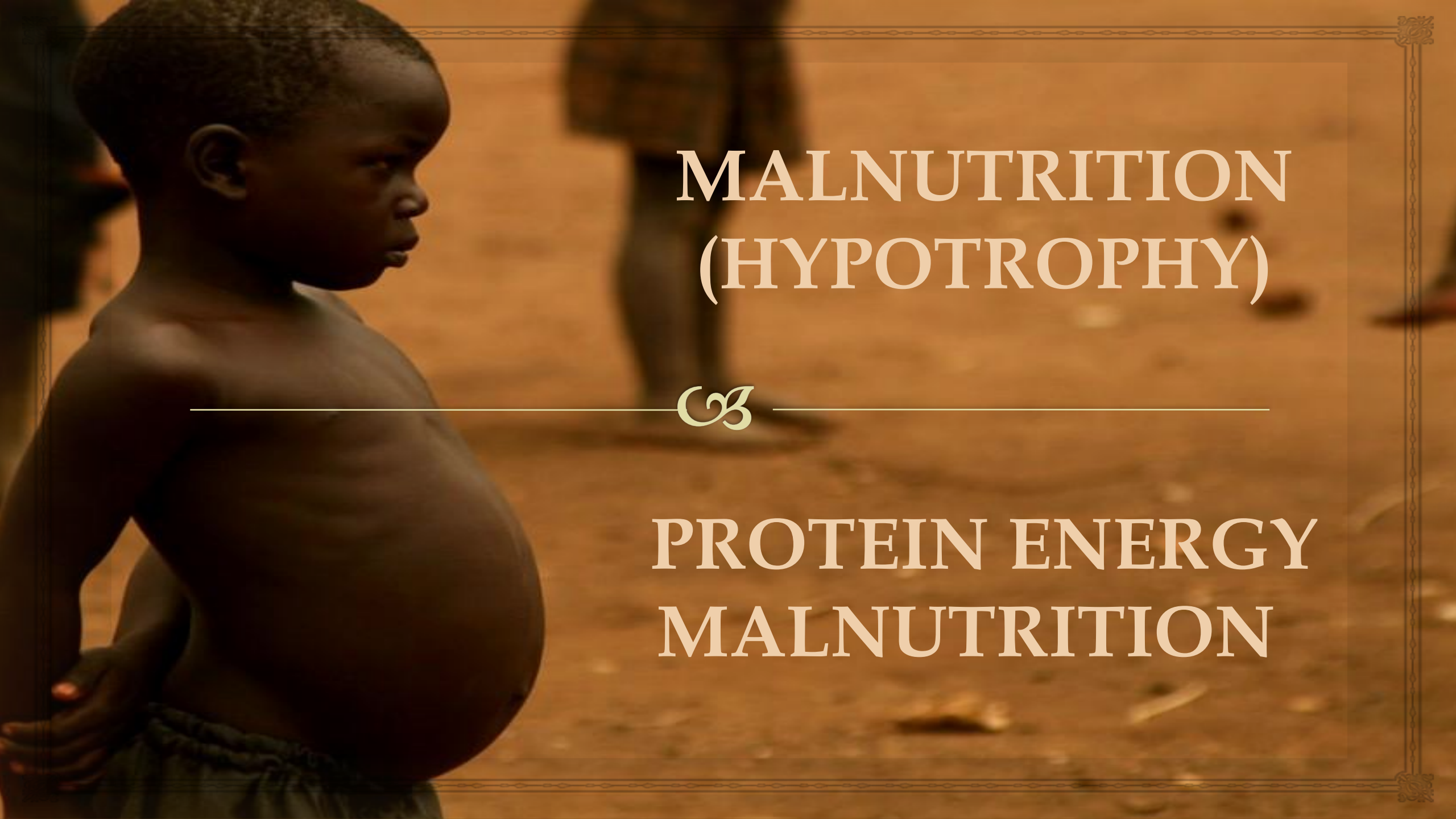
