booklet. Each photo is numbered. For each photo listed below in this exercise, write down all of the following signs you see:

- severe wasting
- oedema
- dermatosis
- eye signs (Bitot's spots, pus, inflammation, corneal clouding, corneal ulceration)

If the child has dermatosis or oedema, try to estimate the degree of severity (+, ++ or +++). If you see none of the signs, write NONE. When everyone in the group has finished, conduct a discussion of the photographs. Photo 1 is described below as an example.

Photo 1: Moderate (++) oedema, seen in feet and lower legs
Severe wasting of upper arms; ribs and collarbones clearly show.

Photo 2:

Photos 3 and 4 (front and back view of same child):

Photo 5:

Photo 6:

Photo 7:

Photo 8:

Photo 9:

Photo 10:

Photo 11:

Photo 12:

Photo 13:

Photo 14:

Photo 15:

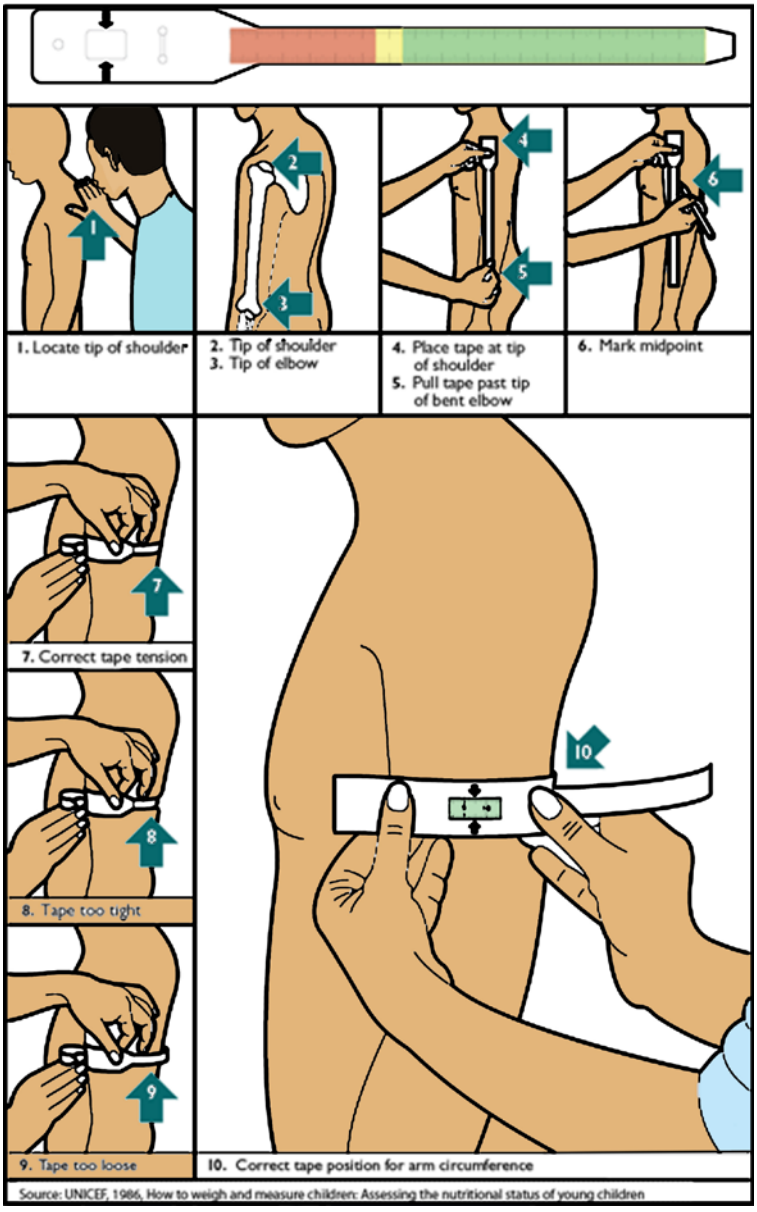
When you have completed this exercise,
tell a facilitator that you are ready for the group discussion.

3.0 Weighing and Measuring a Child

In addition to looking for visible signs of SAM, it is important to measure a child's anthropometry. Anthropometric indicators are commonly used to objectively and promptly classify the nutritional condition of children and, therefore, are used as key criteria for admission to treatment (and discharge).

3.1 Measuring MUAC

- Always measure MUAC on the left arm.
- Measure the length of the child's upper arm, between the bone at the top of the shoulder [2] and the tip of the elbow [3] (the child's arm should be bent to easily locate the tip).
- Find the midpoint of the upper arm and mark it with a pen [6]. It is easier to use a string instead of the MUAC tape to find the midpoint.
- The child's arm should then be relaxed, falling alongside his or her body.
- Wrap the MUAC tape around the child's arm, so that all of it is in contact with the child's skin [7]. It should be neither too tight [8] nor too loose [9].
- Feed the end of the tape through the first opening and then through the second opening. The measurement is read from the window where the arrows point inward [10].
- Record the MUAC reading with a precision of 0.1 cm.



3.2 Interpretation of mid upper arm circumference

Table 2. MUAC Cut Offs

Age	MUAC Measurement	Interpretation
6–59 months	< 11.5 cm	Severe wasting
	≥ 11.5 cm – < 12.5 cm	Moderate wasting
	≥12.5 cm	No wasting
5–9 years	< 13.0cm	Severe wasting
	≥ 13 – < 14.5 cm	Moderate
	≥ 14.5 cm	No wasting
10–15 years	< 16 cm	Severe wasting
	≥ 16.0 – < 18.5 cm	Moderate wasting
	≥ 18.5 cm	No wasting

3.3 Measuring a Child's or Infant's Weight

Weigh the child as soon as possible after he or she arrives, if his/her condition allows. Weigh the child once a day, preferably at about the same time each day. The weighing time should be about 1 hour before or after a feeding.

Tips for Weighing a Child or Infant

- Always explain to the mother how the child will be weighed before weighing the child.
- Children should be weighed naked. Have the mother remove the child's clothes.
- Put a soft cloth or the child's wrapping on the scale to protect the child from the hard and potentially cold surface. Set the scale to zero.
- Read the child's weight when the child is not moving. The child should remain still for the weighing.
- Scales must be cleaned and re-zeroed after each weighing.

An electronic scale is the preferred type of scale to weigh children, and should have the following features:

- Is solidly built and durable
- Has a digital readout
- Measures up to 150 kg
- Measures to a precision of 0.1 kg (100 g) for children and to a precision of 0.01 kg (10 g) for infants
- Allows 'tared weighing'

'Tared weighing' means that the scale can be reset to zero ('tared') with a person on it. Thus, a mother can stand on the scale and be weighed, and the scale can then be tared without the mother getting off. While remaining on the scale, a mother can then be given a child to hold and only the child's weight will appear on the scale.

Tared weighing has two clear advantages:

- There is no need to subtract weights to determine the child's weight alone (reducing the risk of error).
- The child is likely to remain calm when held in the mother's arms.

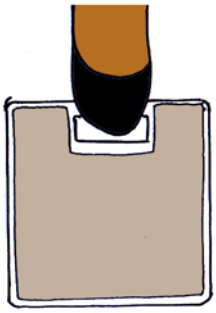
There are many types of scales currently in use. Certain scales can be used for all ages, others only for older children, while others should be used only for infants. The appropriate ages are identified in parentheses after each type of scale.

Solar Electronic Scale (All Ages)

There are solar electronic scales that have all the recommended features listed above, for example, UNICEF's UNISCALE.

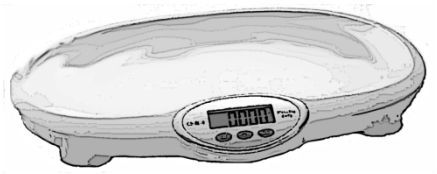
Explain the tared weighing procedure to the mother. Stress that the mother must stay on the scale until her child has been weighed in her arms.

Be sure that the scale is placed on a flat, hard, even surface.



- To turn on the scale and cover the solar panel for a second. When the number 0.0 appears, the scale is ready.
- Check to see that the mother has removed her shoes. You or someone else should hold the naked child wrapped in a *chitenje* or blanket.
- Ask the mother to stand in the middle of the scale, feet slightly apart (on the footprints, if marked), and remain still. The mother's clothing must not cover the display area.
- Remind the mother to stay on the scale even after her weight appears, until the baby has been weighed in her arms.
- With the mother still on the scale and her weight displayed, tare the scale by covering the solar panel for a second. The scale is tared when it displays a figure of a mother and baby and the number 0.0.
- Gently hand the naked baby to the mother and ask her to remain still.
- The baby's weight will appear on the display. Record the weight of the baby.
- Be careful to read the numbers in the correct order (as though you were viewing them while standing on the scale, rather than upside-down).

Infant Bench Scale (Infants less than 12 months)



Steps:

1. Have the mother remove the infant's clothes and hold the child.
2. Put a soft cloth or the infant's wrapping on the scale and turn it on. Wait until the scale shows zeros.
3. Within 60 seconds of the scale showing zeros, have the mother put the infant on the scale. Advise the mother to remain close but not to touch the infant or the scale. The scale will display the infant's weight.
4. Read and write down the infant's weight with a 10-gram precision (e.g., 3 kg 470 g).
5. Turn off the scale and remove the infant.
6. Clean the scale.

3.4 Measuring a Child's Length/Height

Depending on a child's age and ability to stand, measure the child's length or height. A child's length is measured lying down (recumbent). Height is measured standing upright.

- If a child is less than 2 years old (or less than 87 cm if the age is not available), measure recumbent length.
- If the child is aged 2 years or older (or 87 cm or more if the age is not available) and able to stand, measure standing height.

In general, standing height is about 0.7 cm less than recumbent length. This difference was taken into account in developing the World Health Organisation (WHO) growth standards used to make the charts in the Growth Record.

It is important, therefore, to adjust the measurements if length is taken instead of height, and vice versa.

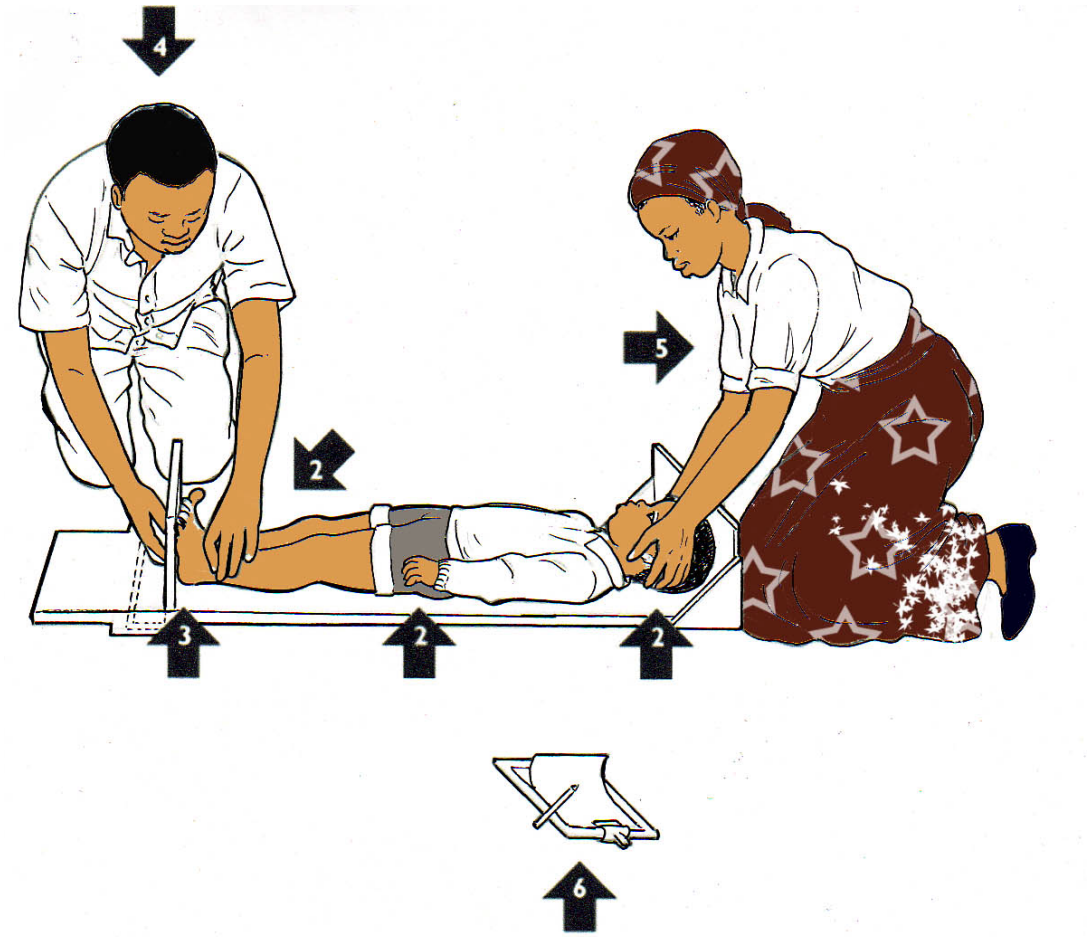
If a child less than 2 years old will not lie down for measurement of length, measure standing height and add 0.7 cm to convert it to length. If a child aged 2 years or older cannot stand, measure recumbent length and subtract 0.7 cm to convert it to height.

