MODULE 2

Children from Birth to Five Years of Age

What Does this Module Cover?

Module 2 focuses on anthropometry of children from birth to 5 years of age (0–60 completed months). It is broken into specific sections that describe the importance of nutrition for children in this age group:

- common nutrition-related conditions identified by anthropometry
- the measurements and indices used to identify nutrition-related conditions
- interpretation of anthropometric measures and classification of nutritional status
- helpful tools

Users are encouraged to review Module 1 alongside this module because it explains key concepts that are relevant to all modules.

Who Is the Focus of Module 2?

Module 2 aligns with the age ranges used in the World Health Organization (WHO) Child Growth Standards. In this module, “children from birth to 5 years of age” refers to **children from birth to 60 completed months of age**. When the child completes 60 months (i.e., the child turns 5 years and 1 month of age), he or she moves into the 5–19-year age group (discussed in Module 3).

Nutrition from Birth to 5 Years of Age: Why Does It Matter?

Good nutrition, adequate health care, and a nurturing environment all contribute to children reaching their full growth and development potential. This is especially important during the 1,000 days from the beginning of the mother’s pregnancy to the child’s second birthday, when children are growing and developing most rapidly. To support this growth, young children have relatively high nutritional needs and are more vulnerable to malnutrition and its consequences than other age groups. Malnourished children are at higher risk of illness and death than well-nourished children; undernutrition is associated with 45 percent of deaths of children under 5 (Black et al. 2013). In addition, nutritional deficits during this period can have lifelong and often irreversible consequences, including impaired cognitive development, lower school performance and achievement, reduced economic productivity, and increased risk of certain chronic diseases in adulthood (UNICEF 2013). While undernutrition in developing countries remains a problem, at the same time, the worldwide increase in infant and childhood overweight and obesity also has both short- and long-term consequences. Overweight and obese children are at higher risk of developing diabetes, high blood pressure, respiratory problems, and of being obese in adulthood, with the associated increased risks of noncommunicable disease, disability, and premature death (WHO 2014c).

Nutrition from Birth to 5 Years of Age: Why Does It Matter? (continued)

Preventing and treating malnutrition in young children can substantially reduce deaths and ensure that children grow optimally, both physically and mentally. Children in this age group, particularly under the age of 2, are very responsive to nutrition interventions, making this a critical period to act (Bhutta et al. 2013).

Anthropometry is a key tool in the design and implementation of nutrition interventions seeking to address child malnutrition. It is helpful in determining and monitoring the nutritional status of individual children and the wider population, which provides information for the care and treatment of individuals, as well as for policy, program design, and resource allocation at the population level. In addition, population-level data can be used to evaluate trends in nutritional status, help determine whether a large-scale intervention is needed, and monitor a nutrition intervention's impact on a population.

What Nutrition-Related Conditions Are Identified through Anthropometry?

This section provides a brief description of the most common nutrition-related conditions affecting children from birth to 5 years of age that can be identified using anthropometry. The anthropometric measurements and indices used to identify these nutrition conditions are described in the **Measurements** section.

CONDITIONS IN THIS SECTION

Already familiar with nutrition-related conditions?
Jump ahead to the **Measurements** section.

CONDITION: **Low Birth Weight**

Low birth weight refers to an infant who weighs less than 2,500 grams (5.5 lbs.) at birth. Low birth weight can occur in infants who are born early (before 37 weeks of gestation), are small for their gestational age and born at term, or are both small for gestational age and born early (preterm) (WHO 2014a). Low birth weight is associated with increased risk of infant death, childhood stunting, and reduced brain development in early childhood; children who are both small for their gestational age and born early are at highest risk (Black et al. 2013; Lundgren and Tuvemo 2008). Pregnant women's nutritional and health status before and during pregnancy affects both the growth of the fetus in the womb and the risk of preterm birth. Babies of mothers who are short (height <145 cm) and underweight (low pre-pregnancy body mass index [BMI] [<18.5]) are at higher risk of being small for gestational age (Black et al. 2013).

TIP

Gestational age refers to the length of a pregnancy and is measured in weeks. An infant born small for gestational age weighs less than would be expected for a newborn of the same sex born from a pregnancy of the same length. A child who is born early (e.g., before 37 weeks gestation) may be at an appropriate weight for his/her gestational age but still have low birth weight. An infant who is small for gestational age is defined as being below the 10th percentile for sex-specific weight for gestational age (WHO 1995).

LINKS TO RELATED CONTENT

Measurement: Birth weight   Interpretation: Cutoffs for birth weight

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CONDITION: **Small Head Size/Circumference**

Small head size/circumference, also referred to as microcephaly, occurs when a child's head is significantly smaller than expected for his/her age and sex. Microcephaly has been linked with poor cognition and lower academic test scores and often indicates that the child's brain has developed abnormally (Ivanovic et al. 2004). Microcephaly may be present at birth (congenital) or develop after birth (acquired) and may result from genetic disorders, infections, exposure to drugs or chemicals, poor fetal growth, or severe malnutrition, among other reasons (U.S. Centers for Disease Control and Prevention [CDC] 2016; Ivanovic et al. 2004). Small head size is determined using the head circumference-for-age index for a child's sex. While macrocephaly (large head size) is also of medical concern and can be identified through anthropometry, it is not related to nutritional status and therefore is not discussed in this guide.

LINKS TO RELATED CONTENT

Measurement: Head-circumference-for-age

Interpretation: Cutoffs for head-circumference-for-age

CONDITION: **Stunting**

Stunting, a reflection of chronic undernutrition, occurs when a child does not grow to his/her potential because of the long-term cumulative effects of inadequate dietary intake, frequent illness/infection, or both (WHO 2014b). Stunting often begins with poor growth in utero because of maternal undernutrition. The result is that the child is shorter than would be expected for a healthy child of his/her age and sex. Stunted children are more likely to die of infectious diseases such as diarrhea, pneumonia, and measles (Black et al. 2013). Stunting is also associated with poor cognitive and motor development and lower school achievement (Grantham-McGregor et al. 2007; Hoddinott et al. 2008). The first 1,000 days is the time when children are most vulnerable to stunting. Lost growth and development during this time are difficult to recover after age 2 (WHO 2014b). Stunting is identified using the length/height-for-age index specific to a child's sex.

LINKS TO RELATED CONTENT

Measurement: Length/height-for-age   Interpretation: Cutoffs for length/height-for-age

CONDITION: **Acute Malnutrition**

Acute malnutrition is caused by an inadequate amount or quality of food, severe and/or repeated infections (e.g., diarrhea and pneumonia), or a combination of these, which results in a child who loses weight rapidly, does not gain enough weight relative to his/her growth in height, and/or experiences bilateral pitting edema. It may be classified as either moderate or severe. Children with acute malnutrition are at higher risk of death from infectious diseases (Black et al. 2013) and require treatment based on the severity of the condition.

There is a lot of terminology used in reference to acute malnutrition that may be confusing to readers. For simplicity, this guide has provided key terminology associated with acute malnutrition:

- **Wasting**
- **Moderate acute malnutrition (MAM)**
- **Severe acute malnutrition (SAM)**

TIP

Severe wasting is also referred to as severe acute malnutrition, marasmus, emaciation, extreme wasting, and nutritional marasmus.

CONDITION: Acute Malnutrition
↳ CONDITION: **Wasting**

Wasting occurs when a child is too thin for his/her height. It is defined using the sex-specific weight-for-length/height or BMI-for-age index. A child with wasting has either moderate or severe acute malnutrition, depending on the severity of wasting.

