



University of Baghdad College of Medicine

Title: Malnutrition- 1

Grade: Fifth years

Module: Pediatrics

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Learning objectives



- To define malnutrition and know its causes
- To assess malnutrition by using the indicators and anthropometric measures.
- To know different types of malnutrition classification.



INTRODUCTION

Malnutrition essentially means “bad nourishment”. It concerns not enough as well as too much food, the wrong types of food, or the inability to use nutrients properly to maintain health.

The [World Health Organization](#) cites malnutrition as the greatest single threat to the world's public health.

Malnutrition in all its forms is a considerable public health concern and is associated with increases risk of disease and early death.

We are still far from a world without malnutrition



144 million children under 5 are *stunted* (too short for their age)



47 million children under 5 are *wasted* (too thin for their height)



38 million children under 5 are *overweight*

unicef

World Health Organization

WORLD BANK GROUP

Joint Child Malnutrition Estimates, 2020

University of Baghdad/ College of Medicine 2022-2023



Globally in 2022,
149 million children under 5 were estimated to be stunted,
45 million were estimated to be wasted,
37 million were overweight or living with obesity.



Wasting malnutrition still affects 8% of all children under 5 years old.

Wasted children are at substantial increased risk of severe acute malnutrition and death, with malnutrition accounting for over 50% of all child deaths worldwide .



Although at least one million child deaths are directly caused by malnutrition , acute malnutrition may predispose up to 3.5 million children under 5 years old to death .

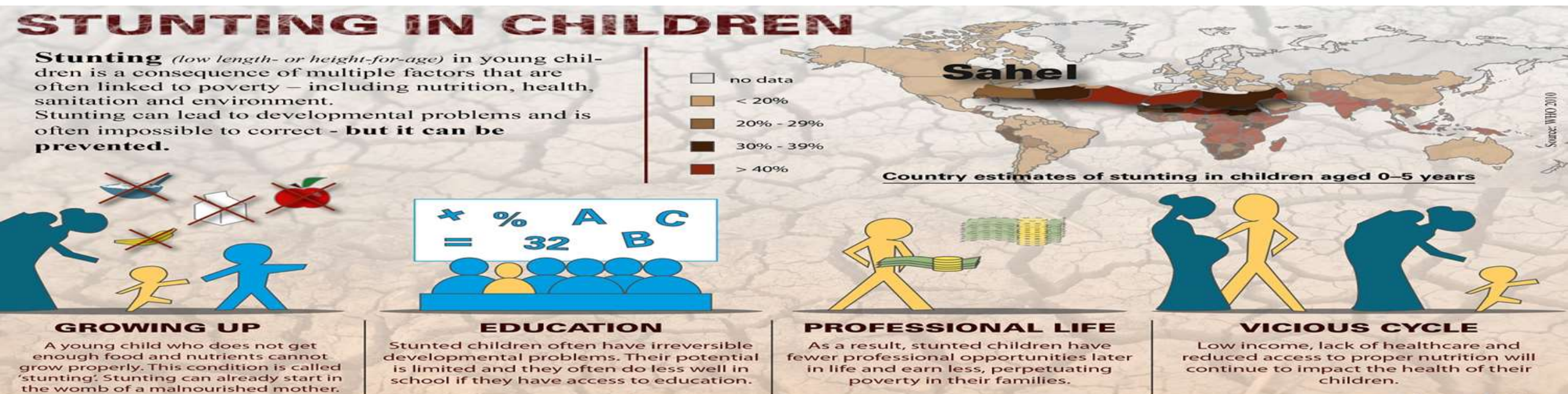




If malnutrition were properly addressed, at least one third of child mortality and morbidity could be averted .

It is also speculated about 11% of the total global disability-adjusted life-years are due to childhood malnutrition.

Geographically 70-80% of undernourished children of the world live in developing countries.