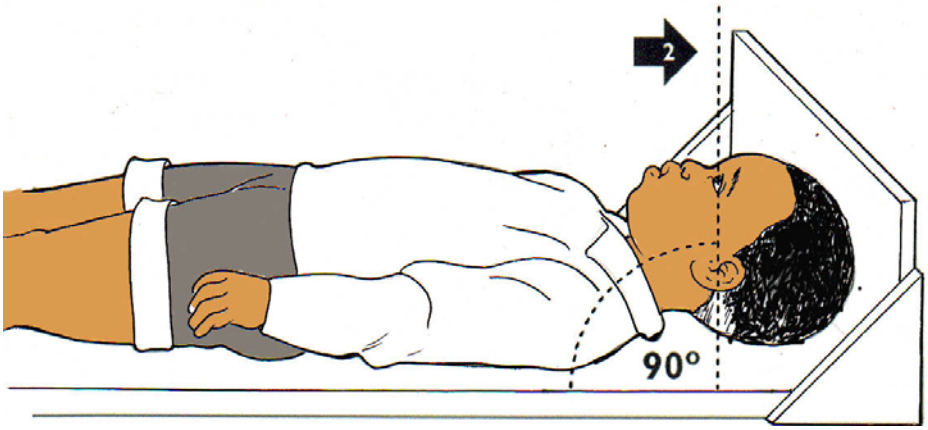
Whether measuring length or height, the mother should be nearby to help soothe and comfort the child.

Length Board (under 2 years *OR* less than 87 cm tall and age is not known *OR* 2 years or older or at least 87 cm tall but unable to stand)

1. Lay the child down along the middle of the board.
2. The assistant holds the sides of the child's head while firmly touching the head against the fixed headboard with the hair compressed.
3. The measurer places her hands on the child's legs and keeps one hand on the knees to prevent flexion.
4. With the legs immobilised the moveable board is pushed firmly against the child's feet.

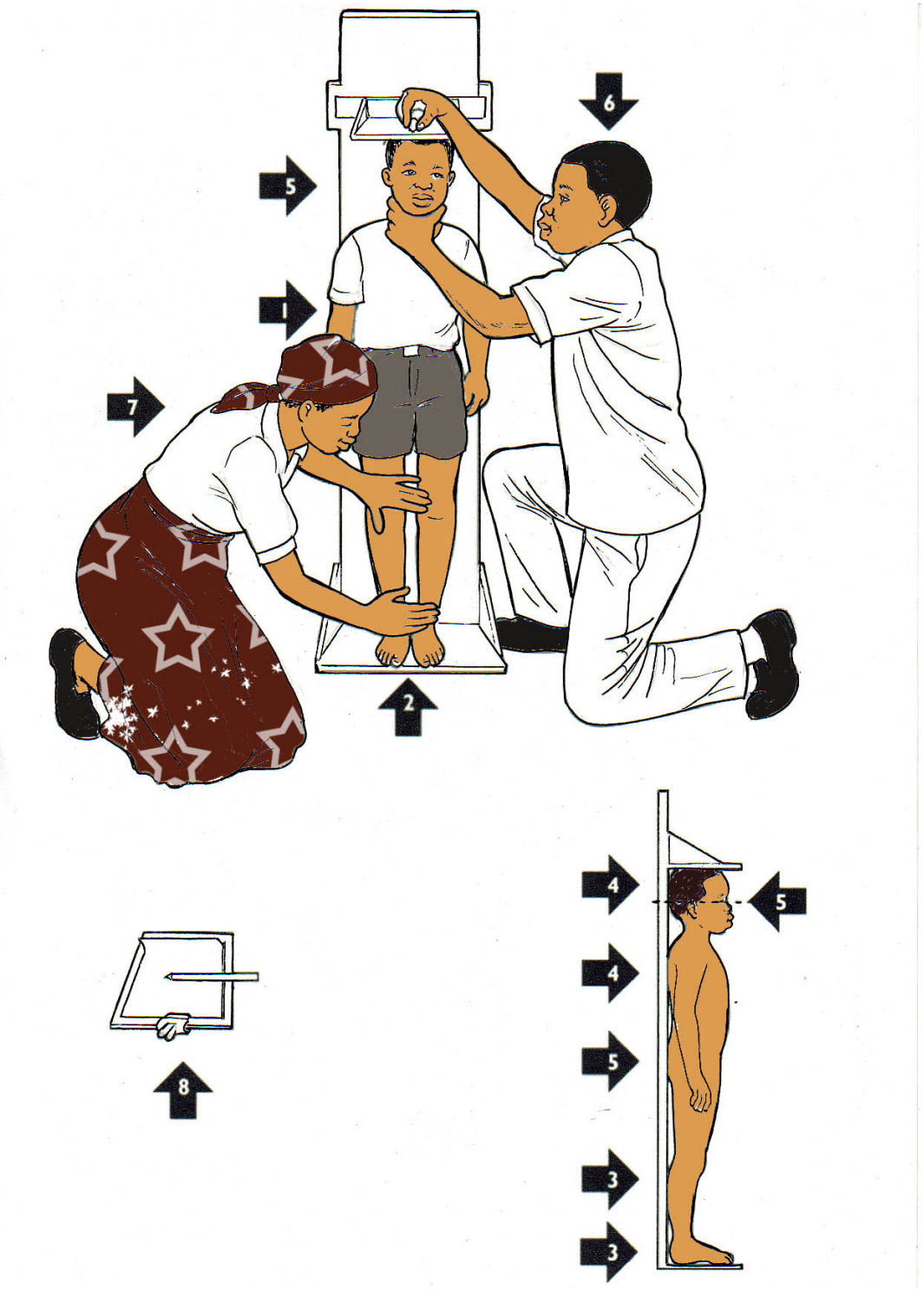
5. The footboard should be perpendicular to the axis of the board and vertical.
6. The height is read to the nearest 0.1 cm.





For children taller than 87 cm, height is measured with the child standing.

1. The child stands upright against the middle of the measuring board.
2. The child's head, shoulders, buttocks, knees and heels are held against the board by the assistant.
3. The child should be looking straight ahead (neither up nor down).
4. The moveable headboard is pressed firmly against the head compressing the hair.
5. The height is measured after checking that the headboard is level (the reading should be the same on both sides of the measuring board).



4.0 Identifying a Child with SAM

4.1 Determining the Presence of Bilateral Pitting Oedema

Bilateral pitting oedema is a form of SAM. A clinical term used for this condition is 'kwashiorkor'. A combination of bilateral pitting oedema and wasting is a severe condition. *Note:* The term kwashiorkor will not be used in this course. This course will simply refer to the signs of bilateral pitting oedema.

We have learned to determine the presence of bilateral pitting oedema earlier in Section 2.0, Recognising Clinical Signs of SAM, see pages 3–9.

4.2 Determining Severe Wasting Based on MUAC

MUAC is an indicator used for defining wasting, expressed in centimetres (cm) or millimetres (mm). MUAC is a sensitive indicator for risk of death and correlates well with wasting of muscle mass. Children 6–59 months are classified as severely wasted based on MUAC if their MUAC reading is below 11.5 cm. Children 5–9 years are classified as severely wasted if their MUAC reading is below 13.0 cm, whereas children 10–15 years are classified as severely wasted if their MUAC reading is below 16.0 cm.

4.3 Determining Severe Wasting Based on WFH

Weight-for-height (WFH) or weight-for-length (WFL) is an indicator used for defining wasting, expressed in number of z-scores from the median of a standard population. Children 6–59 months are classified as severely wasted if their WFH or WFL z-score is below 3 standard deviations of the median of the WHO standard population. WFH and WFL look-up tables are provided in **Annex B** or the Job Aid.

What is a z-score? A z-score is a way of comparing a measurement to an 'average' (median). The 'averages' used for comparing a child's WFH are from the 2006 WHO child growth standards (WHO standards). In the WHO standard population, all children of the same height are distributed around the median weight, some heavier and some lighter. For each height group, there is a standard deviation among the children of the WHO standard population. This standard deviation is expressed as a certain number of kg at each height. The z-score of a child being measured is the number of standard deviations the child's weight is away from the median weight of the WHO standard population at that height group. The WFH or WFL Look-Up Table shows the z-scores for boys and girls of different weights and lengths or heights. The Look-Up Table helps to define the WFH of WFL category of wasting of the child by comparing the weight of child with the weight of the child of the standard population of the same height and sex. The categories are:

- WFH < –3 z-score for severe wasting
- WFH ≥ –3 and < –2 z-score for moderate wasting
- WFH ≥ –2 z-score for mild wasting

Optional: To learn more about z-scores, how they are calculated and what they mean, refer to **Annex A** of this module. Weight-for-length and weight-for height look-up tables are provided in **Annex B**.

It is important to consider a child's WFH rather than a child's weight-for-age (WFA). WFA is also affected by stunting (defined by height-for-age [HFA]). Stunting may cause low WFA when a child has an adequate WFH. Therapeutic feeding can correct wasting but cannot easily correct stunting.

To use the Weight-for-Height/Length Look-Up Table:

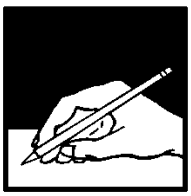
- Find the child's length or height in the middle column of the table.
- If the length or height is between those listed, round up or down as follows: If the height/length of the child is 0.5 cm or more than the lower height/length, round up. Otherwise, round down.
- Then look in the left columns for boys or the right columns for girls to find the where the child's weight is situated.
- Look at the top of the column to see what the child's z-score category is.

The child's weight may be between two standard deviation (SD) scores. If so, indicate that the weight is between these scores by writing less than (<). For example, if the score is between –1 SD and –2 SD, write < −1 SD.

Examples of WFH z-scores

Verify the category of WFH on the weight-for-length or weight-for height look-up tables provided in **Annex B**.

- A boy is 80 cm in length and weighs 9.2 kg. His score is above −2 z-score and below −1 z-score. Record his WFH z-score as < –1 z-score, indicating mild wasting.
- A girl is 77 cm in length and weighs 7.4 kg. Her WFH z-score is = −3 z-score, indicating moderate wasting.
- A girl is 90 cm in height and weighs 10.3 kg. Her weight is above −3 z-score and below −2 zscore. Record her WFH z-score as < −2 zscore, indicating moderate wasting.



Exercise B

Refer to the z-scores in the Weight-for-Height/Length Look-Up Table Job Aid, or **Annex B**. Indicate the WFH z-score for each child listed below.

1. Chimwemwe, girl, and you do not know the age, length 63.0 cm, weight 5.0 kg

2. Chikondi, boy, age 4, height 101.0 cm, weight 11.8 kg

3. Takondwa, girl, and you do not know the age, length 69.8 cm, weight 6.2 kg

4.a Kondwani, boy, age 20 months, length 82.0 cm, weight 8.5 kg

4.b Kondwani, boy, age 26 months, length 82.0 cm, weight 8.5 kg

4.c Kondwani, boy, and you do not know the age, length 82.0 cm, weight 8.5 kg

When you have completed this exercise, please discuss your answers with a facilitator.

5.0 Understanding the Criteria for Admission into CMAM

Recommended admission criteria for infants and children into the CMAM programme are summarized in **Table 3**.

Table 3. Summary of CMAM Admission Criteria

NRU

A. Children > 6 Months

Bilateral pitting oedema +++

OR Marasmic kwashiorkor defined as any grade of bilateral pitting oedema and severe wasting:

- MUAC < 11.5 cm (6–59 months)
- MUAC < 13.0 cm (5–9 years)
- MUAC < 16.0 cm (10–15 years) or
- WFH/L z-score < -3

OR Bilateral oedema + or ++ or severe wasting:

- MUAC < 11.5 cm (6–59 months)
- MUAC < 13.0 cm (5–9 years)
- MUAC < 16.0 cm (10–15 years) or
- WFH/L z-score < -3

WITH Any of the following danger signs:

- Anorexia (no appetite)
- Intractable vomiting
- Convulsions
- Lethargy, not alert
- Unconsciousness
- Inability to drink or breastfeed
- High fever (> 39° C rectal or > 38.5° C axillary)

OR WITH Any of the following medical complications:

- Hypoglycaemia
- Hypothermia (< 35° C axillary or < 35.5° C rectal)
- Infections
- Severe dehydration
- Shock
- Very severe anaemia
- Cardiac failure
- Severe dermatosis
- Signs of vitamin A deficiency
- Diarrhoea
- Malaria

OR Referrals from the OTP due to:

- Deterioration in the child's medical condition, based on the Outpatient Care Action Protocol
- Increase in bilateral pitting oedema
- Weight loss for 3 consecutive weeks or static weight for 5 weeks
- Not responding to treatment after 3 months in the OTP programme

B. Infants < 6 Months

WFL z-score < -3 (if > 45 cm)

OR Bilateral pitting oedema +, ++, or +++

OR Visible severe wasting (if infant is < 6 months and < 45 cm in length)

OR If infant is > 6 months and weighs < 3.0 kg

OR Too weak to suckle effectively (independent of weight-for-length)

OR Failure to gain weight*

* Children < 6 months whose growth is faltering or are below -3 z-scores on the weight-for-age growth curve must be referred to a clinician for further assessment. Children who do not gain weight following breastfeeding counselling and/or treatment of underlying medical conditions should be referred to the NRU.