LINKS TO RELATED CONTENT

Measurement: Weight-for-length/height

Interpretation: Cutoffs for weight-for-length/height and BMI-for-age

Measurement: BMI-for-age

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CONDITION: Acute Malnutrition

⮡ CONDITION: Moderate Acute Malnutrition (MAM)

Moderate acute malnutrition (MAM) occurs when a child is moderately wasted or has low mid-upper arm circumference (MUAC) and does not have bilateral pitting edema. A child with MAM is three times more likely to die of infectious diseases than a well-nourished child. MAM accounts for over 5 percent of child deaths (Black et al. 2008; Black et al. 2013). MAM is identified using the weight-for-height index for a child's sex and/or MUAC.

LINKS TO RELATED CONTENT

- Measurement: Weight-for-length/height
- Interpretation: Cutoffs for weight-for-length/height
- Measurement: MUAC
- Interpretation: Cutoffs for MUAC

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CONDITION: Acute Malnutrition

⮡ CONDITION: Severe Acute Malnutrition (SAM)

Severe acute malnutrition (SAM) occurs when a child is severely wasted, and/or has very low MUAC, and/or has bilateral pitting edema (nutritional edema). Bilateral pitting edema is a clinical sign of SAM and is explained in greater detail in the Measurements section. Children with SAM are up to nine times more likely to die than well-nourished children (Black et al. 2008; WHO and UNICEF 2009). Children with SAM need urgent medical treatment and specialized therapeutic foods to recover. Children under 6 months of age were once considered to be at low risk for SAM because of breastfeeding, so many treatment programs focused only on children age 6 months or older. However, because of poor feeding practices and diseases such as diarrhea, it is now recognized that young infants are at risk for SAM. They are also vulnerable to death and therefore it is important to assess all children under 5 years of age for SAM (WHO n.d.). SAM is identified in children under 6 months of age by using the sex-specific weight-for-length/height index. SAM is identified in children 6–59 months of age by assessing for bilateral pitting edema and using the sex-specific weight-for-length/height index or MUAC cutoffs.

LINKS TO RELATED CONTENT

Measurement: Weight-for-length/height
Measurement: MUAC
Measurement: Bilateral pitting edema
Interpretation: Cutoffs for weight-for-length/height
Interpretation: Cutoffs for MUAC
Interpretation: Classification of bilateral pitting edema

CONDITION: **Underweight**

Underweight occurs when a child weighs less than would be expected for a healthy, well-nourished child of the same age and sex. Underweight may indicate that the child is stunted, wasted, or both, but does not differentiate between the two. It may be caused by a child losing weight or not growing or not gaining weight at the expected pace and is often associated with illness and/or inadequate dietary intake. Underweight is identified using the weight-for-age index appropriate to a child's sex.

LINKS TO RELATED CONTENT

Measurement: Weight-for-age
Interpretation: Cutoffs for weight-for-age

CONDITION: **Overweight and Obesity**

Overweight and obesity (severe overweight) occur when a child has too much body fat and weighs more than would be expected for a healthy child of the same height and sex, putting his/her health at risk. Overweight and obesity are complex conditions with multiple causes, including an imbalance between calories consumed and calories used, low levels of physical activity, medical conditions, and genetics, among others. As of 2016, as many as 41 million children worldwide were overweight or obese (UNICEF, WHO, and World Bank 2015). Childhood overweight/obesity is associated with health risks in childhood and adulthood. Children who are overweight/obese are at increased risk for type 2 diabetes, asthma, and high blood pressure, among other diseases (WHO 2014c); and because overweight/obese children are more likely to become overweight adults, they are also at increased risk of the poor health outcomes associated with adult obesity or overweight, including diabetes, heart disease, cancer, and stroke (Freedman et al. 2005). Overweight/obesity in children from birth to 5 years of age is identified using the BMI-for-age index or weight-for-length/height index specific to that child's sex.

LINKS TO RELATED CONTENT

Measurement: BMI-for-age
Interpretation: Cutoffs for BMI-for-age and weight-for-length/height
Measurement: Weight-for-length/height

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What Anthropometric Measurements and Indices Are Used for Children from Birth to 5 Years of Age?

This section describes the various anthropometric measurements and indices used to identify nutrition conditions in young children: birth weight, length/height-for-age, weight-for-age, weight-for-length/height, BMI-for-age, MUAC, and head circumference-for-age. This guide also includes bilateral pitting edema, which is a clinical indicator, because it is frequently assessed along with anthropometry in children from birth to 5 years of age to identify SAM. **Table 2.1** summarizes the nutritional measurements and indices described in this module and the nutrition conditions they identify.

Already familiar with measurements and indices? Jump ahead to the **Interpretation** section.

TABLE 2.1 Selected Anthropometric Measurements and Indices in this Module

	Birth Weight (only for newborns)	**Length/ Height-for-Age**	**Weight-for-Age**	**Weight-for-Length / Height**	**BMI-for-Age**	**MUAC** (6–59 months only)	**Head Circumference-for-Age**	**Bilateral Pitting Edema**
Nutritional condition that the measurement/ index identifies	Low birth weight	Stunting	Underweight	Wasting, acute malnutrition, overweight, obesity	Wasting, acute malnutrition, overweight, obesity	Acute malnutrition	Microcephaly, which can result from undernutrition	Severe acute malnutrition

MEASUREMENT: **Birth Weight**

Birth weight is measured as soon after birth as possible and within 24 hours of birth (WHO 2007; WHO and UNICEF 2004; MEASURE Evaluation n.d.).

LINKS TO RELATED CONTENT

Condition: Low birth weight   Interpretation: Cutoffs for birth weight

MEASUREMENT: **Length/Height-for-Age**

Length/height-for-age considers a child's length or height relative to his/her age and sex. It is used to identify stunting. In developing countries, it has traditionally been used at the population level for evaluation and benchmarking. However, recently, there have been efforts to use length/height-for-age in regular clinical nutrition assessment and growth monitoring to track children's linear growth.

BOX 2.1 MEASURING LENGTH AND HEIGHT

Length, measured with the child lying down, is used for children under 24 months of age.

Height, measured while the child is standing, is used for children 24 months of age and older.

If the age is unknown, children under 87 cm are measured lying down, and those 87 cm or taller are measured standing.

Source: WHO and UNICEF 2009.

LINKS TO RELATED CONTENT

Condition: Stunting   Interpretation: Cutoffs for length/height-for-age

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MEASUREMENT: **Weight-for-Age**

Weight-for-age considers a child's weight relative to his/her age and sex and identifies underweight. It may reflect wasting, stunting, or both. Weight-for-age has been frequently used in growth promotion programs but has limitations because of its inability to distinguish between wasting and stunting.

LINKS TO RELATED CONTENT

Condition: Underweight

Interpretation: Cutoffs for weight-for-age

MEASUREMENT: **Weight-for-Length/Height**

Weight-for-length/height can be used to identify a child whose weight is too low for his/her length or height (wasting, or acute malnutrition) or who is overweight or obese. It considers a child's weight relative to his/her length or height and sex. In program settings, weight-for-height is one method used to determine admission and discharge criteria for community-based management of acute malnutrition (CMAM) programs.*

LINKS TO RELATED CONTENT

Condition: Wasting

Interpretation: Cutoffs for weight-for-length/height

Condition: Acute malnutrition

Condition: Overweight/obesity

NOTE

It may not be possible to compare the weight-for-length measurement of recently born stunted children against the WHO Child Growth Standards as they will be shorter than the smallest length WHO provides.

* For more information on CMAM programs, visit http://www.severemalnutrition.org.