The Harmful Effects of Poor Nutrition



- 1- Nutritional stunting is associated with both **structural and functional pathology of the brain** and a wide range of cognitive deficits.
- 2- Impaired **behavioral development** in early life, are less likely to enroll at school, enroll late, and tend to achieve lower grades.
- 3- **Tests of attention, visual perception, and verbal comprehension** in malnourished children was deficient as compared to the performance level of adequately nourished children.
- 4- **Growth failure and hormonal implications.**
- 5- Undernutrition in childhood are risk factors for **Type 2 Diabetes, high blood pressure and harmful lipid profiles in adulthood.**
- 6- **Overweight, Obesity Heart Disease and Stroke.**

Nutritional vulnerability

Infants are particularly vulnerable to inadequate nutrition because of:



1- Extra nutritional demands for growth (the weight of a term infant doubles by 5 months and trebles by 1 year of age).

2- Low levels of fat and protein stores.

3- Reduced food intake and increased nutritional demands with illness or following surgery.

Definitions



Malnutrition is a general term for the medical condition caused by an improper or insufficient diet.

- **Under nutrition** (deficiency of one or more essential nutrients);
- Resulting from inadequate consumption, poor absorption, or excessive loss of nutrients.
- **Over nutrition** (an excess of a nutrient or nutrients); resulting from overeating or excessive intake of specific nutrients.

Undernutrition (malnutrition)



- Structural and functional changes due to inadequate intake of nutrients and energy sources.
- Deficiency of a single nutrient is an example of under nutrition, e.g. iron and iodine.
- All children with PEM have micronutrient deficiency

Causes

Primary Malnutrition: resulting from inadequate food intake.



Secondary Malnutrition: resulting from increased nutrient needs, decreased nutrient absorption, and/or increased nutrient losses.