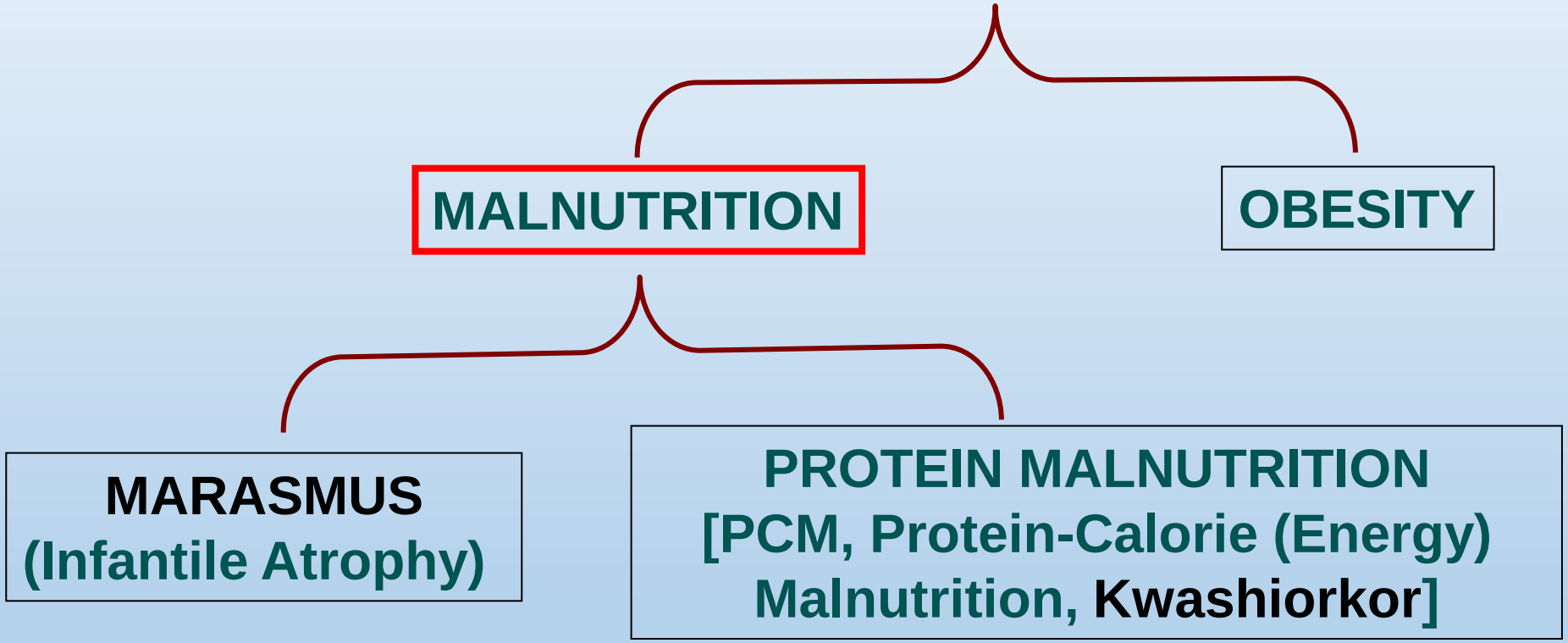