MEASUREMENT: **BMI-for-Age**

BMI-for-age identifies both wasting and overweight/obesity. It is a ratio of weight relative to length/height—calculated using the formula (weight in kilograms)/(length/height in meters)^2 —that is interpreted according to age and sex. The age- and sex-specific interpretation is necessary because this age group is still growing and the relationship between weight, height, and fat changes based on stage of development and sex. BMI-for-age is an appropriate index for children from birth to 5 years of age but is less commonly used in developing countries than weight-for-height.

LINKS TO RELATED CONTENT

Condition: Wasting

Condition: Acute malnutrition

Condition: Overweight/obesity

Interpretation: Cutoffs for BMI-for-age

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MEASUREMENT: **MUAC**

MUAC is used to identify wasting (acute malnutrition) in children 6–59 months of age by measuring the circumference of the mid-upper arm and comparing it to an established cutoff. There is insufficient evidence to recommend a MUAC cutoff for children under 6 months of age. MUAC was previously used mostly for screening. However, it is now also used for diagnosis, admission, and discharge of children with MAM and SAM, particularly in CMAM programs, because it is a simple measurement and a good predictor of risk of death.* Whether using weight-for-length/height or MUAC, the same indicator used to confirm SAM should also be used to assess whether a child has reached nutritional recovery (WHO 2013).

LINKS TO RELATED CONTENT

Condition: Acute malnutrition

Interpretation: Cutoffs for MUAC

NOTE

Although the WHO Child Growth Standards include a sex-specific index that considers MUAC in relation to age for children 3–60 months, it has not been widely adopted. Instead, a single, non-sex-specific set of MUAC cutoffs is more commonly used for all children 6–59 months of age. It has similar accuracy to MUAC-for-age in predicting mortality risk and is more likely than MUAC-for-age to select younger children, who are at highest risk of death (Walters et al. 2012).

* Both MUAC and weight-for-length/height, either alone or in combination, are used by programs to identify children at risk of acute malnutrition and admit them to treatment. Some programs use MUAC to identify and refer at-risk children and use weight-for-length/height to admit them for treatment. Some use either MUAC or weight-for-height for identification and admission for treatment, while others strictly use MUAC as the admission criterion. There is ongoing debate over whether MUAC or weight-for-length/height is best and whether they should both be used independently, as research indicates that MUAC and weight-for-length/height capture overlapping but not identical groups of children (Grellety and Golden 2016; Roberfroid et al. 2015; Walters et al. 2012).

MEASUREMENT: **Head Circumference-for-Age**

Head circumference-for-age compares a child's head circumference measurement to the expected circumference for healthy children of the same age and sex. Measured as part of infant health screening to identify potential neurological or developmental deficits, it can also indicate chronic protein-energy deficiency in children under 2 (WHO Multicentre Growth Reference Study [MGRS] Group 2007; Gibson 2005). Associated with brain volume, head circumference is affected by nutrition during pregnancy (in utero) and during the first months of life (Bartholomeusz et al. 2002). Head circumference should first be measured within the first 24 hours of birth and continued until at least age 2 because this is the period of most rapid growth. However, WHO Child Growth Standards cover children up to age 5 years and continued monitoring of head circumference after age 2 is possible (WHO 2016a).

LINKS TO RELATED CONTENT

Condition: Small head size/circumference   Interpretation: Cutoffs for head-circumference-for-age

MEASUREMENT: **Bilateral Pitting Edema**

Bilateral pitting edema is a clinical sign of a specific form of SAM known as nutritional edema, edematous malnutrition, SAM with edema, or kwashiorkor. Bilateral pitting edema is an abnormal accumulation of fluid in body tissues that causes swelling beginning in both feet in its mild form and is generalized to both feet, legs, hands, arms, and face in its most severe form. It is characterized by a lasting pitting (indentation) of the skin when pressure is applied to both feet for 3 seconds. Even mild bilateral pitting edema indicates SAM or another serious medical condition. Cases should be referred for further assessment and treatment, and a child with severe bilateral pitting edema requires inpatient care.

LINKS TO RELATED CONTENT

Condition: Severe acute malnutrition   Interpretation: Classification of bilateral pitting edema

How to Interpret Anthropometric Indicators and Classify Nutritional Status

This section provides guidance for how to interpret child growth measurements and indices and classify a child's nutritional status. For children from birth to 5 years of age, the WHO Child Growth Standards provide guidance for interpreting most of the anthropometric measurements and indices described in this guide, including cutoffs to classify children's nutritional status. Recently, fetal and newborn growth standards have also been released by the International Fetal and Newborn Growth Consortium for the 21st Century (INTERGROWTH-21st). Both standards provide information on how to classify anthropometric data based on two commonly used systems: z-scores and percentiles (see **Box 2.2**). This guide focuses on z-scores (in detail on page 47) to align with WHO recommendations. Universal internationally accepted cutoffs have also been established for MUAC and low birth weight, which are not included in the WHO Child Growth Standards.

BOX 2.2 Z-SCORES AND PERCENTILES

A **z-score** indicates how far and in what direction an individual's anthropometric measurement deviates from the median of the reference population and is expressed in standard deviations. For example, if a girl's weight-for-age z-score is -2, her weight-for-age is two standard deviations below the median weight-for-age of other girls her age.

A **percentile** indicates where an individual's anthropometric measurement falls relative to other people of the same age and sex in the reference population. For example, if a girl's weight-for-age is in the 85th percentile, she weighs more than 85 percent of other girls her age.

It is possible to convert z-scores to percentiles and vice versa. For example:

- A z-score of +2 is equivalent to the 97.7th percentile.
- A z-score of 0 is equivalent to the 50th percentile.
- A z-score of -2 is equivalent to the 2.3rd percentile.

However, the cutoffs used in each system are not exactly equivalent. For example, while a child in the 5th percentile would likely be identified as having a growth problem, the equivalent z-score of -1.65 would still be considered to be in the normal range.

Source: Wang and Chen 2012.

Putting Anthropometry in Context: Infant and Child Growth Standards

The WHO Child Growth Standards, released in 2006, describe the range of growth that is considered normal in healthy children raised with good feeding practices, health care, and in a healthy environment, regardless of ethnicity, socioeconomic status, or location.

The WHO standards are based on the 1997–2003 Multicentre Growth Reference Study (MGRS), which followed the growth of 8,440 children of diverse cultural and ethnic backgrounds in six countries—Brazil, Ghana, India, Norway, Oman, and the United States. The study specifically selected children who were from healthy environments where recommended health behaviors were practiced (including breastfeeding and standard pediatric care) and whose mothers did not smoke. Growth measurements were taken by carefully trained personnel, using standardized methods, robust and precise equipment, and strict adherence to methods and procedures (de Onis et al. 2004).

The standards include growth charts and tables to assess growth and development from birth to age 5 using key growth indicators (see below). Since girls and boys grow differently, the standards and accompanying growth charts and tables are sex-specific.

The following WHO Child Growth Standards indicators, which are commonly used in developing countries, are discussed in this guide:

- **Length/height-for-age**
- **Weight-for-age**
- **Weight-for-length**/**height**
- **BMI-for-age**
- **Head circumference-for-age**

BOX 2.3
KEY DEFINITIONS

A **growth standard** is prescriptive. It demonstrates how healthy children grow under ideal circumstances.

A **growth reference** describes how a specific population has grown but does not necessarily reflect optimal growth.

A **cutoff** is a threshold beyond which an individual is determined to be malnourished. It also identifies the severity of undernutrition or overweight/obesity in an individual. Cutoffs can be used at the population level to signify when a nutrition situation is considered to be of public health concern.