OTP

Children 6–59 Months

MUAC < 11.5 cm

OR WFH/L z-score < -3

OR Bilateral pitting oedema + or ++

AND RUTF appetite test passed

No medical complications

Clinically well and alert

If child is HIV-positive , admit to OTP if:

MUAC < 12.5 cm

OR WFH/L z-score -3 to -2

AND RUTF appetite test passed

No medical complications

Clinically well and alert

Children 5–15 years

MUAC: 5–9 years < 13.0 cm

10–15 years < 16.0 cm

OR Bilateral pitting oedema + or ++

If child is HIV positive, admit to the OTP with:

MUAC: 5–9 years: 13.0–14.5 cm

10–15 years: 16.0–18.5 cm

AND

RUTF appetite test passed

No medical complications

Clinically well and alert

SFP

Children 6–59 Months

MUAC 11.5–12.5 cm

OR WFH/L z-score -3 to -2

OR Discharged from SAM treatment in OTP or NRU

NB: Admit HIV+ children with MAM to OTP

Children 5–15 Years

MUAC: 5–9 years: 13.0–14.5 cm

10–15 years: 16.0–18.5 cm

OR Discharged from SAM treatment in OTP or NRU

NB: Admit HIV+ children with MAM to OTP

Pregnant and lactating women

MUAC < 22.0 cm

OR Mothers of infants < 6 months old who are discharged from inpatient care

5.1 Admission Criteria for Children 6 Months or Older

- **No appetite:** Lack of appetite is a key indicator of the need to refer a child to inpatient care. Poor appetite is demonstrated by continued refusal to eat ready-to-use therapeutic food (RUTF, appetite test) and might be the result of poor liver and/or gut function due to SAM. Occasionally, some mothers/caregivers might try to force-feed their children RUTF because they would rather stay in outpatient care than go to inpatient care. Observation is needed to make sure this is not the case.
- **Bilateral pitting oedema:** Children with bilateral pitting oedema +++ have an increased mortality risk and must be referred to inpatient care.
- **Marasmic kwashiorkor:** Children with bilateral pitting oedema AND severe wasting (MUAC < 11.5 cm or WFH < –3 z-score) must be referred to inpatient care. These children are at an increased risk of mortality and require careful treatment.
- **SAM with medical complications:** Anorexia, intractable vomiting, convulsions, lethargy or not alert, unconscious, lower respiratory tract infections (LRTIs), high fever (axillary temperature > 38.5° C), severe dehydration, severe anaemia, hypoglycaemia, hypothermia (axillary temperature < 35° C).

Children with SAM are in danger of death from hypoglycaemia, hypothermia, fluid overload and undetected infections. They should not be treated like other children. Their feeding and fluids must be carefully controlled, or they could die.

To ensure the proper feeding and treatment routines, it is critical to keep these children in the NRU. Other health problems and infections should be treated in the NRU.

Admission Criteria for Infants 0–6 Months or > 6 Months Weighing < 3 kg

Infants who are less than 6 months or > 6 months but weighing less than 3 kg can be divided into two groups—those who are breastfeeding or have prospects to breastfeed and those who have no prospects to breastfeed.

5.2 Admission Criteria for Breastfed Infants 0–6 Months or > 6 Months Weighing < 3.0 kg

Breastfed infants 0–6 months, admit if the infant has:

- WFH/L z-score < -3 (if > 45 cm)
- Bilateral pitting odema +, ++, or +++
- Visible severe wasting (if the infant is < 45 cm in length)
- Too weak to suckle effectively (independently of weight-for-length), or
- Fails to gain weight[4]

  Any medical or social issue that requires detailed assessment or intensive support, e.g., disability, depression of the caregiver, or other adverse social circumstance **All infants > 6 months but weighing < 3.0 kg should be admitted to inpatient care.**

[4] Children less than 6 months whose growth is faltering (or is below the -3z weight-for-age growth curve) during growth monitoring must be referred to a clinician for further assessment. If the child does not gain weight following breastfeeding counselling and /or treatment of underlying medical conditions, then the child should be referred to NRU.

5.3 Admission Criteria for Non-breastfed Infants 0–6 Months or > 6 Months Weighing < 3.0 kg

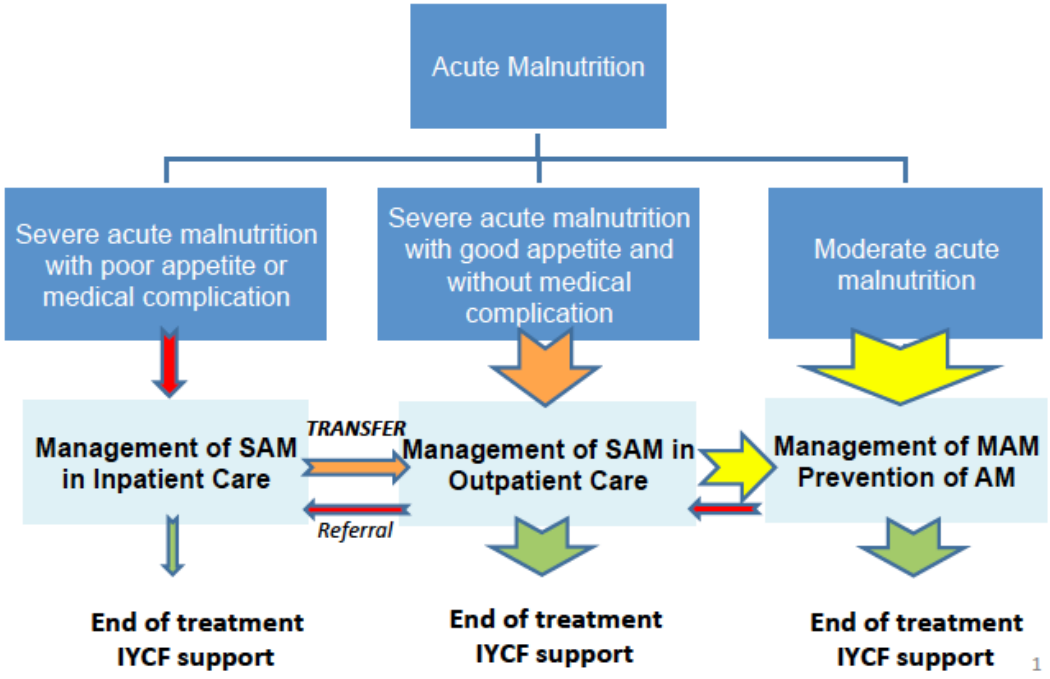
- Visible severe wasting (if the infant is < 6 months and < 45 cm length)
- WFH/L z-score < -3 (if > 45 cm)
- Bilateral pitting oedema
- Any medical or social issue that require detailed assessment or intensive support, e.g. disability, depression of the caregiver, or other adverse social circumstances

  Infant > 6 months and weighs under <3.0 kg)

Low-birth-weight babies are not usually severely wasted or oedematous and so are unlikely to meet the criteria for SAM. Management of low-birth-weight babies is not taught in this course. Low-birth-weight babies should be exclusively breastfed.

The care pathway of the management of SAM in children is presented in **Figure 1** below.

Figure 1. Classification of the Management of Acute Malnutrition and Care Pathway for Children



Exercise C

In this exercise, you will look at photographs and consider information about a child to determine whether the child should be admitted for the management of SAM. Use the criteria given on the previous page in this module. Refer to the Weight-for-Height/Length Look-Up Table Job Aid or in **Annex B**, as needed.

Photo 18: This child is a girl, age 20 months. She is 67 cm in length. She weighs 6.5 kg, and has a MUAC of 11.8 cm. Should she be admitted for the management of SAM? Is she admitted to Inpatient Care or Outpatient Care? Why or why not?

Photo 19: This child is a girl, age 7 months. She is 60 cm in length and weighs 4.2 kg and has a MUAC of 10.4 cm. Should she be admitted for the management of SAM? Is she admitted to inpatient care or outpatient care? Why or why not?

Photo 20: This child is a boy, age 18 months. He is 65 cm in length and weighs 4.8 kg and has a MUAC of 10.8 cm. Should he be admitted for the management of SAM? Is he admitted to Inpatient Care or Outpatient Care? Why or why not?

When you have completed this exercise, tell a facilitator that you are ready for the group discussion and drill.

6.0 How Does the Physiology of SAM Affect Care of a Child?

A child with SAM must be treated differently than other children because his or her physiology is seriously abnormal due to **reductive adaptation.**

6.1 What Is Reductive Adaptation?

The systems of the body begin to 'shut down' with SAM. The systems slow down and do less so that the body can survive on limited calories. This slowing down is known as reductive adaptation. As the child is treated, the body's systems must gradually 'learn' to function fully again. Rapid changes (such as rapid feeding or fluids) would overwhelm the systems, so feeding must be slowly and cautiously increased.

To learn more about how reductive adaptation affects the body's systems, refer to ***Annex C*** *Physiological basis for treatment of SAM. A simplified explanation of the implications for care is provided below.*

6.2 How Does Reductive Adaptation Affect Care of a Child?

Reductive adaptation affects treatment of a child in a number of ways. Some of the important implications for care are described below.

1. Presume and Treat Infection

Nearly all children with SAM have bacterial infections. As a result of reductive adaptation, however, the usual signs of infection may not be apparent, because the body does not use its limited energy to respond in the usual ways, such as inflammation or fever.

Examples of common infections in the child with SAM are ear infection, urinary tract infection and pneumonia. Assume that infection is present and treat all children with SAM with broad-spectrum antibiotics. If a specific infection is identified (such as *Shigella*, *Giardiasis*), add specific appropriate antibiotics to those already being given.

Note: Choices of antibiotics will be discussed in the **Module 3. Initial Management**, and are described on Medicines Protocols and Preventive Actions Job Aid.

2. Do Not Give Iron Early in Treatment

Because of reductive adaptation, a child with SAM makes less Hb than usual. Iron that is not used for making Hb is put into storage. Thus, there is 'extra' iron stored in the body, even though the child may appear anaemic. Giving iron early in treatment will not cure anaemia, since the child already has a supply of stored iron.

Giving iron early in treatment can also lead to 'free iron' in the body. Free iron can cause problems in three ways.

- Free iron is highly reactive and promotes the formation of free radicals, which may engage in uncontrolled chemical reactions with damaging effects.
- Free iron promotes bacterial growth and can make some infections worse.
- The body tries to protect itself from free iron by converting it to ferritin. This conversion requires energy and amino acids and diverts these from other critical activities.

Later, as the child recovers and begins to build new tissue and form more red blood cells, the iron in storage will be used and supplements might be needed when the child is on F-100. Iron will not be supplemented when the child eats RUTF as the daily portion if RUTF will cover the daily iron requirements.

3. Provide Potassium and Restrict Sodium

Normally, the body uses a lot of energy maintaining the appropriate balance of potassium inside the cells and sodium outside the cells. This balance is critical to maintaining the correct distribution of water inside the cells, around the cells and in the blood.

In reductive adaptation, the 'pump' that usually controls the balance of potassium and sodium runs slower. As a result, the level of sodium in the cells rises, and potassium leaks out of the cells and is lost (for example, in urine or stools). Fluid may then accumulate outside of the cells (as in oedema) instead of being properly distributed through the body.

All children with SAM should be given potassium to make up for what is lost. They should also be given magnesium, which is essential for potassium to enter the cells and be retained. Children with SAM already have excess sodium in their cells, so sodium intake should be restricted.

If a child has dehydration (diagnosed based on watery diarrhoea and recent sunken eyes), a special rehydration solution called Rehydration Solution for Malnutrition (ReSoMal) should be used instead of standard low-osmolarity oral rehydration solution (ORS). ReSoMal has less sodium and more potassium than standard low-osmolarity ORS. (Note that a child with profuse watery diarrhoea or suspected cholera will need the standard low-osmolarity ORS for rehydration, which will be discussed in **Module, 3 Initial Management**).

If children are receiving therapeutic foods that comply with WHO specifications, such as the F-75, F-100, and RUTF, then the increased requirements of potassium and magnesium and decreased requirements of sodium are covered. If children are receiving therapeutic foods that do not comply with WHO specifications, then potassium and magnesium supplementation will be needed and reduced sodium intake respected.

4. Refeeding syndrome

'Refeeding syndrome' refers to malnourished patients (and those who have been fasting for more than one week[5]) who develop any of the following shortly after they have a rapid, large increase in their food intake: acute weakness, 'floppiness', lethargy, delirium, neurological symptoms, acidosis, muscle necrosis, liver and pancreatic failure, cardiac failure or sudden unexpected death. The syndrome is caused by rapid consumption of key nutrients for metabolism particularly if the diet is unbalanced as the body shifts to glycolysis and anabolism when food is given. Frequently, there is a large reduction in plasma phosphorus, potassium and magnesium, and associated sodium and fluid retention. Thiamine deficiency is induced (due to increase utilization for glycolysis). Other separate problems during early refeeding include refeeding-œdema and refeeding-diarrhoea.