MALNUTRITION (HYPOTROPHY)

PROTEIN ENERGY MALNUTRITION

NUTRITIONAL DISORDERS



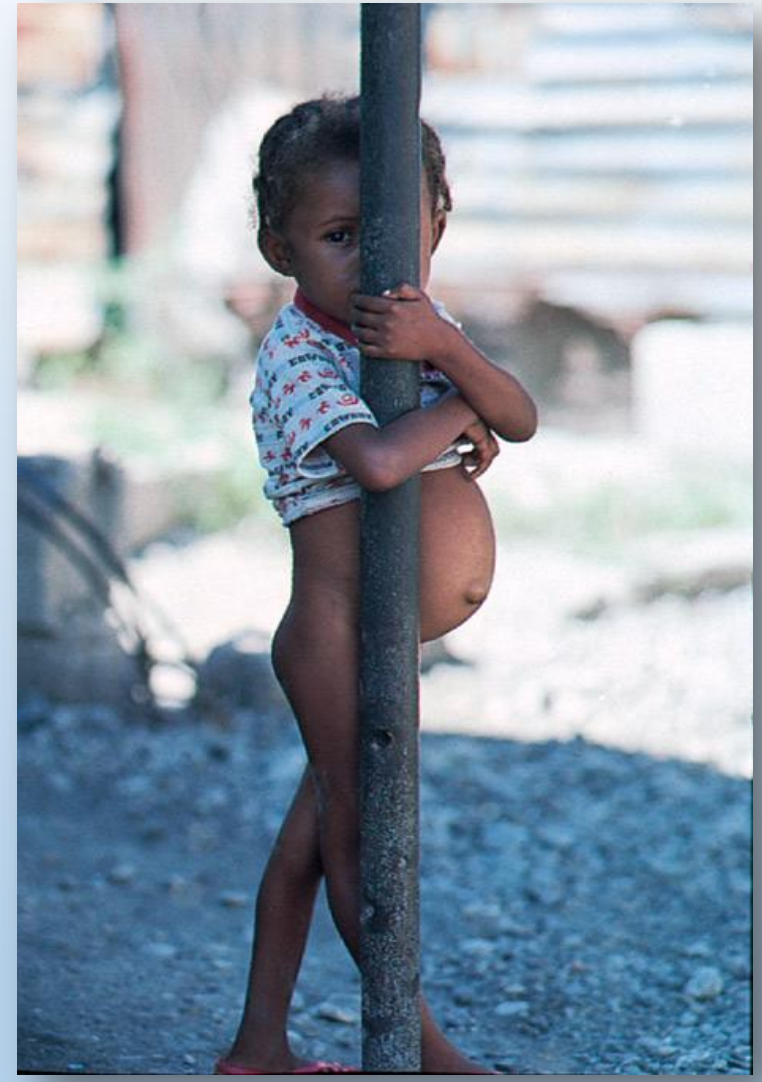
MARASMUS

- The term is derived from the Greek word marasmos, which means withering or wasting (“to waste away”). Marasmus results from the inadequate intake of protein and calories.
- However, to avoid confusion, the term severe wasting is preferred.

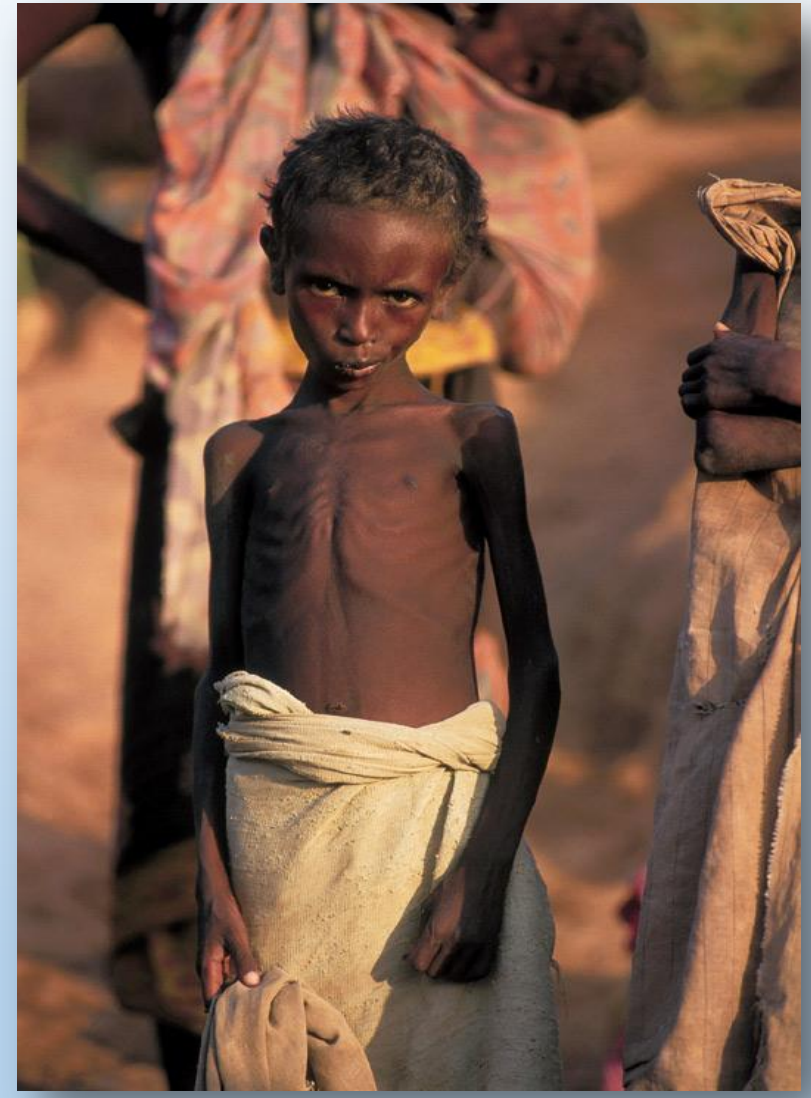
KWASHIORKOR

- The term is taken from the language of Ghana and means “the sickness of the weaning”, “reddish boy”, or from the West African word for “displaced child”. Kwashiorkor is a nutritional deficiency disease caused when very young children are weaned from their mother's milk and placed on a diet high in calories and carbohydrates, but low in protein.