The WHO Child Growth Standards also include several other indicators that are not frequently used in developing countries (arm circumference-for-age; sub-scapular skinfold-for-age; triceps skinfold-for-age; weight, length, and head circumference velocity) or do not involve anthropometric measurements (motor development milestones—sitting, standing, crawling, walking alone/assisted). These indicators are not discussed in this guide.

Adopted by over 140 countries, the 2006 standards replace the National Center for Health Statistics (NCHS)/WHO Child Growth Reference that had been in use since 1977 (WHO 2011). For more information on the WHO Child Growth Standards, see the WHO website.

BOX 2.4 INTERGROWTH-21ST STANDARDS

In 2008, INTERGROWTH-21st launched a multi-country project to extend the WHO Child Growth Standards into the fetal and neonatal period by developing prescriptive standards for fetuses, newborns, and the postnatal growth of preterm infants.

The INTERGROWTH-21st standards provide information on how fetuses and newborns are expected to grow (from 9 weeks post-conception until birth), irrespective of nationality or ethnicity, when they are born to healthy, well-nourished mothers; experience minimal environmental impacts that would constrain growth; have had access to adequate health care; and are breastfed. Using the same conceptual framework as the WHO Child Growth Standards, INTERGROWTH-21st pooled information from eight countries to produce prescriptive growth standards and a new way to classify preterm and small-for-gestational-age babies (Villar et al. 2014). INTERGROWTH-21st provides a new opportunity to understand whether a child is small due to preterm birth, impaired fetal growth, or both (Hughes et al. 2017). New sex-specific standards were developed on measurements of newborn size at birth, birth length, head circumference, biparietal diameter, occipitofrontal diameter, femur length, and abdominal circumference.

Since the INTERGROWTH-21st standards have not yet been widely adopted in developing countries and require use of ultrasound technology to determine gestational age—which is not practical in most low-resource settings—they are not covered in this guide. However, they are important standards to be aware of and can be used if ultrasound technology is available.

More information is available on the INTERGROWTH-21st Standards website.

Making Sense of the Data: Z-Scores

What Are Z-Scores and What Do They Tell Us?

Anthropometric z-scores describe how far and in what direction an individual's measurement is from the reference populations' median value. Z-scores that fall outside of the normal range indicate a nutritional issue (undernutrition or overweight). If a z-score is outside the normal range, its distance from the median indicates the severity of the nutritional issue; the further away, the more severe. When a high proportion of individuals in a given population have z-scores outside of the "normal" range, there is a population-level nutrition problem. See Module 1 for guidance on how to understand the nutrition situation at the population level.

NOTE

The **reference population** used in the WHO Child Growth Standards is composed of children from birth to 5 years who were raised in optimal environmental conditions. An individual child's z-score is based on a comparison with children of the same sex and, depending on the measure, age.

In addition to providing information on current nutritional status, z-scores can be used to follow an individual child's growth over time. This helps health care providers see whether a child is growing well, is at risk of undernutrition or overweight, or is on the path to recovery from malnutrition (see **Box 2.5**).

BOX 2.5 PLOTTING A CHILD'S GROWTH OVER TIME USING GROWTH CHARTS

It is not possible to fully understand the pattern of a child's growth by looking at his/her z-score at one single point in time. Rather, it is important to consider the child's growth trend over time (Is he gaining or losing weight? Has she grown taller or stopped growing?). For example, consider a child with a weight-for-height z-score of -1, which falls in the "normal" range. If that child's previous z-score was also normal and close to -1, there would be no cause for concern; however, if his/her z-score was higher in a previous measurement, the child's weight is lower relative to his/her height than before and his/her growth may be faltering. Likewise, a z-score below -2 may raise concern unless comparisons with previous z-scores show that the child is improving from previous weight loss.

Health workers use growth charts (often based on the WHO Child Growth Standards for children 0–60 months) to track a child's growth over time. The growth chart contains z-score lines that relate a child's measurements to the standard. Marking where the child's individual measurements fall at certain points in time allows growth to be tracked and indicates whether the child is growing at a healthy pace.

For more information on plotting measurements and interpreting growth pattern, see **Annex 1**.

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Why Z-Scores?

A major advantage of z-scores is that at the population level, they can be used to calculate summary statistics such as means, which allows the entire population's nutritional status to be assessed. They are also very useful for identifying individual children with extreme measurements that differ substantially from those of normal, healthy children. This is especially important in populations with high levels of malnutrition because children at the extreme ends of the distribution have the most severe forms of malnutrition (Gorstein et al. 1994; WHO 1995; Gibson 2005).

Who Needs to Understand Z-Scores and Why?

Z-score cutoffs are used to define malnutrition according to anthropometric indices (e.g., weight-for-length/height). Therefore, health care workers and nutrition program staff need to understand what z-scores are, how to interpret them, and what they mean to make informed decisions at both the individual level (e.g., for growth monitoring and entry into/graduation from feeding programs) and population level (e.g., for nutrition assessments or situational reports for a population and monitoring and evaluation of programs).

> **TIP**
>
> In clinic or community settings, health workers are not expected to discuss z-scores with patients. Instead, they should talk about the individual's nutritional status (e.g., MAM) and growth pattern (e.g., growing well, growing too slowly, or lagging far behind).

How Is a Z-Score Determined?

Z-scores can be estimated using growth charts/tables (see the Tools section), obtained using computer software, or calculated by hand. In a clinical context such as during health facility visits or growth monitoring, sex-specific growth charts or tables are used to estimate a child's z-score and classify nutritional status, based on anthropometric measurements and often age. In a research or survey setting, where exact z-scores are needed, special software programs such as WHO Anthro[2] and Epi-Info can calculate z-scores. The WHO website also provides macros for the SPSS, Stata, SAS, S-Plus, and R statistical software packages to calculate z-scores for the anthropometric indicators in the growth standards. For specific guidance on how a z-score is calculated, see Annex 2.

[2] WHO Anthro is used to calculate z-scores for children 0–60 months of age only. For older children (5–19 years of age), WHO AnthroPlus is used. WHO Anthro and AnthroPlus are available on the WHO website at: http://www.who.int/childgrowth/software/en/ and http://www.who.int/growthref/tools/en/, respectively.

Using Anthropometry to Classify Nutritional Status of Children from Birth to 5 Years of Age

Tables 2.3 to 2.6 provide information on classifying a child's nutritional status using the measurements and indices described in this module.

TABLE 2.3 WHO Child Growth Standards Classification

ANTHROPOMETRIC INDICATOR AND CONDITION	AGE: 0–23 months	AGE: 24–60 months	Z-SCORE: < -3	≥ -3 to < -2	≥ -2 to < -1	≥-1 to ≤ +1	> +1 to ≤ +2	> +2 to ≤+3	> +3
Length-for-age Stunting	✓		Severe stunting	Moderate stunting	Normal				Extreme tallness is not usually a nutrition issue. May indicate endocrine disorder.
Height-for-age Stunting		✓							
Weight-for-age Underweight	✓	✓	Severe underweight	Moderate underweight	Normal		Do not use weight-for-age to determine overweight. Weight-for-length/height (0–60 months) and BMI-for-age (all ages) are better for assessing overweight in children.		
Weight-for-length Wasting, overweight/obesity	✓		Severe wasting/ severe acute malnutrition (SAM)	Moderate wasting/ moderate acute malnutrition (MAM)	Normal		Possible risk of overweight	Overweight	Obesity
Weight-for-height Wasting, overweight/obesity		✓							
BMI-for-age* Wasting, overweight/obesity	✓	✓	Severe wasting/SAM	Moderate wasting/MAM	Normal		Possible risk of overweight	Overweight	Obesity
Head-circumference-for-age Small head circumference	✓	✓	Very small head circumference (severe microcephaly)	Small head circumference (microcephaly)	Normal			Large head circumference (macrocephaly) Not related to nutritional status.	