Developing countries $1^{\circ} > 2^{\circ}$ malnutrition

Developed countries $2^{\circ} > 1^{\circ}$ malnutrition



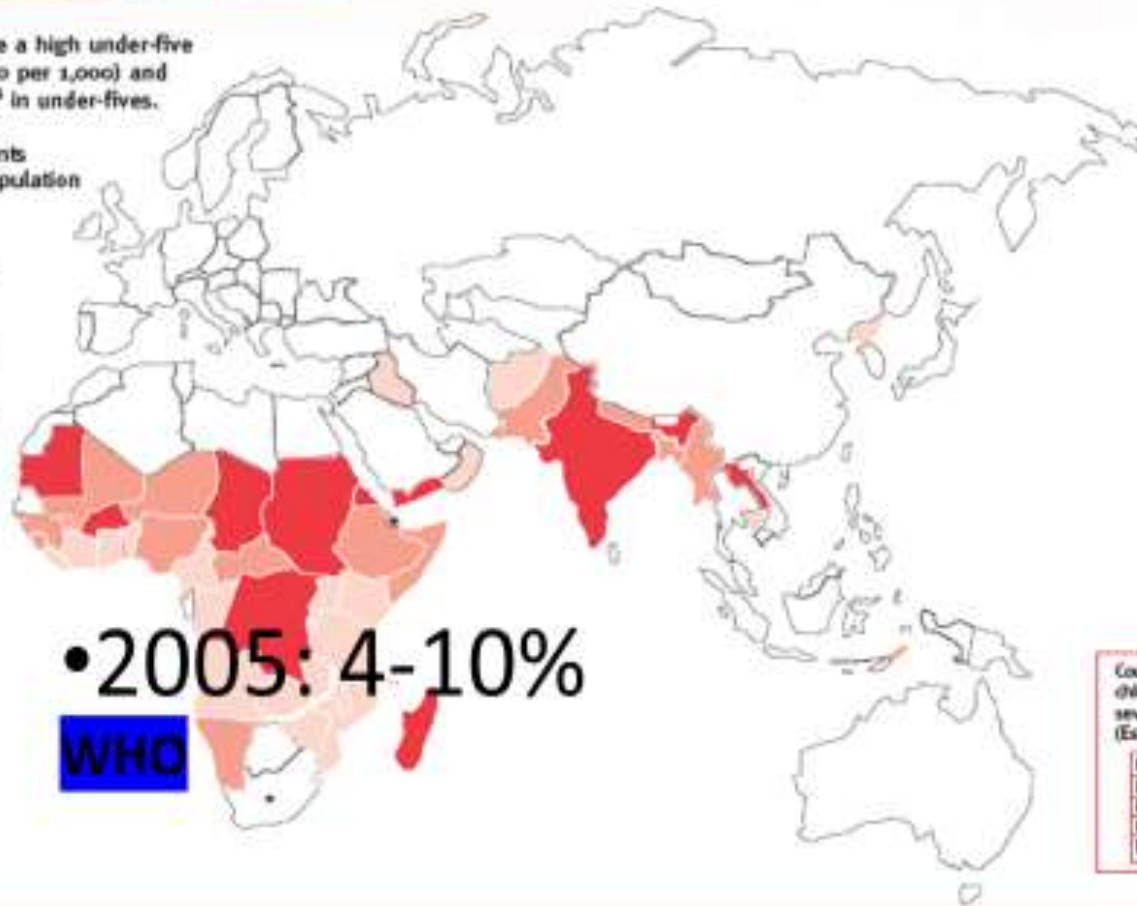
Malnutrition Hotspots

The 50 shaded countries have a high under-five mortality rate (greater than 50 per 1,000) and greater than 30% of stunting⁸ in under-fives.

The following legend represents wasting⁹ in the under-five population of these countries.

- Countries with more than 15% acute malnutrition¹⁰
- Countries with more than 10% acute malnutrition¹¹
- Countries with more than 4% acute malnutrition¹²

* No data



Countries with the most children under-five with severe acute malnutrition. (Estimates in millions)

India	8.0
DRC	3.3
Pakistan	3.2
Nigeria	3.1
Ethiopia	0.6

⁸ Stunting – Growth retardation, indicated by low height for age (height for age <-2 Z according to WHO 2005 Growth Standards).

⁹ Wasting – Emaciation or thinness as measured by low weight for one's height (weight for height <-2 Z according to WHO 2005 Growth Standards)

¹⁰ Burkina Faso, Chad, Democratic Republic of Congo, Eritrea, India, Lao People's Democratic Republic, Madagascar, Mauritania, Sudan, Yemen.