It is important at the start of treatment not to have a sudden jump in the adapted malnourished state to a very high intake. On admission, malnourished patients should never be force-fed amounts of diet more than those prescribed in the protocol, taking particular care with those who are being fed by NG tube. Preventing refeeding syndrome is the purpose of the transition phase of treatment. In the OTP

[5] The syndrome also occurs in obese patients who have been fasting as part of their treatment; they are not wasted but, like the malnourished patient, have metabolically adapted to a low intake of food.

protocol, very large amounts of RUTF are sometimes given at the start of treatment. If any mother forces her child to take all the diet, then refeeding syndrome is a real possibility.

For patients who are in the stabilisation phase: Reduce the diet to 50 percent of the recommended intake until all signs and symptoms disappear and then gradually increase the amount given. Check to make sure that there is sufficient potassium and magnesium in the diet. If the diet is not based on cow's milk (or the mother is also giving cereals/pulses, etc.) additional phosphorus should be given to prevent refeeding syndrome.

For patients in the recovery phase: The child should be returned to the stabilisation phase if there is deterioration during the transition or rehabilitation phase of treatment.

5. Dehydration/Overhydration

The SAM child, because of the reductive adaptive state, may not be able to show the clear signs of either dehydration or congested cardiac failure. The body is also not capable of clearing all fluids and electrolytes when administered to the child. Contractility of the heart and capillary refill are critical measures in this state and requires any child diagnosed with dehydration to be managed in a high dependency unit (HDU) under close medical and nursing supervision.

SHORT ANSWER EXERCISE

Briefly answer these questions as a review of the previous section:

1. When a child has SAM, why is it important to begin feeding slowly and cautiously?

2. Why should all children with SAM be given antibiotics?

3. Why is it dangerous to give iron early in treatment?

4. Why is ReSoMal preferred over standard low-osmolarity ORS for rehydrating children with SAM with diarrhoea and recent sunken eyes?

Tell the facilitator when you are ready to discuss these questions with the group.

7.0 Essential Components of Care

7.1 Feeding with F-75, F-100, or F-100 Diluted or RUTF

F-75 is the 'starter' formula therapeutic milk to use during initial management, beginning as soon as possible and continuing for 2–7 days until the child is stabilised. F-75 contains **75 kcal and 0.9 g protein per 100 ml.** Children with SAM cannot tolerate usual amounts of protein and sodium at this stage (during stabilisation), or high amounts of fat. They may die if given too much protein or sodium. They also need glucose, so they must be given a diet that is low in protein and sodium and high in carbohydrate. F-75 is specially made to meet the child's needs without overwhelming the body's systems in the initial stage of treatment. Use of F-75 prevents deaths. As soon as the child is stabilised on F-75, RUTF or F-100 will be introduced.

F-100 is a 'catch-up' formula to rebuild wasted tissues. F-100 contains more calories and protein: **100 kcal and 2.9 g protein per 100 ml**.

Infants less than 6 months being breastfed will be supplemented with F-100 Diluted or F-75 (if they have bilateral pitting oedema). Infants without the prospect of breastfeeding will receive replacement feeding with commercial infant formula or F-100 Diluted.

F-100 Diluted provides **74 kcal/100 ml** (one-third more water added to the F-100 mixture). F-100 Diluted provides adequate calories and nutrients with lower osmolarity and renal solute load then F-75 and F-100, which is better adapted for immature organs, and provides adequate calories and nutrients to restore electrolyte and metabolic balance to promote catch-up growth when given in the right amounts. F-100 Diluted is provided in inpatient care to infants less than 6 months if no bilateral pitting oedema. Feeding with F-75 is recommended when there is presence of oedema, until the oedema has resolved.

F-100-Diluted for small number of infants is prepared by adding 35 ml of water to 100 ml of F-100 already prepared, which will yield 135 ml of F-100 Diluted, or adding 70 ml of water to 200 ml of F-100, which will yield 270 ml of F-100 Diluted. When using a commercial (pre-packaged) F-100 milk powder package, instead of adding 500 ml for obtaining F-100, 675 ml is added for obtaining F-100 Diluted.

RUTF is an energy-dense, mineral/vitamin-enriched food that is equivalent to F-100. RUTF is an integral part of outpatient care, because it allows children to be treated at home rather than at inpatient treatment centres. RUTF is similar in composition to F-100. The only difference is that RUTF has iron added to cover the daily iron requirements after stabilisation.

There are currently two forms and several commercial types of RUTF: a lipid-based spread and a biscuit bar. There are two companies in Malawi that produce RUTF. Their products have similar nutritional quality as F-100 and have been shown to be physiologically similar to commercial forms of F-100 and RUTF. Clean drinking water must be made available to children while they consume RUTF. The product should be given only to children who can indicate they are thirsty.

Most commonly RUTF will be used that is packaged in individual packets or pots. The paste is composed of vegetable fat, groundnut butter, skimmed milk powder, lactoserum, maltodextrin, sugar and a mineral and vitamin mix. The commercially prepared lipid-based RUTF usually has a shelf life of 24 months from manufacturing date and should be stored in a cool and dry place. It often comes in a 92 g packet that contains 500 kcal, combined in a carton of around 15.1 kg containing 150 packets.

Recipes for local preparation of therapeutic milks are provided in the Table 4 below**.** Compositions of F-75, F-100 and F-100 Diluted and RUTF are described in **Annex D**.

7.2 Mineral and Vitamin Mix

Commercial (pre-packaged) F-75, F-100 and RUTF currently available comply with WHO specifications and contain enough minerals and vitamins to supplement the daily requirements of a child with SAM.

In case the commercial (pre-packaged) F-75, RUTF or F-100 is not used, a **mineral and vitamin mix** must be added to the recipes for local preparation of therapeutic foods to correct the electrolyte and vitamin imbalance of the child with SAM, or separate multivitamin drops and vitamin A supplements will be needed. The mineral mix should contain potassium, magnesium and other essential minerals. The mineral mix and vitamin mix recipes are described in **the Table 4 below**.

A commercial Combined Mineral and Vitamin Mix (CMV) may be used if available. CMV contains all essential minerals and vitamins, including vitamin A, and is added to the recipes for local preparation of therapeutic foods to comply with the WHO specifications (**Annex D**).

Whether using CMV or vitamin mix and mineral mix in preparing therapeutic foods, extra folic acid is needed. These requirements will be discussed in **Module 3. Initial Management** and **Module 5. Daily Care.**

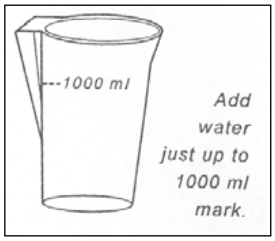
Therapeutic Milk Recipes

If you have cereal flour and cooking facilities, use one of the top three recipes for F-75:

Alternatives	Ingredients	Amount for F-75
If you have dried skimmed milk	Dried skimmed milk Sugar Cereal flour Vegetable oil Combined mineral and vitamin mix (CMV)* *Water to make 1000 ml*	25 g 70 g 35 g 30 g ½ levelled scoop *1000 ml***
If you have dried whole milk	Dried whole milk Sugar Cereal flour Vegetable oil CMV* *Water to make 1000 ml*	35 g 70 g 35 g 20 g ½ levelled scoop *1000 ml***
If you have fresh cow's milk, or full-cream (whole) long-life milk	Fresh cow's milk, or full-cream (whole) long-life milk Sugar Cereal flour Vegetable oil CMV* *Water to make 1000 ml*	300 ml 70 g 35 g 20 g ½ levelled scoop *1000 ml***
If you do not have cereal flour, or there are no cooking facilities, use one of the following recipes for F-75:		No cooking is required for F-100:
Alternatives	**Ingredients**	**Amount for F-100**
If you have dried skimmed milk	Dried skimmed milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	80 g 50 g 60 g ½ levelled scoop *1000 ml***
If you have dried whole milk	Dried whole milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	110 g 50 g 30 g ½ levelled scoop *1000 ml***
If you have fresh cow's milk, or full-cream (whole) long-life milk	Fresh cow's milk, or full- cream (whole) long-life milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	880 ml 75 g 20 g ½ levelled scoop *1000 ml***

** For contents of the CMV, see **Annex D**. Where CMV is not available, use 20 ml for one litre or preparation). Contents of mineral and vitamin mix are given on the next page.*

*** Important note about adding water: Add just the amount of water needed to make 1000 ml of formula. (This amount will vary from recipe to recipe, depending on the other ingredients.) Do not simply add 1000 ml of water, as this will make the formula too dilute. A mark for 1000 ml should be made on the mixing container for the formula, so that water can be added to the other ingredients up to this mark.*



Mineral Mix

If the mineral mix is not commercially available or affordable, prepare 2,500 ml using the following ingredients:

Minerals	G	mol/20 ml
Potassium chloride	224	24 mmol
Tripotassium citrate	81	2 mmol
Magnesium chloride	76	3 mmol
Zinc acetate	8.2	300 µmol
Copper sulfate	1.4	45 µmol
Water	make up to 2500 ml	
If available, add selenium (0.028 g sodium selenate) and iodine (0.012 g potassium iodide)		

Preparation:

- Dissolve the ingredients in cooled boiled water. Store the solution in sterilised bottles in the refrigerator to retard deterioration. Discard if it turns cloudy. Make fresh each month.
- For 1 litre F-75 and F-100, add 20 ml of the mineral mix to 1 litre prepared milk.
- For 2 litres ReSoMal, add 40 ml mineral mix (or 45 ml of potassium chloride solution) to 1 litre standard ORS package.

If it is not possible to prepare the mineral mix:

- Make a 10% solution of potassium chloride (100g in 1 litre of water) and a 1.5% solution of zinc acetate (15 g in 1 litre of water).
- For 1 litre F-75 and F-100, add 22.5 ml of potassium chloride solution to one litre of milk.
- For 2 litres ReSoMal, add 45 ml of potassium chloride solution to one-litre standard ORS package.
- Give the child 1.5% zinc acetate solution 1 ml/kg/day orally, and 50% magnesium sulfate 0.3 ml/kg to maximum 2 ml/kg IM single dose.

Vitamin Mix

The vitamin mix is added to therapeutic foods to comply with WHO specifications. If the vitamin mix cannot be added, a multivitamin supplement should be given to the child.

Vitamin	Amount per litre of liquid diet
Water-soluble	
Thiamine (vitamin B1)	0.7 mg
Riboflavin (vitamin B2)	2.0 mg
2.0 mg Nicotinic acid	10.0 mg
Pyridoxine (vitamin B6)	0.7 mg
Cyanocobalamin (vitamin B12)	1.0 µg
Folic acid	0.35 mg
Ascorbic acid (vitamin C)	100 mg

Pantothenic acid (vitamin B5)	3 .0 mg
Biotin	0.1 mg
Fat-soluble	
Retinol (vitamin A)	1.5 mg
Calciferol (vitamin D)	30 µg
α-Tocopherol (vitamin E)	22 mg
Vitamin K	40 µg
Note: This vitamin mix contains vitamin A. Multivitamin drops will not contain vitamin A.	

SHORT ANSWER EXERCISE

Briefly answer these questions as a review of the previous section:

1. What are two important differences between F-75 and F-100 (and RUTF)?

2. Why is it important to have different formulas (F-75, F-100 and RUTF) for managing SAM?

3. CMV is included in F-75, F-100 and RUTF to correct electrolyte imbalance. What are two important minerals in this mix and why?

4. What is the difference between F-100 and RUTF?

5. Why should F-100 Diluted be given to the child less than 6 months of age?

Tell the facilitator when you are ready to discuss these questions with the group.

7.3 Procedures for the Successful Management of the Child with Severe Acute Malnutrition

Inpatient management covers the stages of **stabilisation** and **transition** until the child is transferred to outpatient care to continue treatment until full recovery at home. **Table 5** provides an overview of the procedures for successfully manage the child with SAM.

If transfer to outpatient care is not possible the child or infant should be managed as an inpatient during the rehabilitation phase until full recovery. In case RUTF is not available and/or outpatient management is not possible, all children with SAM are treated from the start as inpatients, covering the stages of stabilisation, transition and rehabilitation until full recovery.

SAM is both a medical and a socio-economic disorder. That is, the medical problems of the child result in part from social, environmental and economic problems of the home in which the child lives. Malnutrition is the end result of chronic nutritional and frequently emotional deprivation; because of poor understanding, poverty or family problems the home cannot give the child with the nutrition and care he or she needs.

Children with SAM with medical complications need highly qualified personnel as they may present with severe illness and shock (septic or hypovolemic), including complications related to HIV infection and definitely will benefit from senior medical staff for appropriate evaluation and management.

Each child with SAM should be identified early before progress of severe disease and should be treated with a level of care and affection that is appropriate to the risks that a child with SAM faces. When appropriately trained and dedicated so that health workers carry out each phase of the treatment properly, the risk of death can be reduced substantially and the opportunity for full recovery greatly improved.

Treating children with SAM involves 10 WHO steps in two phases; an initial stabilisation phase (Phase 1 and transition phase) for children with SAM with complications and/or no appetite. In stabilisation life-threatening problems are identified and treated, specific deficiencies are corrected, metabolic abnormalities are reversed and feeding is established. This process should take about 2 to 7 days. The child is then transferred to the OTP until recovery is completed. F-75 is used during the stabilisation phase to promote repair of physiological and metabolic functions, including electrolyte balance. No weight gain is expected while the child is taking F-75 and the amount of F-75 given to the child remains unchanged. Rapid weight gain at this stage is dangerous. If it occurs, check the amount being dispensed and the actual amount required according to the child's weight.