Sources: WHO 2008; CDC 2016; WHO 2016b.
** Less commonly used than weight-for-height in children from birth to 5 years of age in developing countries.*

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TABLE 2.4 Mid-Upper Arm Circumference

The table below identifies universally accepted international MUAC cutoffs for children 6–59 months of age based on WHO guidance. There is insufficient evidence to recommend a MUAC cutoff for children under 6 months of age.

Age Group	Nutritional Status (identifies wasting/acute malnutrition)	
	SAM	**MAM**
6–59 months	<115 mm	≥115 mm to <125 mm

Source: WHO/UNICEF/WFP 2014; WHO 2013.

LINKS TO RELATED CONTENT

Measurement: MUAC   Condition: Moderate acute malnutrition   Condition: Severe acute malnutrition

TABLE 2.5 Birth Weight

The table below identifies universally accepted international low birth weight (LBW) cutoffs for newborns, based on WHO guidance.

Age Group	Low Birth Weight	Normal Birth Weight
Newborns, within 24 hours of birth	< 2,500 grams	≥ 2,500 grams

Source: WHO 2014.

LINKS TO RELATED CONTENT

Measurement: Birth weight   Condition: Low birth weight

Clinical Assessment: Bilateral Pitting Edema

Bilateral pitting edema is a clinical sign of SAM.

TABLE 2.6 Nutritional Status Classification of Bilateral Pitting Edema

Description	Grade of Edema	Nutritional Status
No bilateral pitting edema	Absent (0)	Does not have edematous malnutrition
Present in both feet/ankles	Mild (+)	SAM
Present in both feet/ankles, plus lower legs, hands, or lower arms	Moderate (++)	SAM
Generalized, including both feet, legs, hands, arms, and face	Severe (+++)	SAM

Sources: WHO 2013; WHO e-Library of Evidence for Nutrition Actions (eLENA) n.d. (a); WHO eLENA n.d. (b).

LINKS TO RELATED CONTENT

Measurement: Bilateral pitting edema

Condition: Severe acute malnutrition

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BOX 2.6 SPECIAL CONDITIONS

Certain developmental, neurologic, and genetic conditions, such as Down syndrome, achondroplasia, and cerebral palsy, may alter an individual's body composition, size, growth pattern, and/or overall growth potential. In addition, it can be challenging to accurately measure individuals with conditions that affect the ability to stand; straighten their arms, legs, or back; or hold their head steady. In addition, comparing the weight of amputees to a reference population of non-amputees is problematic. When assessing people with special needs, it is important to be aware of the implications of their condition and potential explanations for their altered growth.

There is limited guidance on applying anthropometry to individuals with special needs. While the CDC has provided some alternative measurement options for individuals, WHO has not issued specific guidelines or references. However, alternative anthropometric references exist for certain conditions. The alternative charts have been developed from small, homogeneous samples and may not have used standardized measurement techniques or accounted for secondary conditions that affect growth. Therefore, although they may be a useful reference to understand how a condition may affect growth or anthropometric measurements, they should be used with caution and in conjunction with the WHO standards and references.

For more information on the CDC's alternative approaches for measuring an individual with special needs, see The CDC Growth Charts for Children with Special Health Care Needs.

For alternative anthropometric references, see:

Amputation: Mini Nutritional Assessment (Appendix 3: Determining BMI for Amputees)

Down syndrome: UK Down Syndrome 0–18 years

Cerebral palsy: The Life Expectancy Project charts, according to gross motor function classification system

Cornelia de Lange syndrome: Girls Boys

Additional resources: The Greenwood Genetic Center in the United States published a set of references (1998) from age 25 weeks through adulthood for several conditions, including achondroplasia, Marfan syndrome, and Turner syndrome, among others. They are available for purchase.

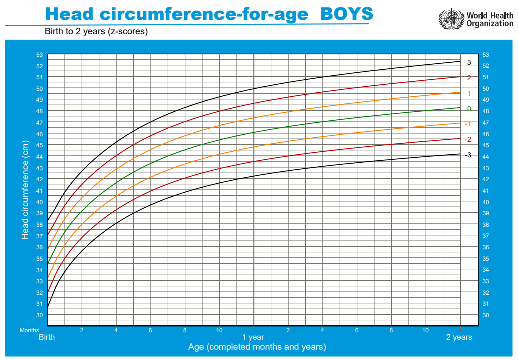
Source: Gibson 2005; U.S. Department of Health and Human Services n.d.; CDC 2013; Life Expectancy Project 2011; Nestle Nutrition Institute n.d.

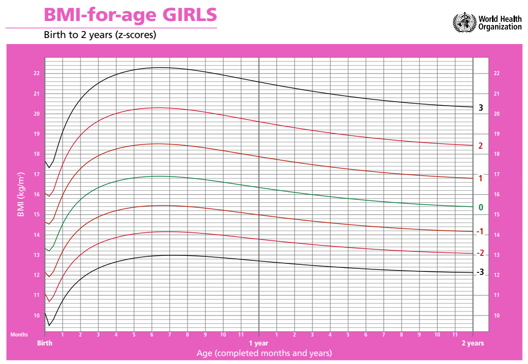
Tools to Assess, Classify, and/or Monitor Nutritional Status of Children from Birth to 5 Years of Age

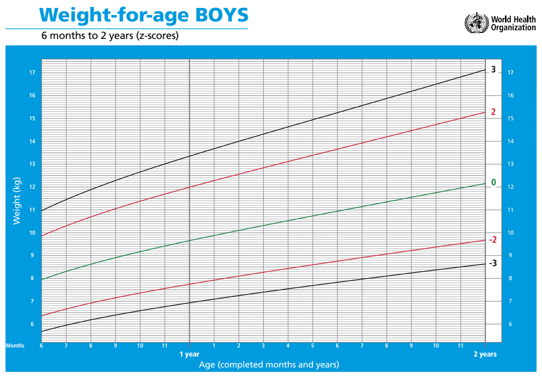
This section describes the various anthropometric tools (growth charts and reference tables) that support the assessment, classification, and monitoring of a child's nutritional status.

TOOL: **Growth Charts**[2]

When anthropometric measurements, such as height and weight, are used as part of individual assessment or screening in a community, clinic, or facility, health workers will typically plot the measurements on a sex-specific growth chart included in the child's health card. Measuring and plotting a child's measurements over time allows growth to be tracked and indicates whether the child is growing at a healthy pace. In most developing countries, the growth charts are based on the WHO Child Growth Standards. Examples of growth charts and more information on how to interpret the plotted data from the growth charts can be found in Annex 1.







Growth charts for the WHO Child Growth Standards are accessible on the WHO website.

TOOL: **Quick Reference Tables**

Simple sex-specific reference tables can also be used to classify a child's nutritional status. Although they do not provide precise z-scores, they can quickly estimate a child's approximate z-score and nutritional status. WHO has developed simplified sex-specific field tables,[3] which show the z-score value corresponding to the cutoff for each classification (mild, moderate, severe malnutrition) for the weight-for-length/height, length/height-for-age, weight-for-age, and BMI-for-age indices. FANTA has further adapted the WHO tables for weight-for-length/height to provide the weight and z-score ranges corresponding to each nutritional status category. Instructions for the FANTA reference tables are here with the full set beginning on the next page.