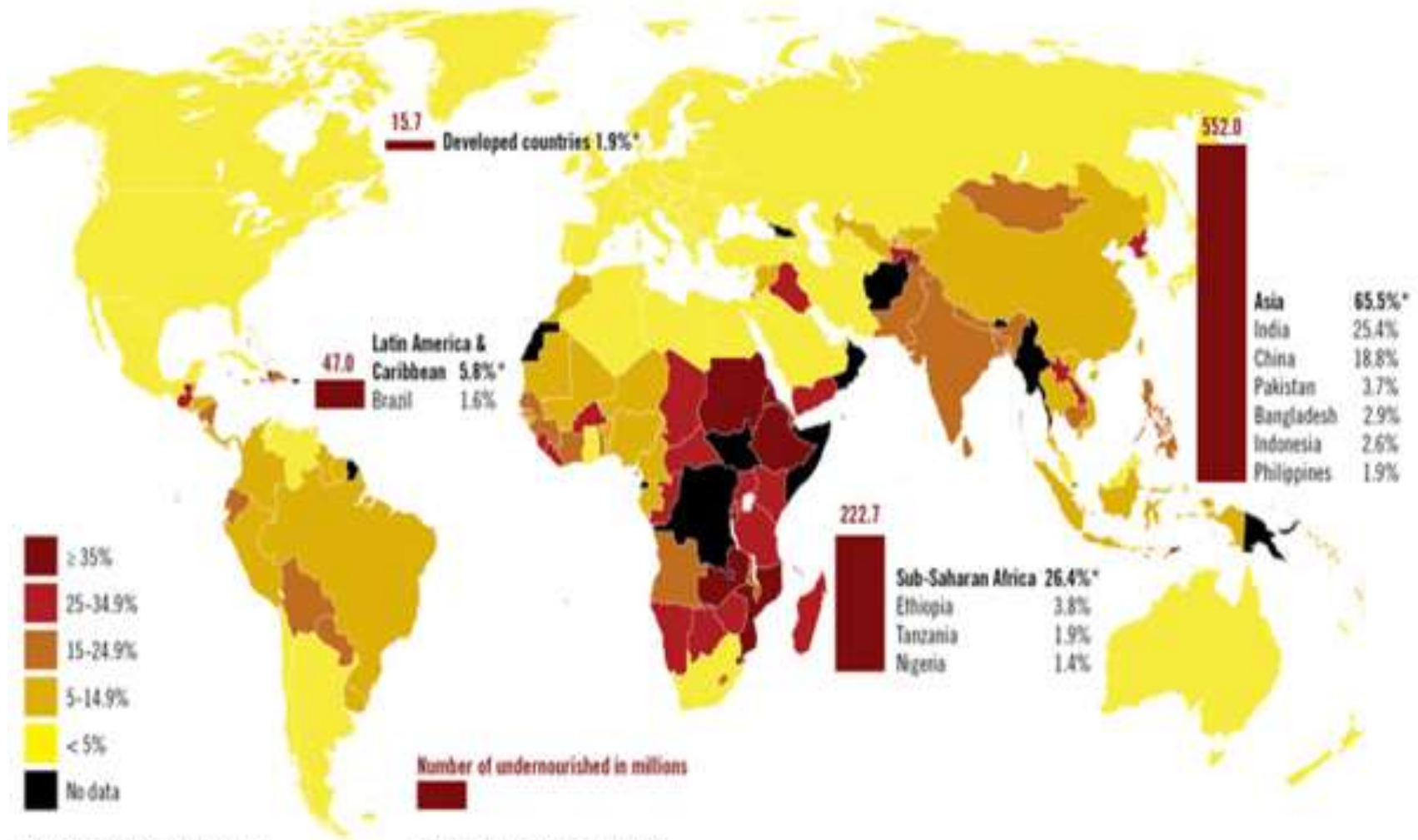
¹¹ Bangladesh, Central Africa Republic, Comoros, Ethiopia, Guinea, Guinea Bissau, Haiti, Mali, Myanmar, Namibia, Nepal, Niger, Nigeria, Pakistan, Sierra Leone, Somalia, Timor-Leste, Togo.

¹² Afghanistan, Angola, Benin, Burundi, Cambodia, Cameroon, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Ghana, Iraq, Kenya, Democratic People's Republic of Korea, Liberia, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe.

Sources for map: Population Reference Bureau 2007 World Population Data. WHO Analyses of national nutritional surveys done 2001-2006.

UNICEF – The State of the World's Children 2008

The world map of undernourishment



Source: FAO (2013), data for the period 2011-2013.

• 2011-2013: 25-34%

FAO



- Extremely alarming (≥ 50.0)
- Alarming (35.0 – 49.9)
- Serious (20.0 – 34.9)
- Moderate (10.0 – 19.9)
- Low (≤ 9.9)
- Insufficient data, significant concern
- Not calculated or insufficient data

•2019----- 10-20%

https://en.wikipedia.org/wiki/Global_Hunger_Index

Causes of 1 ° Malnutrition

Accounts for the vast majority of cases:

- **Nutrition:** Inadequate food intake due to:-
 - ✓ Insufficient or inappropriate food supplies.
 - ✓ Early cessation of breastfeeding.
 - ✓ Cultural and religious food customs (in some areas).



Causes of 2 ° Malnutrition

Children with chronic illness are at risk for nutritional problems for several reasons, including the following:



1-Anorexia, which leads to inadequate food intake.

2- Increased inflammatory burden and increased **metabolic demands** can increase caloric need.

3- Any chronic illness that involves the liver or small bowel affects nutrition adversely by impairing digestive and absorptive functions.