In the transition phase the child starts to gain weight. The diet is changed to RUTF (or F-100) to increase the energy intake by about 30 percent. A transition phase is important because a sudden change to large amounts of diet (in rehabilitation phase), before physiological function is fully restored, can be dangerous and lead to electrolyte disequilibrium and 'refeeding syndrome'. See Figure 4 below for the approximate timescale of treatment in the two phases.

Figure 2. The WHO 10 steps for treatment of SAM

Steps and Action	Stabilisation		Rehabilitation
	Day 1–3 Phase 1	Day 3–7 Transition	Week 2—recovery Phase 2
1 Prevent or treat hypoglycaemia	→	→	
2 Prevent or treat hypothermia	→	→	
3 Prevent or treat dehydration	→	→	
4 Correct urea and electrolyte imbalance	→	→	
5 Treat and prevent infection	→	→	
6 Correct micronutrient deficiencies	No iron →	No iron →	With iron→
7 Start cautious feeding	→	→	
8 Give catch-up diet for rapid growth			→
9 Provide loving care, play and stimulation	→	→	→
10 Prepare for follow-up and discharge to OTP		→	→

Important Things NOT to Do in Inpatient Management of SAM and Why

Do not give diuretics to treat oedema. The oedema is due partly to potassium and magnesium deficiencies that may take up to 2 weeks to correct. The oedema will go away with proper feeding that includes potassium and magnesium. Giving a diuretic will worsen the child's electrolyte imbalance and may cause death.

Do not give iron during the initial feeding phase. There is no need to add iron when the child is on RUTF. Add iron only after the child has been on F-100 for 2 days (usually during week two). As described earlier, giving iron early in treatment can have toxic effects and interfere with the body's ability to resist infection.

Do not give high protein formula (over 1.5 g protein per kg body weight daily). Too much protein in the first days of treatment may be dangerous because the child with SAM has compromised ability to metabolise protein. Too much protein could overload the liver, heart and kidneys, and may cause death.

Do not give IV fluids routinely. IV fluids can easily cause fluid overload and heart failure in a child with SAM. Give IV fluids only to children with signs of shock and lethargy or unconsciousness. (Treatment will be described in **Module 3, Initial Management**.)

Do not give undiluted F-100 to children under the age of 6 months or those who are more than 6 months but weighing less than 3 kg. The kidneys cannot handle the high solute load and will lead to hypernatremic dehydration.

Be sure that health workers in the emergency room of the hospital know these important things NOT to do, as well as what to do.

The essential steps for successful inpatient management of SAM are listed in **Table 5.** You will learn how to do these steps in **Module 3. Initial Management, Module 4. Feeding, Module 5. Daily Care, and Module 7. Involving Mothers in Care.**

Table 5. Overview of Activities in the Inpatient Management of SAM in Children

STABILISATION (range of 1 to 10 days)

EMERGENCY TRIAGE ASSESSMENT AND TREATMENT (ETAT) *(Repeated as necessary)*

Assessment of emergency signs and prompt treatment:

- Central cyanosis, severe respiratory distress, cough with fast breathing and lower chestwall indrawing
- Cold hands with slow capillary refill and weak and fast pulse
- Unconscious, convulsions
- Hypoglycaemia
- Hypothermia, hyperthermia
- Severe pallor
- Diarrhoea and recent sunken eyes
- Blinding eye signs

FULL ASSESSMENT *(Repeated as necessary)*

- History and examination
- Laboratory and other investigations
- Differential diagnoses (Decision: treatment as inpatient or outpatient)

DAILY CARE

- Prevention of hypoglycaemia
- Prevention of hypothermia
- Management of infections and other medical conditions
- Feeding during stabilisation—for breastfed infant, breastfeeding stimulation and supplementation by supplementary suckling
- Monitoring for signs of improvement, complications, failure to respond to treatment *(When necessary: ETAT and/or full assessment)*

TRANSITION (range of 1 to 3 days)

DAILY CARE

- Management of infections, other medical conditions and fluids and electrolyte balance continued
- Feeding during transition—for breastfed infant, breastfeeding stimulation and supplementation by supplementary suckling
- Monitoring for signs of improvement, complications, failure to respond to treatment *(When necessary: ETAT and/or full assessment)*
- Preparation for discharge from hospital and ***transfer to outpatient care*** to continue treatment

TRANSFER TO OUTPATIENT CARE

REHABILITATION (If no transfer to outpatient care possible, range of 1 to 8 weeks or less)

DAILY CARE

- Feeding for catch-up growth during rehabilitation—for breastfed infant, breastfeeding stimulation and supplementation by supplementary suckling
- Monitoring for signs of improvement, complications, failure to respond to treatment *(When necessary: ETAT and/or full assessment)*
- Preparation for discharge from hospital and ***end of treatment,*** including gradual introduction of family foods

END OF TREATMENT

The following activities are integral part of daily care of inpatient management of SAM.

- Hygiene promotion
- Emotional and sensorial stimulation of the child
- Psychosocial support of mother or carer
- Health and nutrition counselling of mother or carer

SHORT ANSWER EXERCISE

Fill in the blanks based on your reading in the module and the Guidelines.

1. Two conditions that are related and must be treated immediately in a child with SAM are _____ and _____.

2. Cautious feeding with _____ is necessary at first to stabilise the child. Later, _____ or _____ is given to rebuild wasted tissues and gain weight.

3. To correct electrolyte imbalance, it is important to give feeds prepared with a _____ mix or a product called *Combined Mineral and Vitamin Mix* (CMV).

4. If a child with SAM has diarrhoea, a special rehydration solution called _____ should be given. This solution has less _____ and more _____ than standard low-osmolarity ORS.

Indicate in the blank whether the statement is true or false:

5. _____ Giving iron too early in treatment can have toxic effects.

6. _____ All children with SAM and medical complications should be given antibiotics.

7. _____ Giving IV fluids too quickly can cause heart failure in a child with SAM.

8. _____ Diuretics should be given to reduce oedema.

9. _____ Commercially prepared therapeutic foods, or local prepared recipes with added CMV contains minerals and vitamins. If CMV is used, separate multivitamin drops are not needed. If mineral mix without vitamin mix is being used, multivitamin drops are needed.

Check your own answers to this exercise by comparing them to the answers given at the end of this module on page 44.

8.0 Understanding Procedures for Discharge, Transfer and End of Treatment of Inpatient Management of SAM in Children

The *National Guidelines for CMAM in Malawi* recommend that a child be kept in inpatient care until his or her condition is stabilised and appetite regained. Once medical complications have stabilised and appetite has returned, the child should be referred to a health facility that provides outpatient care services to continue with the management of SAM until full recovery.

In special cases where there is no access to RUTF or when a child remains in inpatient care until full recovery, a child is ready for discharge as **cured** from inpatient care if the discharge criteria are met.

8.1 Transfer from Inpatient Care after Stabilisation to Outpatient Care

A child aged 6 months or older is ready for **Transfer to Outpatient Care** if the following criteria are met:

- Appetite has returned (passed a RUTF appetite test—the child is eating 75 percent of the daily ration) and has started to gain weight.
- Medical complications are resolved or under control (e.g., started on anti-tuberculosis treatment with good response).
- Bilateral pitting oedema decreasing (if marasmic kwashiorkor on admission, bilateral pitting oedema has resolved).
- Child is clinically well and alert.

Breastfeeding infant less than 6 months of age is ready for **Transfer to Outpatient Care** if the following criteria are met:

- Medical complication has resolved.
- Bilateral pitting oedema has resolved.
- Infant is clinically well and alert.
- Weight gain on exclusive breastfeeding is satisfactory (e.g., infant is gaining 5 g/kg/day at least for 3 successive days).
- Infant has been checked for immunisations and other routine interventions.

It is recommended that the following elements be also considered at discharge from the hospital and transfer to outpatient care (or in case of no outpatient care, discharged from the hospital after the end of treatment). If a child or infant leaves before being stabilised, he or she is likely to get worse and have to return, or he or she may die.

- Health and nutrition counselling scheme has started or completed
- Psychosocial support is given to the mother or carer.
- Emotional and sensory stimulation is given for child.
- Immunisation schedule is updated.
- Adequate arrangements are made for linking the mother and child with the primary health care facility for continued treatment and follow-up in outpatient care, and with the community health worker (CHW) for home support.
- Appropriate linking is made for continued community-based IYCF and preventative community initiatives.

8.2 Discharge from Inpatient Care After Full Recovery

In special cases when a child cannot be transferred to the outpatient care, then it is recommended that a child stays in hospital until full recovery as follows.

The child 6–59 months is ready for discharge from inpatient care after full recovery when the following discharge criteria are met:

- No bilateral pitting oedema for 2 consecutive weeks, and
- MUAC ≥ 12.5 cm or WFH ≥ –2 z-score, and
- Clinically well and alert.

The child 5–15 years is ready for discharge from inpatient care after full recovery when the following discharge criteria are met:

- MUAC ≥ 14.5cm (5–9 years) or,
- MUAC ≥ 18.5cm (10–15 years) and
- No bilateral pitting oedema for 2 consecutive weeks, and
- Clinically well and alert

The non-breastfeeding infant less than 6 months is ready for discharge from inpatient care after full recovery when following discharge criteria are met:

- WFH/L z-score ≥ –2 for 2 consecutive weeks
- No oedema for two consecutive weeks
- Clinically well and alert, with no medical problems

Other recommendations:

- Infants can switch to infant formula or other breast milk substitutes upon discharge, per the Malawi IYCF recommendations.
- Caregivers should be provided adequate counselling on care and feeding practices, danger signs and when to return to the health centre for follow-up.
- Children should be referred to the supplementary feeding programme (SFP) for routine monitoring.
- Caregivers should be referred to social welfare.
- Continuity of care and follow-up are important after discharge to monitor the child's recovery and progress and to educate the caregivers on the need to introduce complementary food at 6 months of age.
- Follow-up should be done every two weeks in the SFP until the child is 6 months of age.
- Non-breastfed children < 6 months should be referred to social welfare.
- Children over 6 months children whose criteria of admission was weight less than 3 kg should be discharged to the SFP and given CSB++.

Other criteria for leaving the hospital before the end of treatment include:

- **Died** while in treatment
- **Defaulted** absent for two consecutive days
- **Non-cured –** those who did not recover or did not meet the discharge criteria after 4 months in treatment; during treatment, these children would have shown signs of failure-to-respond-to-treatment and undergone a full assessment for detecting underlying infections or medical conditions, or been referred for medical investigation.

If early discharge is necessary, many preparations must be made to ensure that the mother can continue care at home. Follow-up visits are essential. There will be a discussion exercise about early discharge situations in **Module 7. Involving Mothers in Care**.

NOTE: It is unusual to classify SAM children as "non-cured" in the inpatient care. This is more applicable in outpatient care (OTP or SFP). Failure-to-respond-to-treatment (non-cured) is an indication for referral for further assessment at a higher level of hospital care. This may be due to, for example, undiagnosed TB, HIV infection (not started on ART) or other medical condition such as cardiac and other chronic conditions that require long term follow up in hospital.

Tell the facilitator when you have reached this point in the module. There will be a brief video showing signs of SAM and the transformations that can occur when severely malnourished children are correctly managed. You will also discuss photos 21–29, which show children before and after treatment for SAM. Look at these photos while waiting for the video.

Answers to Exercises

Answers to Short Exercise, page 40

Fill in the blanks:

1. Two conditions that are related and must be treated immediately in a child with SAM are hypoglycaemia and hypothermia.

2. Cautious feeding with F-75 is necessary at first to stabilise the child. Later, F-100 or RUTF is given to rebuild wasted tissues and gain weight.

3. To correct electrolyte imbalance, it is important to give feeds prepared with

   a product called Combined Mineral and Vitamin Mix (CMV).

4. If a child with SAM has diarrhoea, a special rehydration solution called ReSoMal should be given. This solution has less sodium and more potassium than standard low-osmolarity ORS. Note: ReSoMal also has more sugar than low-osmolarity ORS.

5. True

6. True

7. True

8. False Diuretics should never be given to reduce oedema. With correct feeding, the oedema will eventually go away.

9. True Commercially prepared therapeutic foods, or local prepared recipes with added CMV, contain minerals and vitamins. If CMV is used, separate multivitamin drops are not needed. If mineral mix without vitamin mix is being used, multivitamin drops are needed.

Annex A: Explanation of Z-Scores

What Does a Z-Score Tell Us?