Instructions with Example:

John, a boy age 18 months, is 82 cm long and weighs 13.5 kg. What is his nutritional status, based on the tables on the next page?

Steps:

1. Find the correct table for the child's age (0–23 months or 24–59 months) and sex (boy or girl).

   Use the "Boys 0-23 months, Weight-for-Length" table for John.

2. Find the value closest to the child's measured length/height in the left column.

   82 cm

3. Move your finger to the right to the range that includes the child's weight in kilograms.

   12.9-14.0 kg

4. Classify the child's nutritional status according to the label on top of the column that includes the child's weight.

   Answer: John is overweight.

NOTE

Looking for a full set of simplified sex-specific field tables with instructions?

Download FANTA's field tables

[3] WHO field tables: Weight-for-height, Length/height-for-age, Weight-for-age, BMI-for-age

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BOYS 0–23 months, Weight-for-Length

Length (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3	Length (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
45	0–1.8	1.9	2.1–3.0	3.1–3.3	> 3.3	73	0–7.1	7.2–7.6	7.7–10.8	10.9–11.8	> 11.8
46	0–1.9	2.0–2.1	2.2–3.1	3.2–3.5	> 3.5	74	0–7.2	7.3–7.8	7.9–11.0	11.1–12.1	> 12.1
47	0–2.0	2.1–2.2	2.3–3.3	3.4–3.7	> 3.7	75	0–7.4	7.5–8.0	8.1–11.3	11.4–12.3	> 12.3
48	0–2.2	2.3–2.4	2.5–3.6	3.7–3.9	> 3.9	76	0–7.5	7.6–8.2	8.3–11.5	11.6–12.6	> 12.6
49	0–2.3	2.4–2.5	2.6–3.8	3.9–4.2	> 4.2	77	0–7.7	7.8–8.3	8.4–11.7	11.8–12.8	> 12.8
50	0–2.5	2.6–2.7	2.8–4.0	4.1–4.4	> 4.4	78	0–7.8	7.9–8.5	8.6–12.0	12.1–13.1	> 13.1
51	0–2.6	2.7–2.9	3.0–4.2	4.3–4.7	> 4.7	79	0–8.0	8.1–8.6	8.7–12.2	12.3–13.3	> 13.3
52	0–2.8	2.9–3.1	3.2–4.5	4.6–5.0	> 5.0	80	0–8.1	8.2–8.8	8.9–12.4	12.5–13.6	> 13.6
53	0–3.0	3.1–3.3	3.4–4.8	4.9–5.3	> 5.3	81	0–8.3	8.4–9.0	9.1–12.6	12.7–13.8	> 13.8
54	0–3.2	3.3–3.5	3.6–5.1	5.2–5.6	> 5.6	82	0–8.4	8.5–9.1	9.2–12.8	12.9–14.0	> 14.0
55	0–3.5	3.6–3.7	3.8–5.4	5.5–6.0	> 6.0	83	0–8.6	8.7–9.3	9.4–13.1	13.2–14.3	> 14.3
56	0–3.7	3.8–4.0	4.1–5.8	5.9–6.3	> 6.3	84	0–8.8	8.9–9.5	9.6–13.3	13.4–14.6	> 14.6
57	0–3.9	4.0–4.2	4.3–6.1	6.2–6.7	> 6.7	85	0–9.0	9.1–9.7	9.8–13.6	13.7–14.9	> 14.9
58	0–4.2	4.3–4.5	4.6–6.4	6.5–7.1	> 7.1	86	0–9.2	9.3–9.9	10.0–13.9	14.0–15.2	> 15.2
59	0–4.4	4.5–4.7	4.8–6.8	6.9–7.4	> 7.4	87	0–9.4	9.5–10.1	10.2–14.2	14.3–15.5	> 15.5
60	0–4.6	4.7–5.0	5.1–7.1	7.2–7.8	> 7.8	88	0–9.6	9.7–10.4	10.5–14.5	14.6–15.8	> 15.8
61	0–4.8	4.9–5.2	5.3–7.4	7.5–8.1	> 8.1	89	0–9.8	9.9–10.6	10.7–14.7	14.8–16.1	> 16.1
62	0–5.0	5.1–5.5	5.6–7.7	7.8–8.5	> 8.5	90	0–10.0	10.1–10.8	10.9–15.0	15.1–16.4	> 16.4
63	0–5.2	5.3–5.7	5.8–8.0	8.1–8.8	> 8.8	91	0–10.2	10.3–11.0	11.1–15.3	15.4–16.7	> 16.7
64	0–5.4	5.5–5.9	6.0–8.3	8.4–9.1	> 9.1	92	0–10.4	10.5–11.2	11.3–15.6	15.7–17.0	> 17.0
65	0–5.6	5.7–6.1	6.2–8.6	8.7–9.4	> 9.4	93	0–10.6	10.7–11.4	11.5–15.8	15.9–17.3	> 17.3
66	0–5.8	5.9–6.3	6.4–8.9	9.0–9.7	> 9.7	94	0–10.7	10.8–11.6	11.7–16.1	16.2–17.6	> 17.6
67	0–6.0	6.1–6.5	6.6–9.2	9.3–10.0	> 10.0	95	0–10.9	11.0–11.8	11.9–16.4	16.5–17.9	> 17.9
68	0–6.2	6.3–6.7	6.8–9.4	9.5–10.3	> 10.3	96	0–11.1	11.2–12.0	12.1–16.7	16.8–18.2	> 18.2
69	0–6.4	6.5–6.9	7.0–9.7	9.8–10.6	> 10.6	97	0–11.3	11.4–12.2	12.3–17.0	17.1–18.5	> 18.5
70	0–6.5	6.6–7.1	7.2–10.0	10.1–10.9	> 10.9	98	0–11.5	11.6–12.4	12.5–17.3	17.4–18.9	> 18.9
71	0–6.7	6.8–7.3	7.4–10.2	10.3–11.2	> 11.2	99	0–11.7	11.8–12.6	12.7–17.6	17.7–19.2	> 19.2
72	0–6.9	7.0–7.5	7.6–10.5	10.6–11.5	> 11.5	100	0–11.9	12.0–12.8	12.9–18.0	18.1–19.6	> 19.6

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GIRLS 0–23 months, Weight-for-Length