Like:

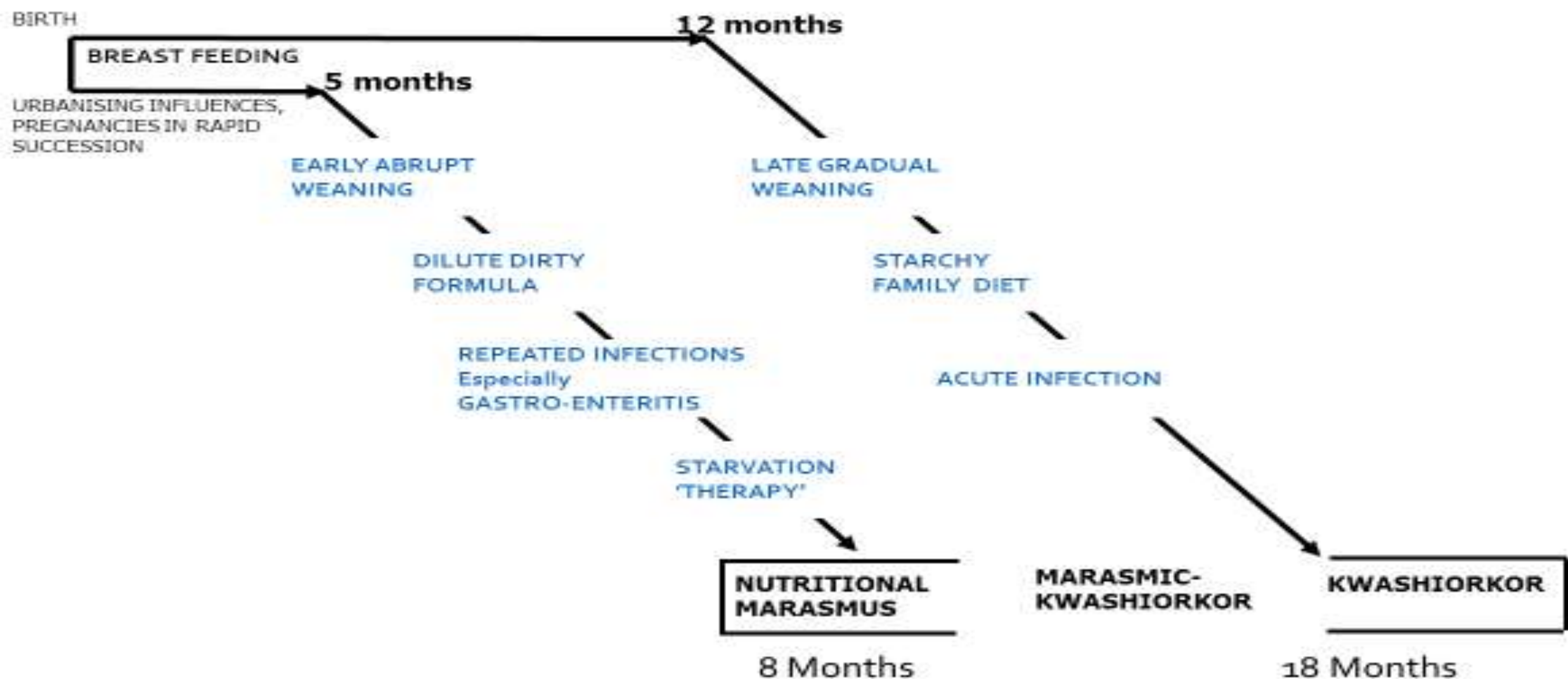
- Cystic fibrosis.
- Chronic renal failure.
- Childhood malignancies Congenital heart disease.
- Neuromuscular diseases.
- Chronic inflammatory bowel diseases.