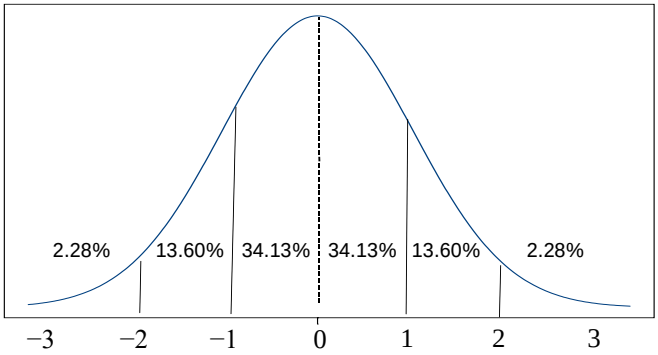
The lines on the growth charts are called z-score lines based on z-scores, also known as standard deviation (SD) scores. Z-scores are used to describe how far a measurement is from the median (or average in a normal distribution). For example, a WFH z-score of –2.33 means that the child's weight is 2.33 SD below the expected median weight of children of the same height. The child has a lower weight for his/her height compared to the standard and he/she is classified as 'wasted'. A positive z-score indicates that the child's weight is to the right of the median, i.e., the child is heavier compared to the standard.

Z-scores are calculated differently for measurements that are distributed normally and non-normally in the standard population.

Normally Distributed Measurements

The concept of a normal distribution is helpful for understanding what a z-score is. In a normal distribution, most values are grouped around the middle as shown below.

Normal Bell-Shaped Curve Cut into z-score



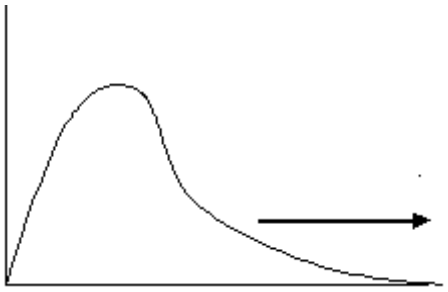
The distribution of heights of all boys (or all girls) of a given age forms a bell-shaped curve, or a normal (or almost normal) distribution. Each segment on the horizontal axis represents one standard deviation or z-score, and the z-scores −1 and 1 are at equal distances in opposite directions from the median. The distance from the median to 1 is half of the distance from the median to 2.

The z-score of an observed point in this distribution is calculated as follows:

$$\text{z-score} = \frac{(\text{observed value}) - (\text{median reference value})}{\text{z-score of the reference population}}$$

Non-normally Distributed Measurements

Unlike the distribution of height, the distribution of weight has a shape that when graphed looks like a 'deformed' bell whose right side is longer than the left and is described as right-skewed (not normal).



It is more difficult to calculate z-scores for weight-based indicators. Unlike in a normal distribution, distances between adjacent z-scores are not constant.

Calculating the z-score of an observed point involves a series of mathematical calculations that take into account the non-normal distribution of measurements in the standard population. The following formula is used:

$$\text{z-score} = \frac{(\text{observed value} \div \text{M})^{\text{L}} - 1}{\text{L} \times \text{S}}$$

In this formula, *M*, *L* and *S* are values for the standard population. *M* is the standard median value that estimates the population mean. *L* is the power needed to transform the data to remove skewness (i.e., to normalise the data). *S* is the coefficient of variation (or equivalent).

This formula (sometimes called the LMS formula) is used to calculate z-scores for WFA, WFH and body mass index (BMI)-for-age.

To select children for interventions if they are below specified WFH cut-offs based on WHO standards, the Weight-for-Height/Length Look-Up Table Job Aid should be used.

Annex B: Weight-for-Length/Height Look-Up Tables

1. Weight-for-Length Look-Up Table for Children less than 24 Months. If a child is under 2 years (or if a child is less than 87 cm tall and his/her age is not known), measure length while the child is lying down (recumbent). Use the weight-for-length look-up table.

Boys				Length	Girls			
-3 Z	-2 Z	-1 Z	Median	cm	Median	-1 Z	-2 Z	-3 Z
1.9	2.0	2.2	2.4	45.0	2.5	2.3	2.1	1.9
1.9	2.1	2.3	2.5	45.5	2.5	2.3	2.1	2.0
2.0	2.2	2.4	2.6	46.0	2.6	2.4	2.2	2.0
2.1	2.3	2.5	2.7	46.5	2.7	2.5	2.3	2.1
2.1	2.3	2.5	2.8	47.0	2.8	2.6	2.4	2.2
2.2	2.4	2.6	2.9	47.5	2.9	2.6	2.4	2.2
2.3	2.5	2.7	2.9	48.0	3.0	2.7	2.5	2.3
2.3	2.6	2.8	3.0	48.5	3.1	2.8	2.6	2.4
2.4	2.6	2.9	3.1	49.0	3.2	2.9	2.6	2.4
2.5	2.7	3.0	3.2	49.5	3.3	3.0	2.7	2.5
2.6	2.8	3.0	3.3	50.0	3.4	3.1	2.8	2.6
2.7	2.9	3.1	3.4	50.5	3.5	3.2	2.9	2.7
2.7	3.0	3.2	3.5	51.0	3.6	3.3	3.0	2.8
2.8	3.1	3.3	3.6	51.5	3.7	3.4	3.1	2.8
2.9	3.2	3.5	3.8	52.0	3.8	3.5	3.2	2.9
3.0	3.3	3.6	3.9	52.5	3.9	3.6	3.3	3.0
3.1	3.4	3.7	4.0	53.0	4.0	3.7	3.4	3.1
3.2	3.5	3.8	4.1	53.5	4.2	3.8	3.5	3.2
3.3	3.6	3.9	4.3	54.0	4.3	3.9	3.6	3.3
3.4	3.7	4.0	4.4	54.5	4.4	4.0	3.7	3.4
3.6	3.8	4.2	4.5	55.0	4.6	4.2	3.8	3.5
3.7	4.0	4.3	4.7	55.5	4.7	4.3	3.9	3.6
3.8	4.1	4.4	4.8	56.0	4.8	4.4	4.0	3.7
3.9	4.2	4.6	5.0	56.5	5.0	4.5	4.2	3.8
4.0	4.3	4.7	5.1	57.0	5.1	4.6	4.3	3.9
4.1	4.5	4.9	5.3	57.5	5.2	4.8	4.4	4.0
4.3	4.6	5.0	5.4	58.0	5.4	4.9	4.5	4.1
4.4	4.7	5.1	5.6	58.5	5.5	5.0	4.6	4.2
4.5	4.8	5.3	5.7	59.0	5.6	5.1	4.7	4.3
4.6	5.0	5.4	5.9	59.5	5.7	5.3	4.8	4.4
4.7	5.1	5.5	6.0	60.0	5.9	5.4	4.9	4.5
4.8	5.2	5.6	6.1	60.5	6.0	5.5	5.0	4.6
4.9	5.3	5.8	6.3	61.0	6.1	5.6	5.1	4.7
5.0	5.4	5.9	6.4	61.5	6.3	5.7	5.2	4.8
5.1	5.6	6.0	6.5	62.0	6.4	5.8	5.3	4.9
5.2	5.7	6.1	6.7	62.5	6.5	5.9	5.4	5.0
5.3	5.8	6.2	6.8	63.0	6.6	6.0	5.5	5.1
5.4	5.9	6.4	6.9	63.5	6.7	6.2	5.6	5.2
5.5	6.0	6.5	7.0	64.0	6.9	6.3	5.7	5.3
5.6	6.1	6.6	7.1	64.5	7.0	6.4	5.8	5.4
5.7	6.2	6.7	7.3	65.0	7.1	6.5	5.9	5.5
5.8	6.3	6.8	7.4	65.5	7.2	6.6	6.0	5.5
5.9	6.4	6.9	7.5	66.0	7.3	6.7	6.1	5.6
6.0	6.5	7.0	7.6	66.5	7.4	6.8	6.2	5.7
6.1	6.6	7.1	7.7	67.0	7.5	6.9	6.3	5.8
6.2	6.7	7.2	7.9	67.5	7.6	7.0	6.4	5.9
6.3	6.8	7.3	8.0	68.0	7.7	7.1	6.5	6.0
6.4	6.9	7.5	8.1	68.5	7.9	7.2	6.6	6.1
6.5	7.0	7.6	8.2	69.0	8.0	7.3	6.7	6.1
6.6	7.1	7.7	8.3	69.5	8.1	7.4	6.8	6.2
6.6	7.2	7.8	8.4	70.0	8.2	7.5	6.9	6.3
6.7	7.3	7.9	8.5	70.5	8.3	7.6	6.9	6.4
6.8	7.4	8.0	8.6	71.0	8.4	7.7	7.0	6.5
6.9	7.5	8.1	8.8	71.5	8.5	7.7	7.1	6.5

Boys				Length	Girls			
-3 Z	-2 Z	-1 Z	Median	cm	Median	-1 Z	-2 Z	-3 Z
7.0	7.6	8.2	8.9	72.0	8.6	7.8	7.2	6.6
7.1	7.6	8.3	9.0	72.5	8.7	7.9	7.3	6.7
7.2	7.7	8.4	9.1	73.0	8.8	8.0	7.4	6.8
7.2	7.8	8.5	9.2	73.5	8.9	8.1	7.4	6.9
7.3	7.9	8.6	9.3	74.0	9.0	8.2	7.5	6.9
7.4	8.0	8.7	9.4	74.5	9.1	8.3	7.6	7.0
7.5	8.1	8.8	9.5	75.0	9.1	8.4	7.7	7.1
7.6	8.2	8.9	9.6	75.5	9.2	8.5	7.8	7.1
7.6	8.3	8.9	9.7	76.0	9.3	8.5	7.8	7.2
7.7	8.3	9.0	9.8	76.5	9.4	8.6	7.9	7.3
7.8	8.4	9.1	9.9	77.0	9.5	8.7	8.0	7.4
7.9	8.5	9.2	10.0	77.5	9.6	8.8	8.1	7.4
7.9	8.6	9.3	10.1	78.0	9.7	8.9	8.2	7.5
8.0	8.7	9.4	10.2	78.5	9.8	9.0	8.2	7.6
8.1	8.7	9.5	10.3	79.0	9.9	9.1	8.3	7.7
8.2	8.8	9.5	10.4	79.5	10.0	9.1	8.4	7.7
8.2	8.9	9.6	10.4	80.0	10.1	9.2	8.5	7.8
8.3	9.0	9.7	10.5	80.5	10.2	9.3	8.6	7.9
8.4	9.1	9.8	10.6	81.0	10.3	9.4	8.7	8.0
8.5	9.1	9.9	10.7	81.5	10.4	9.5	8.8	8.1
8.5	9.2	10.0	10.8	82.0	10.5	9.6	8.8	8.2
8.6	9.3	10.1	10.9	82.5	10.6	9.7	8.9	8.2
8.7	9.4	10.2	11.0	83.0	10.7	9.8	9.0	8.3
8.8	9.5	10.3	11.2	83.5	10.9	9.9	9.1	8.4
8.9	9.6	10.4	11.3	84.0	11.0	10.1	9.2	8.5
9.0	9.7	10.5	11.4	84.5	11.1	10.2	9.3	8.6
9.1	9.8	10.6	11.5	85.0	11.2	10.3	9.4	8.7
9.2	9.9	10.7	11.6	85.5	11.3	10.4	9.6	8.8
9.3	10.0	10.8	11.7	86.0	11.5	10.5	9.7	8.9
9.4	10.1	11.0	11.9	86.5	11.6	10.6	9.8	9.0
9.5	10.2	11.1	12.0	87.0	11.7	10.7	9.9	9.1
9.6	10.4	11.2	12.1	87.5	11.8	10.9	10.0	9.2
9.7	10.5	11.3	12.2	88.0	12.0	11.0	10.1	9.3
9.8	10.6	11.4	12.4	88.5	12.1	11.1	10.2	9.4
9.9	10.7	11.5	12.5	89.0	12.2	11.2	10.3	9.5
10.0	10.8	11.6	12.6	89.5	12.3	11.3	10.4	9.6
10.1	10.9	11.8	12.7	90.0	12.5	11.4	10.5	9.7
10.2	11.0	11.9	12.8	90.5	12.6	11.5	10.6	9.8
10.3	11.1	12.0	13.0	91.0	12.7	11.7	10.7	9.9
10.4	11.2	12.1	13.1	91.5	12.8	11.8	10.8	10.0
10.5	11.3	12.2	13.2	92.0	13.0	11.9	10.9	10.1
10.6	11.4	12.3	13.3	92.5	13.1	12.0	11.0	10.1
10.7	11.5	12.4	13.4	93.0	13.2	12.1	11.1	10.2
10.7	11.6	12.5	13.5	93.5	13.3	12.2	11.2	10.3
10.8	11.7	12.6	13.7	94.0	13.5	12.3	11.3	10.4
10.9	11.8	12.7	13.8	94.5	13.6	12.4	11.4	10.5
11.0	11.9	12.8	13.9	95.0	13.7	12.6	11.5	10.6
11.1	12.0	12.9	14.0	95.5	13.8	12.7	11.6	10.7
11.2	12.1	13.1	14.1	96.0	14.0	12.8	11.7	10.8
11.3	12.2	13.2	14.3	96.5	14.1	12.9	11.8	10.9
11.4	12.3	13.3	14.4	97.0	14.2	13.0	12.0	11.0
11.5	12.4	13.4	14.5	97.5	14.4	13.1	12.1	11.1
11.6	12.5	13.5	14.6	98.0	14.5	13.3	12.2	11.2
11.7	12.6	13.6	14.8	98.5	14.6	13.4	12.3	11.3
11.8	12.7	13.7	14.9	99.0	14.8	13.5	12.4	11.4
11.9	12.8	13.9	15.0	99.5	14.9	13.6	12.5	11.5
12.0	12.9	14.0	15.2	100.0	15.0	13.7	12.6	11.6
12.1	13.0	14.1	15.3	100.5	15.2	13.9	12.7	11.7
12.2	13.2	14.2	15.4	101.0	15.3	14.0	12.8	11.8
12.3	13.3	14.4	15.6	101.5	15.5	14.1	13.0	11.9
12.4	13.4	14.5	15.7	102.0	15.6	14.3	13.1	12.0