Length (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
45	0–1.8	1.9–2.0	2.1–3.0	3.1–3.3	> 3.3
46	0–1.9	2.0–2.1	2.2–3.2	3.3–3.5	> 3.5
47	0–2.1	2.2–2.3	2.4–3.4	3.5–3.7	> 3.7
48	0–2.2	2.3–2.4	2.5–3.6	3.7–4.0	> 4.0
49	0–2.3	2.4–2.5	2.6–3.8	3.9–4.2	> 4.2
50	0–2.5	2.6–2.7	2.8–4.0	4.1–4.5	> 4.5
51	0–2.7	2.8–2.9	3.0–4.3	4.4–4.8	> 4.8
52	0–2.8	2.9–3.1	3.2–4.6	4.7–5.1	> 5.1
53	0–3.0	3.1–3.3	3.4–4.9	5.0–5.4	> 5.4
54	0–3.2	3.3–3.5	3.6–5.2	5.3–5.7	> 5.7
55	0–3.4	3.5–3.7	3.8–5.5	5.6–6.1	> 6.1
56	0–3.6	3.7–3.9	4.0–5.8	5.9–6.4	> 6.4
57	0–3.8	3.9–4.2	4.3–6.1	6.2–6.8	> 6.8
58	0–4.0	4.1–4.4	4.5–6.5	6.6–7.1	> 7.1
59	0–4.2	4.3–4.6	4.7–6.8	6.9–7.5	> 7.5
60	0–4.4	4.5–4.8	4.9–7.1	7.2–7.8	> 7.8
61	0–4.6	4.7–5.0	5.1–7.4	7.5–8.2	> 8.2
62	0–4.8	4.9–5.2	5.3–7.7	7.8–8.5	> 8.5
63	0–5.0	5.1–5.4	5.5–8.0	8.1–8.8	> 8.8
64	0–5.2	5.3–5.6	5.7–8.3	8.4–9.1	> 9.1
65	0–5.4	5.5–5.8	5.9–8.6	8.7–9.5	> 9.5
66	0–5.5	5.6–6.0	6.1–8.8	8.9–9.8	> 9.8
67	0–5.7	5.8–6.2	6.3–9.1	9.2–10.0	> 10.0
68	0–5.9	6.0–6.4	6.5–9.4	9.5–10.3	> 10.3
69	0–6.0	6.1–6.6	6.7–9.6	9.7–10.6	> 10.6
70	0–6.2	6.3–6.8	6.9–9.9	10.0–10.9	> 10.9
71	0–6.4	6.5–6.9	7.0–10.1	10.2–11.1	> 11.1
72	0–6.5	6.6–7.1	7.2–10.3	10.4–11.4	> 11.4

Length (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
73	0–6.7	6.8–7.3	7.4–10.6	10.7–11.7	> 11.7
74	0–6.8	6.9–7.4	7.5–10.8	10.9–11.9	> 11.9
75	0–7.0	7.1–7.6	7.7–11.0	11.1–12.2	> 12.2
76	0–7.1	7.2–7.7	7.8–11.2	11.3–12.4	> 12.4
77	0–7.3	7.4–7.9	8.0–11.5	11.6–12.6	> 12.6
78	0–7.4	7.5–8.1	8.2–11.7	11.8–12.9	> 12.9
79	0–7.6	7.7–8.2	8.3–11.9	12.0–13.1	> 13.1
80	0–7.7	7.8–8.4	8.5–12.1	12.2–13.4	> 13.4
81	0–7.9	8.0–8.6	8.7–12.4	12.5–13.7	> 13.7
82	0–8.0	8.1–8.7	8.8–12.6	12.7–13.9	> 13.9
83	0–8.2	8.3–8.9	9.0–12.9	13.0–14.2	> 14.2
84	0–8.4	8.5–9.1	9.2–13.2	13.3–14.5	> 14.5
85	0–8.6	8.7–9.3	9.4–13.5	13.6–14.9	> 14.9
86	0–8.8	8.9–9.6	9.7–13.8	13.9–15.2	> 15.2
87	0–9.0	9.1–9.8	9.9–14.1	14.2–15.5	> 15.5
88	0–9.2	9.3–10.0	10.1–14.4	14.5–15.9	> 15.9
89	0–9.4	9.5–10.2	10.3–14.7	14.8–16.2	> 16.2
90	0–9.6	9.7–10.4	10.5–15.0	15.1–16.5	> 16.5
91	0–9.8	9.9–10.6	10.7–15.3	15.4–16.9	> 16.9
92	0–10.0	10.1–10.8	10.9–15.6	15.7–17.2	> 17.2
93	0–10.1	10.2–11.0	11.1–15.9	16.0–17.5	> 17.5
94	0–10.3	10.4–11.2	11.3–16.2	16.3–17.9	> 17.9
95	0–10.5	10.6–11.4	11.5–16.5	16.6–18.2	> 18.2
96	0–10.7	10.8–11.6	11.7–16.8	16.9–18.6	> 18.6
97	0–10.9	11.0–11.9	12.0–17.1	17.2–18.9	> 18.9
98	0–11.1	11.2–12.1	12.2–17.5	17.6–19.3	> 19.3
99	0–11.3	11.4–12.3	12.4–17.8	17.9–19.6	> 19.6
100	0–11.5	11.6–12.5	12.6–18.1	18.2–20.0	> 20.0

BOYS 24–59 months, Weight-for-Height

Height (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
65	0–5.8	5.9–6.2	6.3–8.8	8.9–9.6	> 9.6
66	0–6.0	6.1–6.4	6.5–9.1	9.2–9.9	> 9.9
67	0–6.1	6.2–6.6	6.7–9.4	9.5–10.2	> 10.2
68	0–6.3	6.4–6.8	6.9–9.6	9.7–10.5	> 10.5
69	0–6.5	6.6–7.0	7.1–9.9	10.0–10.8	> 10.8
70	0–6.7	6.8–7.2	7.3–10.2	10.3–11.1	> 11.1
71	0–6.8	6.9–7.4	7.5–10.4	10.5–11.4	> 11.4
72	0–7.0	7.1–7.6	7.7–10.7	10.8–11.7	> 11.7
73	0–7.2	7.3–7.8	7.9–11.0	11.1–12.0	> 12.0
74	0–7.3	7.4–7.9	8.0–11.2	11.3–12.2	> 12.2
75	0–7.5	7.6–8.1	8.2–11.4	11.5–12.5	> 12.5
76	0–7.6	7.7–8.3	8.4–11.7	11.8–12.8	> 12.8
77	0–7.8	7.9–8.4	8.5–11.9	12.0–13.0	> 13.0
78	0–7.9	8.0–8.6	8.7–12.1	12.2–13.3	> 13.3
79	0–8.1	8.2–8.7	8.8–12.3	12.4–13.5	> 13.5
80	0–8.2	8.3–8.9	9.0–12.6	12.7–13.7	> 13.7
81	0–8.4	8.5–9.1	9.2–12.8	12.9–14.0	> 14.0
82	0–8.6	8.7–9.2	9.3–13.0	13.1–14.2	> 14.2
83	0–8.7	8.8–9.4	9.5–13.3	13.4–14.5	> 14.5
84	0–8.9	9.0–9.6	9.7–13.5	13.6–14.8	> 14.8
85	0–9.1	9.2–9.9	10.0–13.8	13.9–15.1	> 15.1
86	0–9.3	9.4–10.1	10.2–14.1	14.2–15.4	> 15.4
87	0–9.5	9.6–10.3	10.4–14.4	14.5–15.7	> 15.7
88	0–9.7	9.8–10.5	10.6–14.7	14.8–16.0	> 16.0
89	0–9.9	10.0–10.7	10.8–14.9	15.0–16.3	> 16.3
90	0–10.1	10.2–10.9	11.0–15.2	15.3–16.6	> 16.6
91	0–10.3	10.4–11.1	11.2–15.5	15.6–16.9	> 16.9
92	0–10.5	10.6–11.3	11.4–15.8	15.9–17.2	> 17.2