Protein-Energy Malnutrition



- The term PEM applies to a group of related disorders that include marasmus, kwashiorkor, and intermediate states of marasmus-kwashiorkor.
- The distinction between the 2 forms of PEM is based on the presence or absence of **oedema**.
- Marasmus**; inadequate intake of protein and calories (absence of oedema).
- Kwashiorkor**; fair-to-normal calorie intake with inadequate protein intake (presence of oedema).

Classic history of PEM





Clinical effects of Malnutrition



Measuring malnutrition

- Malnutrition is assessed by a combination of clinical features and anthropometry (body measurements).





Protein Energy malnutrition (anthropometric measurements)

- Underweight

- Measurements that fall below 2 standard deviations under the normal **weight** for **age**.

- Stunting

- Measurements that fall below 2 standard deviations below **height** for **age**.

- Wasting

- Measurements that fall below 2 standard deviations below **weight** for **height**.



Wasted
Stunted
Underweight





Measuring mid-upper arm circumference

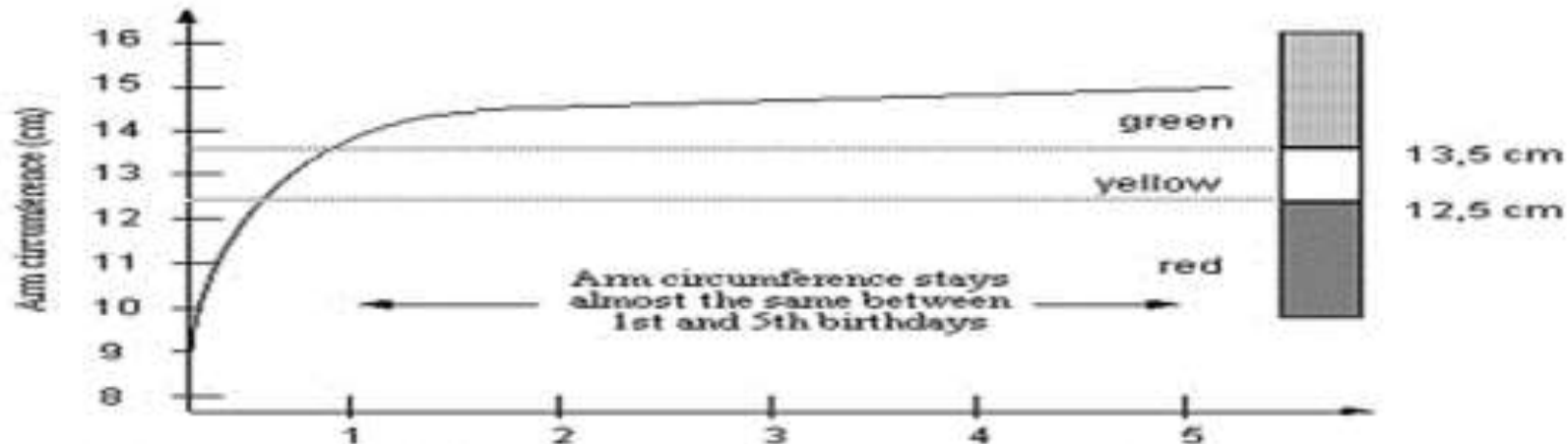
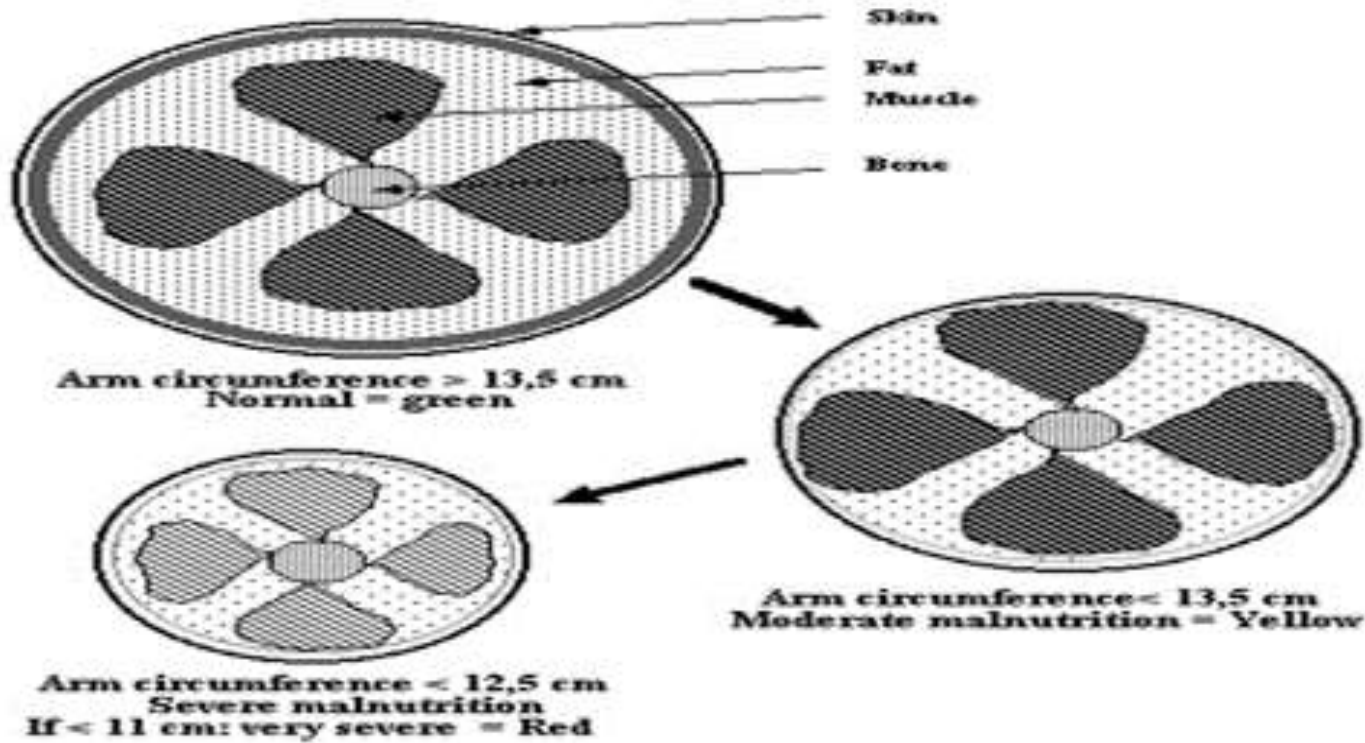