Boys				Length	Girls			
-3 Z	-2 Z	-1 Z	Median	cm	Median	-1 Z	-2 Z	-3 Z
12.5	13.5	14.6	15.9	102.5	15.8	14.4	13.2	12.1
12.6	13.6	14.8	16.0	103.0	15.9	14.5	13.3	12.3
12.7	13.7	14.9	16.2	103.5	16.1	14.7	13.5	12.4
12.8	13.9	15.0	16.3	104.0	16.2	14.8	13.6	12.5
12.9	14.0	15.2	16.5	104.5	16.4	15.0	13.7	12.6
13.0	14.1	15.3	16.6	105.0	16.5	15.1	13.8	12.7
13.2	14.2	15.4	16.8	105.5	16.7	15.3	14.0	12.8
13.3	14.4	15.6	16.9	106.0	16.9	15.4	14.1	13.0
13.4	14.5	15.7	17.1	106.5	17.1	15.6	14.3	13.1
13.5	14.6	15.9	17.3	107.0	17.2	15.7	14.4	13.2
13.6	14.7	16.0	17.4	107.5	17.4	15.9	14.5	13.3
13.7	14.9	16.2	17.6	108.0	17.6	16.0	14.7	13.5
13.8	15.0	16.3	17.8	108.5	17.8	16.2	14.8	13.6
14.0	15.1	16.5	17.9	109.0	18.0	16.4	15.0	13.7
14.1	15.3	16.6	18.1	109.5	18.1	16.5	15.1	13.9
14.2	15.4	16.8	18.3	110.0	18.3	16.7	15.3	14.0

2. Weight-for-Height Look-Up Table for Children 24–59 Months.

If a child is 2 years or older (or if a child is at least 87 cm tall and his/her age is not known), measure standing height. If a child 2 years or older or at least 87 cm tall is unable to stand, measure length while the child is lying down (recumbent) and subtract 0.7 cm from the length to arrive at a comparable height and use the weight-for-height look-up table.

Boys				Height	Girls			
-3 Z	-2 Z	-1 Z	Median	Cm	Median	-1 Z	-2 Z	-3 Z
5.9	6.3	6.9	7.4	65.0	7.2	6.6	6.1	5.6
6.0	6.4	7.0	7.6	65.5	7.4	6.7	6.2	5.7
6.1	6.5	7.1	7.7	66.0	7.5	6.8	6.3	5.8
6.1	6.6	7.2	7.8	66.5	7.6	6.9	6.4	5.8
6.2	6.7	7.3	7.9	67.0	7.7	7.0	6.4	5.9
6.3	6.8	7.4	8.0	67.5	7.8	7.1	6.5	6.0
6.4	6.9	7.5	8.1	68.0	7.9	7.2	6.6	6.1
6.5	7.0	7.6	8.2	68.5	8.0	7.3	6.7	6.2
6.6	7.1	7.7	8.4	69.0	8.1	7.4	6.8	6.3
6.7	7.2	7.8	8.5	69.5	8.2	7.5	6.9	6.3
6.8	7.3	7.9	8.6	70.0	8.3	7.6	7.0	6.4
6.9	7.4	8.0	8.7	70.5	8.4	7.7	7.1	6.5
6.9	7.5	8.1	8.8	71.0	8.5	7.8	7.1	6.6
7.0	7.6	8.2	8.9	71.5	8.6	7.9	7.2	6.7
7.1	7.7	8.3	9.0	72.0	8.7	8.0	7.3	6.7
7.2	7.8	8.4	9.1	72.5	8.8	8.1	7.4	6.8
7.3	7.9	8.5	9.2	73.0	8.9	8.1	7.5	6.9
7.4	8.0	8.6	9.3	73.5	9.0	8.2	7.6	7.0
7.4	8.0	8.7	9.4	74.0	9.1	8.3	7.6	7.0
7.5	8.1	8.8	9.5	74.5	9.2	8.4	7.7	7.1
7.6	8.2	8.9	9.6	75.0	9.3	8.5	7.8	7.2
7.7	8.3	9.0	9.7	75.5	9.4	8.6	7.9	7.2
7.7	8.4	9.1	9.8	76.0	9.5	8.7	8.0	7.3
7.8	8.5	9.2	9.9	76.5	9.6	8.7	8.0	7.4
7.9	8.5	9.2	10.0	77.0	9.6	8.8	8.1	7.5
8.0	8.6	9.3	10.1	77.5	9.7	8.9	8.2	7.5
8.0	8.7	9.4	10.2	78.0	9.8	9.0	8.3	7.6
8.1	8.8	9.5	10.3	78.5	9.9	9.1	8.4	7.7
8.2	8.8	9.6	10.4	79.0	10.0	9.2	8.4	7.8
8.3	8.9	9.7	10.5	79.5	10.1	9.3	8.5	7.8
8.3	9.0	9.7	10.6	80.0	10.2	9.4	8.6	7.9
8.4	9.1	9.8	10.7	80.5	10.3	9.5	8.7	8.0
8.5	9.2	9.9	10.8	81.0	10.4	9.6	8.8	8.1
8.6	9.3	10.0	10.9	81.5	10.6	9.7	8.9	8.2
8.7	9.4	10.1	11.0	82.0	10.7	9.8	9.0	8.3
8.7	9.4	10.2	11.1	82.5	10.8	9.9	9.1	8.4
8.8	9.5	10.3	11.2	83.0	10.9	10.0	9.2	8.5
8.9	9.6	10.4	11.3	83.5	11.0	10.1	9.3	8.6
9.0	9.7	10.5	11.4	84.0	11.1	10.2	9.4	8.6
9.1	9.9	10.7	11.5	84.5	11.3	10.3	9.5	8.7
9.2	10.0	10.8	11.7	85.0	11.4	10.4	9.6	8.8
9.3	10.1	10.9	11.8	85.5	11.5	10.6	9.7	8.9
9.4	10.2	11.0	11.9	86.0	11.6	10.7	9.8	9.0
9.5	10.3	11.1	12.0	86.5	11.8	10.8	9.9	9.1
9.6	10.4	11.2	12.2	87.0	11.9	10.9	10.0	9.2
9.7	10.5	11.3	12.3	87.5	12.0	11.0	10.1	9.3
9.8	10.6	11.5	12.4	88.0	12.1	11.1	10.2	9.4
9.9	10.7	11.6	12.5	88.5	12.3	11.2	10.3	9.5
10.0	10.8	11.7	12.7	89.0	12.4	11.4	10.4	9.6

Boys				Height	Girls			
-3 Z	-2 Z	-1 Z	Median	Cm	Median	-1 Z	-2 Z	-3 Z
10.1	10.9	11.8	12.8	89.5	12.5	11.5	10.5	9.7
10.2	11.0	11.9	12.9	90.0	12.6	11.6	10.6	9.8
10.3	11.1	12.0	13.0	90.5	12.8	11.7	10.7	9.9
10.4	11.2	12.1	13.1	91.0	12.9	11.8	10.9	10.0
10.5	11.3	12.2	13.2	91.5	13.0	11.9	11.0	10.1
10.6	11.4	12.3	13.4	92.0	13.1	12.0	11.1	10.2
10.7	11.5	12.4	13.5	92.5	13.3	12.1	11.2	10.3
10.8	11.6	12.6	13.6	93.0	13.4	12.3	11.3	10.4
10.9	11.7	12.7	13.7	93.5	13.5	12.4	11.4	10.5
11.0	11.8	12.8	13.8	94.0	13.6	12.5	11.5	10.6
11.1	11.9	12.9	13.9	94.5	13.8	12.6	11.6	10.7
11.1	12.0	13.0	14.1	95.0	13.9	12.7	11.7	10.8
11.2	12.1	13.1	14.2	95.5	14.0	12.8	11.8	10.8
11.3	12.2	13.2	14.3	96.0	14.1	12.9	11.9	10.9
11.4	12.3	13.3	14.4	96.5	14.3	13.1	12.0	11.0
11.5	12.4	13.4	14.6	97.0	14.4	13.2	12.1	11.1
11.6	12.5	13.6	14.7	97.5	14.5	13.3	12.2	11.2
11.7	12.6	13.7	14.8	98.0	14.7	13.4	12.3	11.3
11.8	12.8	13.8	14.9	98.5	14.8	13.5	12.4	11.4
11.9	12.9	13.9	15.1	99.0	14.9	13.7	12.5	11.5
12.0	13.0	14.0	15.2	99.5	15.1	13.8	12.7	11.6
12.1	13.1	14.2	15.4	100.0	15.2	13.9	12.8	11.7
12.2	13.2	14.3	15.5	100.5	15.4	14.1	12.9	11.9
12.3	13.3	14.4	15.6	101.0	15.5	14.2	13.0	12.0
12.4	13.4	14.5	15.8	101.5	15.7	14.3	13.1	12.1
12.5	13.6	14.7	15.9	102.0	15.8	14.5	13.3	12.2
12.6	13.7	14.8	16.1	102.5	16.0	14.6	13.4	12.3
12.8	13.8	14.9	16.2	103.0	16.1	14.7	13.5	12.4
12.9	13.9	15.1	16.4	103.5	16.3	14.9	13.6	12.5
13.0	14.0	15.2	16.5	104.0	16.4	15.0	13.8	12.7
13.1	14.2	15.4	16.7	104.5	16.6	15.2	13.9	12.8
13.2	14.3	15.5	16.8	105.0	16.8	15.3	14.0	12.9
13.3	14.4	15.6	17.0	105.5	17.0	15.5	14.2	13.0
13.4	14.5	15.8	17.2	106.0	17.1	15.6	14.3	13.1
13.5	14.7	15.9	17.3	106.5	17.3	15.8	14.5	13.3
13.7	14.8	16.1	17.5	107.0	17.5	15.9	14.6	13.4
13.8	14.9	16.2	17.7	107.5	17.7	16.1	14.7	13.5
13.9	15.1	16.4	17.8	108.0	17.8	16.3	14.9	13.7
14.0	15.2	16.5	18.0	108.5	18.0	16.4	15.0	13.8
14.1	15.3	16.7	18.2	109.0	18.2	16.6	15.2	13.9
14.3	15.5	16.8	18.3	109.5	18.4	16.8	15.4	14.1
14.4	15.6	17.0	18.5	110.0	18.6	17.0	15.5	14.2
14.5	15.8	17.1	18.7	110.5	18.8	17.1	15.7	14.4
14.6	15.9	17.3	18.9	111.0	19.0	17.3	15.8	14.5
14.8	16.0	17.5	19.1	111.5	19.2	17.5	16.0	14.7
14.9	16.2	17.6	19.2	112.0	19.4	17.7	16.2	14.8
15.0	16.3	17.8	19.4	112.5	19.6	17.9	16.3	15.0
15.2	16.5	18.0	19.6	113.0	19.8	18.0	16.5	15.1
15.3	16.6	18.1	19.8	113.5	20.0	18.2	16.7	15.3
15.4	16.8	18.3	20.0	114.0	20.2	18.4	16.8	15.4
15.6	16.9	18.5	20.2	114.5	20.5	18.6	17.0	15.6
15.7	17.1	18.6	20.4	115.0	20.7	18.8	17.2	15.7
15.8	17.2	18.8	20.6	115.5	20.9	19.0	17.3	15.9
16.0	17.4	19.0	20.8	116.0	21.1	19.2	17.5	16.0
16.1	17.5	19.2	21.0	116.5	21.3	19.4	17.7	16.2

Boys				Height	Girls			
-3 Z	-2 Z	-1 Z	Median	Cm	Median	-1 Z	-2 Z	-3 Z
16.2	17.7	19.3	21.2	117.0	21.5	19.6	17.8	16.3
16.4	17.9	19.5	21.4	117.5	21.7	19.8	18.0	16.5
16.5	18.0	19.7	21.6	118.0	22.0	20.0	18.2	16.6
16.7	18.2	19.9	21.8	118.5	22.2	20.1	18.4	16.8
16.8	18.3	20.0	22.0	119.0	22.4	20.3	18.5	16.9
16.9	18.5	20.2	22.2	119.5	22.6	20.5	18.7	17.1
17.1	18.6	20.4	22.4	120.0	22.8	20.7	18.9	17.3

Annex C: Physiological Basis for Treatment of SAM

Affected organ or system	Effects	Treatment
Cardiovascular system	Cardiac output and stroke volume are reduced. Infusion of saline may cause an increase in venous pressure. Any increase in blood volume can easily produce acute heart failure; any decrease will further compromise tissue perfusion. Blood pressure is low. Renal perfusion and circulation time are reduced. Plasma volume is usually normal and red cell volume is reduced.	If the child appears dehydrated, give system ReSoMal or F-75 diet (see section 7.0 of the main text); do not give fluids intravenously unless the child is in shock. Restrict blood transfusion to 10 ml/kg and give a diuretic.
Liver	Synthesis of all proteins is reduced. Abnormal metabolites of amino acids are produced. Capacity of liver to take up, metabolise and excrete toxins is severely reduced. Energy production from substrates such as galactose and fructose is much slower than normal. Gluconeogenesis is reduced, which increases the risk of hypoglycaemia during infection. Bile secretion is reduced.	Do not give the child large meals. Ensure that the amount of protein given does not exceed the metabolic capacity of the liver, but is sufficient to support synthesis of proteins (1–2 g/kg per day). Reduce the dosage of drugs that depend on hepatic disposal or are hepatotoxic. Ensure that sufficient carbohydrate is given to avoid the need for gluconeogenesis. Do not give iron supplements, which may be dangerous because transferrin levels are reduced.
Genito-urinary system	Glomerular filtration is reduced. Capacity of kidney to excrete excess acid or a water load is greatly reduced. Urinary phosphate output is low. Sodium excretion is reduced. Urinary tract infection is common.	Prevent further tissue breakdown by treating any infections and providing adequate energy (80–100 kcal/kg/day). Do not give the child more protein than is required to maintain tissues. Ensure that high-quality proteins are given, with balanced amino acids. Avoid nutrients that give an acid load, such as magnesium chloride. Restrict dietary sodium. Ensure that water intake is sufficient but not excessive.
Gastrointestinal system	Production of gastric acid is reduced. Intestinal motility is reduced. Pancreas is atrophied and production of digestive enzymes is reduced. Small intestinal mucosa is atrophied; secretion of digestive enzymes is reduced.	Give the child small, frequent feeds. If absorption is poor, increase the frequency and reduce the size of each feed. If there is malabsorption of fat, treatment with pancreatic enzymes may be useful.