Height(cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
93	0–10.7	10.8–11.5	11.6–16.0	16.1–17.5	> 17.5
94	0–10.9	11.0–11.7	11.8–16.3	16.4–17.8	> 17.8
95	0–11.0	11.1–11.9	12.0–16.6	16.7–18.1	> 18.1
96	0–11.2	11.3–12.1	12.2–16.9	17.0–18.4	> 18.4
97	0–11.4	11.5–12.3	12.4–17.2	17.3–18.8	> 18.8
98	0–11.6	11.7–12.5	12.6–17.5	17.6–19.1	> 19.1
99	0–11.8	11.9–12.8	12.9–17.9	18.0–19.5	> 19.5
100	0–12.0	12.1–13.0	13.1–18.2	18.3–19.9	> 19.9
101	0–12.2	12.3–13.2	13.3–18.5	18.6–20.3	> 20.3
102	0–12.4	12.5–13.5	13.6–18.9	19.0–20.7	> 20.7
103	0–12.7	12.8–13.7	13.8–19.3	19.4–21.1	> 21.1
104	0–12.9	13.0–13.9	14.0–19.7	19.8–21.6	> 21.6
105	0–13.1	13.2–14.2	14.3–20.1	20.2–22.0	> 22.0
106	0–13.3	13.4–14.4	14.5–20.5	20.6–22.5	> 22.5
107	0–13.6	13.7–14.7	14.8–20.9	21.0–22.9	> 22.9
108	0–13.8	13.9–15.0	15.1–21.3	21.4–23.4	> 23.4
109	0–14.0	14.1–15.2	15.3–21.8	21.9–23.9	> 23.9
110	0–14.3	14.4–15.5	15.6–22.2	22.3–24.4	> 24.4
111	0–14.5	14.6–15.8	15.9–22.7	22.8–25.0	> 25.0
112	0–14.8	14.9–16.1	16.2–23.1	23.2–25.5	> 25.5
113	0–15.1	15.2–16.4	16.5–23.6	23.7–26.0	> 26.0
114	0–15.3	15.4–16.7	16.8–24.1	24.2–26.6	> 26.6
115	0–15.6	15.7–17.0	17.1–24.6	24.7–27.2	> 27.2
116	0–15.9	16.0–17.3	17.4–25.1	25.2–27.8	> 27.8
117	0–16.1	16.2–17.6	17.7–25.6	25.7–28.3	> 28.3
118	0–16.4	16.5–17.9	18.0–26.1	26.2–28.9	> 28.9
119	0–16.7	16.8–18.2	18.3–26.6	26.7–29.5	> 29.5
120	0–17.0	17.1–18.5	18.6–27.2	27.3–30.1	> 30.1

GIRLS 24–59 months, Weight-for-Height

Height (cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
65	0–5.5	5.6–6.0	6.1–8.7	8.8–9.7	> 9.7
66	0–5.7	5.8–6.2	6.3–9.0	9.1–10.0	> 10.0
67	0–5.8	5.9–6.3	6.4–9.3	9.4–10.2	> 10.2
68	0–6.0	6.1–6.5	6.6–9.5	9.6–10.5	> 10.5
69	0–6.2	6.3–6.7	6.8–9.8	9.9–10.8	> 10.8
70	0–6.3	6.4–6.9	7.0–10.0	10.1–11.1	> 11.1
71	0–6.5	6.6–7.0	7.1–10.3	10.4–11.3	> 11.3
72	0–6.6	6.7–7.2	7.3–10.5	10.6–11.6	> 11.6
73	0–6.8	6.9–7.4	7.5–10.7	10.8–11.8	> 11.8
74	0–6.9	7.0–7.5	7.6–11.0	11.1–12.1	> 12.1
75	0–7.1	7.2–7.7	7.8–11.2	11.3–12.3	> 12.3
76	0–7.2	7.3–7.9	8.0–11.4	11.5–12.6	> 12.6
77	0–7.4	7.5–8.0	8.1–11.6	11.7–12.8	> 12.8
78	0–7.5	7.6–8.2	8.3–11.8	11.9–13.1	> 13.1
79	0–7.7	7.8–8.3	8.4–12.1	12.2–13.3	> 13.3
80	0–7.8	7.9–8.5	8.6–12.3	12.4–13.6	> 13.6
81	0–8.0	8.1–8.7	8.8–12.6	12.7–13.9	> 13.9
82	0–8.2	8.3–8.9	9.0–12.8	12.9–14.1	> 14.1
83	0–8.4	8.5–9.1	9.2–13.1	13.2–14.5	> 14.5
84	0–8.5	8.6–9.3	9.4–13.4	13.5–14.8	> 14.8
85	0–8.7	8.8–9.5	9.6–13.7	13.8–15.1	> 15.1
86	0–8.9	9.0–9.7	9.8–14.0	14.1–15.4	> 15.4
87	0–9.1	9.2–9.9	10.0–14.3	14.4–15.8	> 15.8
88	0–9.3	9.4–10.1	10.2–14.6	14.7–16.1	> 16.1
89	0–9.5	9.6–10.3	10.4–14.9	15.0–16.4	> 16.4
90	0–9.7	9.8–10.5	10.6–15.2	15.3–16.8	> 16.8
91	0–9.9	10.0–10.8	10.9–15.5	15.6–17.1	> 17.1
92	0–10.1	10.2–11.0	11.1–15.8	15.9–17.4	> 17.4

Height(cm)	SAM < -3	MAM ≥ -3 to < -2	Normal ≥ -2 to ≤ +2	Overweight > +2 to ≤ +3	Obesity > +3
93	0–10.3	10.4–11.2	11.3–16.1	16.2–17.8	> 17.8
94	0–10.5	10.6–11.4	11.5–16.4	16.5–18.1	> 18.1
95	0–10.7	10.8–11.6	11.7–16.7	16.8–18.5	> 18.5
96	0–10.8	10.9–11.8	11.9–17.0	17.1–18.8	> 18.8
97	0–11.0	11.1–12.0	12.1–17.4	17.5–19.2	> 19.2
98	0–11.2	11.3–12.2	12.3–17.7	17.8–19.5	> 19.5
99	0–11.4	11.5–12.4	12.5–18.0	18.1–19.9	> 19.9
100	0–11.6	11.7–12.7	12.8–18.4	18.5–20.3	> 20.3
101	0–11.9	12.0–12.9	13.0–18.7	18.8–20.7	> 20.7
102	0–12.1	12.2–13.2	13.3–19.1	19.2–21.1	> 21.1
103	0–12.3	12.4–13.4	13.5–19.5	19.6–21.6	> 21.6
104	0–12.5	12.6–13.7	13.8–19.9	20.0–22.0	> 22.0
105	0–12.8	12.9–13.9	14.0–20.3	20.4–22.5	> 22.5
106	0–13.0	13.1–14.2	14.3–20.8	20.9–23.0	> 23.0
107	0–13.3	13.4–14.5	14.6–21.2	21.3–23.5	> 23.5
108	0–13.6	13.7–14.8	14.9–21.7	21.8–24.0	> 24.0
109	0–13.8	13.9–15.1	15.2–22.1	22.2–24.5	> 24.5
110	0–14.1	14.2–15.4	15.5–22.6	22.7–25.1	> 25.1
111	0–14.4	14.5–15.7	15.8–23.1	23.2–25.7	> 25.7
112	0–14.7	14.8–16.1	16.2–23.6	23.7–26.2	> 26.2
113	0–15.0	15.1–16.4	16.5–24.2	24.3–26.8	> 26.8
114	0–15.3	15.4–16.7	16.8–24.7	24.8–27.4	> 27.4
115	0–15.6	15.7–17.1	17.2–25.2	25.3–28.1	> 28.1
116	0–15.9	16.0–17.4	17.5–25.8	25.9–28.7	> 28.7
117	0–16.2	16.3–17.7	17.8–26.3	26.4–29.3	> 29.3
118	0–16.5	16.6–18.1	18.2–26.9	27.0–29.9	> 29.9
119	0–16.8	16.9–18.4	18.5–27.4	27.5–30.6	> 30.6
120	0–17.2	17.3–18.8	18.9–28.0	28.1–31.2	> 31.2

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