Figure 1: Physiopathological principle of arm circumference measurement in children aged from 1 to 5 and the relationship with the severity of malnutrition

Diagnosis

- Anthropometry
 - Acute: Wasting: low weight for height
 - Chronic: Stunted: low height for age



skin fold thickness



Skinfold thickness (SFT) measurement is a reliable, cheap, simple, noninvasive method of body fat estimation at all ages including the newborn period.

It measures the thickness of subcutaneous fat at various sites of the body from which total body fat and hence contribution of fat to body mass can be estimated.

It involves using a device called **Harpenden's caliper** to lightly pinch the skin and underlying fat in several places (triceps, biceps, subscapular, iliac crest, suprascapular, abdominal, anterior thigh, medial calf, among others). This quick and simple method of estimating body fat requires a high level of skill to get accurate results.

The skinfold with subcutaneous fat is picked up by thumb and index finger and caliper is applied below the pinch.



Triceps

The measurement of the triceps skinfold is taken halfway between the top of the shoulder and the elbow (halfway along the upper arm).



Quadriceps

The Measurement of the quadriceps (thigh) skinfold is taken halfway along the top of the upper leg.



Subscapular

The measurement of the subscapular skinfold is taken at the bottom right corner of the left shoulder blade.



Fat thickness

> 10 mm – healthy children 1~6 years

< 6 mm – is indicative of moderate to severe degree of malnutrition



Gomez classification



one of the earliest systems (In 1956 Mexico City) for classifying

protein-energy malnutrition in children, **based on percentage of**

expected weight for age: over 90% is normal, 76–90% is mild

(first degree) malnutrition, 61–75% is moderate (second degree) malnutrition, and less than 60%

is severe (third degree) malnutrition.