	Absorption of nutrients is reduced when large amounts of food are eaten.	
Immune system	All aspects of immunity are diminished. Lymph glands, tonsils and the thymus are atrophied. Cell-mediated (T-cell) immunity is severely depressed. Immunoglobulin A (IgA) levels in secretions are reduced. Complement components are low. Phagocytes do not kill ingested bacteria efficiently. Tissue damage does not result in inflammation or migration of white cells to the affected area. Acute phase immune response is diminished. Typical signs of infection, such as an increased white cell count and fever, are frequently absent. Hypoglycaemia and hypothermia are both signs of severe infection and are usually associated with septic shock.	Treat all children with broad-spectrum antimicrobials. Because of the risk of transmission of infection, ensure that newly admitted children are kept apart from children who are recovering from infection.
Endocrine System	Insulin levels are reduced and the child has glucose intolerance. Insulin growth factor 1 (IGF-1) levels are reduced, although growth hormone levels are increased. Cortisol levels are usually increased.	Give the child small, frequent feeds. Do not give steroids.
Metabolism	Basic metabolic rate is reduced by about 30%. Energy expenditure due to activity is very low. Both heat generation and heat loss; hypothermic in a cold environment and hyperthermic in a warm environment.	Keep the child warm to prevent hypothermia; dry the child quickly and properly after washing and cover with clothes and blankets, ensure that windows are kept closed at night and keep the temperature of the living environment at 25–30°C. If a child has fever, cool the child by tepid sponging (never alcohol rubs).
Cellular function	Sodium pump activity is reduced and cell membranes are more permeable than normal, which leads to an increase in magnesium in intracellular sodium and a decrease in intracellular potassium and magnesium. Protein synthesis is reduced.	Give large doses of potassium and magnesium to all children. Restrict sodium intake.
Skin, muscles and glands	The skin and subcutaneous fat are atrophied, which leads to loose folds of skin. Many signs of dehydration are unreliable; eyes may be sunken because of loss of subcutaneous fat in the orbit.	Rehydrate the child with ReSoMal or F-75 diet.

	Many glands, including the sweat, tear and salivary glands, are atrophied; the child has dryness of the mouth and eyes and sweat production is reduced. Respiratory muscles are easily fatigued; the child is lacking in energy.	

Annex D: F-75, F-100, Ready-to-Use Therapeutic Food and Combined Mineral and Vitamin Mix Specifications

Nutrition Composition of F-75 and F-100 per 100 ml

Constituent	F-75 (Amount in 100 ml)	F-100 (Amount in 100 ml)
Energy	75 kcal	100 kcal
Protein	1g (5% of total energy)	3g (11% of total energy)
Lipids	2.5g (32% of total energy)	5.8g (53% of total energy)
Carbohydrate	12g (64% of total energy)	9g (36% of total energy)
Lactose	1.4mg max	4.2g max
n-6 fatty acid	6.5% of total energy	6.5% of total energy
n-3 fatty acid	1.5% of total energy	2.8% of total energy
Ash	Max 4%	Max 4%
Moisture	Max 4%	Max 2.5%

Minerals in F-75 and F-100 per 100 ml

Constituent	F-75 (Amount in 100 ml)	F-100 (Amount in 100 ml)
Sodium	17mg maximum	55mg maximum
Potassium	122 – 156mg	210 - 270mg
Calcium	50 – 100mg	55 – 115mg
Phosphorous*	50 – 100mg	44 – 115mg
Magnesium	8.5 – 11mg	15 – 25mg
Iron	0.05mg maximum	0.05 maximum
Zinc	1.8 – 3.0mg	2.0 – 3.0mg
Copper	0.2 – 0.3mg	0.25 – 0.35mg
Selenium	3.5 - 7mcg	3.5 – 7.7mcg
Iodine	12.3 – 24.5mcg	13 – 27mcg

*excluding phytate in F100

Vitamins in F-75 and F-100 per 100 ml

Constituent	F-75 (Amount in 100 ml)	F-100 (Amount in 100 ml)
Vitamin A	0.1-0.3mg	0.15-0.32mg
Vitamin D3	2.5-5.0mcg	3.0-5.3mcg
Vitamin E	3.3-6.5mg	4-6.5mg
Vitamin K	2.5mcg minimum	3 mcg minimum
Thiamine	0.8mg minimum	0.1mg minimum
Riboflavine	0.3mg minimum	0.3mgminimum
Ascorbic acid	10mg minimum	9.6mg minimum
Vitamin B6	0.1mg minimum	0.1mg minimum
Vitamin B12	0.3mcg minimum	0.3mcg minimum
Folic acid	35mcg minimum	38mcg minimum
Niacin	0.8mg minimum	1.0mg minimum
Pantothenic acid	0.5mg minimum	0.6mg minimum
Biotin	10mcg minimum	11mcg minimum

Ready-to-Use Therapeutic Food Specification

RUTF is an integral part of outpatient programmes, as it allows children to be treated at home rather than at inpatient treatment centres. RUTF is an energy-dense, mineral- and vitamin-enriched food, which is equivalent to F-100 therapeutic milk.

There are several commercial types of RUTF, such as Plumpy'nut® and BP 100®. Several countries are producing their own RUTF using recipes that are adapted to locally available ingredients, and those products have nutritional quality similar to F-100. They have also been shown to be physiologically similar to both commercial forms of F-100 and RUTF.

Mean Nutrition Value of Plumpy'nut®

Nutrients	For 100 g	Per Packet of 92 g	Nutrients	For 100 g	Per Packet of 92 g
Energy	545 kcal	500 kcal	Vitamin A	910 µg	840 µg
Proteins	13.6 g	12.5 g	Vitamin D	16 µg	15 µg
Lipids	35.7 g	32.86 g	Vitamin E	20 mg	18.4 mg
Calcium	300 mg	276 mg	Vitamin C	53 mg	49 mg
Phosphorus	300 mg	276 mg	Vitamin B1	0.6 mg	0.55 mg
Potassium	1,111 mg	1,022 mg	Vitamin B2	1.8 mg	1.66 mg
Magnesium	92 mg	84.6 mg	Vitamin B6	0.6 mg	0.55 mg
Zinc	14 mg	12.9 mg	Vitamin B12	1.8 µg	1.7 µg
Copper	1.8 mg	1.6 mg	Vitamin K	21 µg	19.3 µg
Iron	11.5 mg	10.6 mg	Biotin	65 µg	60 µg
Iodine	100 µg	92 µg	Folic acid	210 µg	193 µg
Selenium	30 µg	27.6 µg	Pantothenic acid	3.1 mg	2.85 mg
Sodium	< 290 mg	< 267 mg	Niacin	5.3 mg	4.88 mg

RUTF is suitable for the treatment of severely malnourished children. RUTF should be soft or crushable, palatable, and easy for young children to eat without any preparation. At least half of the proteins contained in the product should come from milk products.

Nutrition Composition of RUTF

Moisture content	2.5% maximum
Energy	520–550 kcal/100 g
Proteins	10–12% total energy
Lipids	45–60% total energy
Sodium	290 mg/100 g maximum
Potassium	1,100–1,400 mg/100 g
Calcium	300–600 mg/100 g
Phosphorus (excluding phytate)	300–600 mg/100 g
Magnesium	80–140 mg/100 g
Iron	10–14 mg/100 g
Zinc	11–14 mg/100 g
Copper	1.4–1.8 mg/100 g
Selenium	20–40 µg
Iodine	70–140 µg/100 g
Vitamin A	0.8–1.1 mg/100 g
Vitamin D	15–20 µg/100 g
Vitamin E	20 mg/100 g minimum
Vitamin K	15–30 µg/100 g
Vitamin B1	0.5 mg/100 g minimum
Vitamin B2	1.6 mg/100 g minimum
Vitamin C	50 mg/100 g minimum
Vitamin B6	0.6 mg/100 g minimum
Vitamin B12	1.6 µg/100 g minimum
Folic acid	200 µg/100 g minimum
Niacin	5 mg/100 g minimum
Pantothenic acid	3 mg/100 g minimum
Biotin	60 µg/100 g minimum
n-6 fatty acids	3–10% of total energy
n-3 fatty acids	0.3–2.5% of total energy

Note: *Iron is already added to RUTF, but not to F-100.*

Combined Mineral and Vitamin Mix Composition

Nutritional Value of Commercial CMV (Per 6.35 g or 1 Level Scoop)

Vitamins		Minerals	
Biotin	0.2 mg	Copper	5.7 mg
Folic acid	700 µg	Iodine	154 µg
Niacin	20 mg	Iron	0 mg
Pantothenic	6 mg	Magnesium	146 mg
acid	3,000 µg	Potassium	2,340 mg
Vitamin A	1.4 mg	Selenium	94 µg
Vitamin B1	2 µg	Zinc	40 mg
Vitamin B12	4 mg		
Vitamin B2	1.4 mg		
Vitamin B6	200 mg		
Vitamin C	60 µg		
Vitamin D	44 mg		
Vitamin E	80 µg		
Vitamin K			

Annex E: Summary of Discharge Criteria

NRU	OTP	SFP
STABILISED AND REFERRED TO OUTPATIENT CARE Appetite returned (passed appetite test for RUTF; the child is eating more than 75% of daily prescription of RUTF) and start of weight gain **AND** Medical complications resolving **AND** If bilateral pitting oedema on admission, bilateral pitting oedema decreasing **AND** If marasmic kwashiorkor on admission, bilateral pitting oedema resolved **AND** Clinically well and alert **FULL RECOVERY IN INPATIENT CARE** **Children 6–59 months** • MUAC ≥ 12.5 cm • WFH/L z-score ≥ -2 • No bilateral pitting oedema for two consecutive weeks • Clinically well and alert **Children 5–15 Years** • MUAC ≥ 14.5 cm (5–9 years) • MUAC ≥ 18.5 cm (10–15 years) **AND** • No bilateral pitting oedema for 2 consecutive weeks • Clinically well and alert **Infants < 6 months (Breastfeeding)** • Successful re-lactation with effective suckling • Good appetite, clinically well and alert • Weight gain with exclusive breastfeeding is satisfactory **Infants < 6 months (Not Breastfeeding)** • WFL z-score ≥ -2 for 2 consecutive weeks • No oedema for 2 consecutive weeks • Clinically well and alert, no medical problems	**Children 6–59 Months** MUAC ≥ 12.5 cm **AND** WFH/L z-score ≥ -3 **AND** No bilateral pitting oedema for 2 consecutive weeks **AND** Clinically well and alert **Children 5–15 Years** MUAC ≥ 14.5 cm (5–9 years) MUAC ≥ 18.5 cm (10–15 years) **AND** No bilateral pitting oedema for 2 consecutive weeks **AND** Clinically well and alert	**Children 6–59 Months** MUAC ≥ 12.5 cm **AND** WFH/L z-score ≥ -2 **AND** No bilateral pitting oedema **AND** Clinically well and alert for two consecutive visits **NOTE:** Children referred to the SFP from the OTP or NRU should be discharged after 1 month of follow-up in the SFP **Children 5–15 Years** MUAC: 5–9 years: ≥ 14.5 cm 10–15 years: ≥ 18.5 cm **AND** No bilateral pitting oedema **AND** Clinically well and alert for two consecutive visits **Pregnant and lactating women** MUAC ≥ 22.5 cm for 2 consecutive visits **OR** Child reaches 6 months of age