Weight-for—Age (%)	Nutritional grade
≥ 90	Normal
75–89.9	Grade I (Mild malnutrition)
60–74.9	Grade II (Moderate malnutrition)
≤ 60	Grade III (Severe malnutrition)

Although an adaptation of Gomez's original classification is still used today, the classification has been criticized for **being "arbitrary"** and for **not considering overweight as a form of malnutrition.**



Also, height alone may not be the best indicator of malnutrition; children who are born prematurely may be considered short for their age even if they have good nutrition.

Waterlow classification

By John Conrad Waterlow (13 June 1916 – 19 October 2010) was a British physiologist who specialized in childhood malnutrition. (Proposed in 1976)



A system for classifying protein-energy malnutrition in children based on wasting (the percentage of expected weight for height) and the degree of stunting (the percentage of expected height for age)

CLASIFICATION BASED ON WEIGHT-FOR-HEIGHT & HEIGHT-FOR-AGE

Weight-for-Height	Height-for-age	
>80%	>90%	Normal
	<90%	Stunted
<80%	>90%	Wasted
	<90%	Wasted & Stunted

WATERLOW CLASSIFICATION

One advantage of the Waterlow classification over the Gomez classification is that weight for height can be examined even if ages are not known.



Wellcome Classification



A system for classifying protein-energy malnutrition in children based on percentage of expected weight-for-age and the presence or absence of oedema

In 1970 the Wellcome classification for PEM was proposed.

A drawback of the Wellcome classification is that:

- 1- It requires age to be precisely known which is often not the case in rural areas with limited standards of healthcare and education.
- 2- Also it has become clear that weight-for-age is in fact a compound parameter of two virtually independent processes, namely stunting (low height-for-age due to past or chronic mild growth retardation) and wasting (low weight-for-height due to acute severe growth retardation).

Classification	Definition	Grade	Nutritional Oedema
Wellcome	Weight-for-age %		
	60 -80	Undernourished	Absent
		Kwashiorkor	present
	<60 (= – 4SDS)	Marasmus	Absent
		Marasmic-kwashiorkor	present

Wellcome Classification

- Definition :

- Marasmus: Weight less than 60% of expected weight - no oedema.
- Kwashiorkor: Weight between 60-80% of expected weight + oedema.



No oedema

Oedema

<80 %=Underweight for age	<80 %=Kwashiorkor
<60%=Marasmus	<60%=Marasmic-Kwashiorkor

What do we need?



Weighing scale



Growth chart



Finger

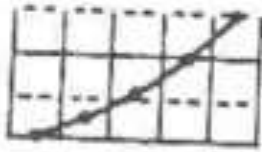
In 1993 the use of **z scores** in anthropometric variables was recommended.

Although z scores are now often used in anthropometric studies, they are little utilized in clinical PEM in developing countries.

Also such a classification has not been evaluated.

(-1 to -1.9: mild malnutrition, -2.0 to -2.9: moderate malnutrition and ≥ -3 : severe malnutrition)

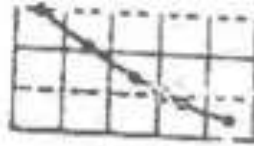




GOOD:
means the child is
growing well



DANGER:
Find out why?
and advice



VERY
DANGEROUS:
May be very ill
needs extra care

Summary:

- Malnutrition essentially means “bad nourishment”. It concerns not enough as well as too much food.
- Primary Malnutrition result from inadequate food intake,
Secondary Malnutrition result from increased nutrient needs,
decreased nutrient absorption, and/or increased nutrient losses.
- Welcome classification:- Marasmus; inadequate intake of protein and calories (absence of oedema)
- Kwashiorkor; fair-to-normal calorie intake with inadequate protein intake (presence of oedema).





THANK YOU