Protein Deficiency Diseases



- **Kwashiorkor** - "Displaced Child" - Occurs mainly in children whose diet lacks high-quality protein.



•**Marasmus** - "To Waste Away" - Caused by a diet low in both protein and calories.

The World Health Organization **(WHO)** defines malnutrition as *"the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions."*

However, the term «**malnutrition**» is frequently used to denote either the lack of adequate nutrition or inadequate supply/amount of calories, as the synonym of **«undernutrition»!!!**

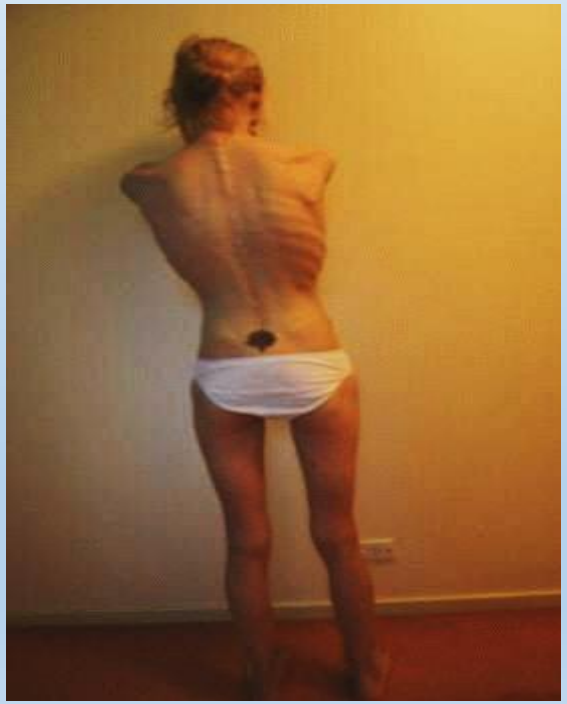
- In Russian-speaking medical literature the term "***dystrophy***" is usually used to mean children's chronic disorders of nutrition. It corresponds to the English term «***malnutrition***».
- ***Dystrophy*** (from Greek *dis* – frustration, *trophy* – a nutrition) is a group of diseases which are accompanied by polyorganic insufficiency, endogen intoxication, disorders of the weight, growth and development. It is diagnosed more often for children of first three years of life.

There are three forms of CND (Dystrophy)

DYSTROPHY

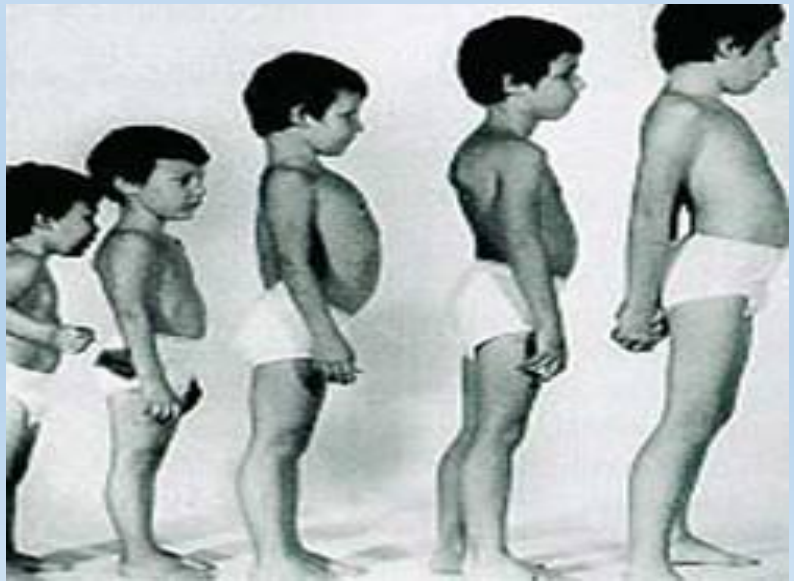
HYPOTROPHIA

PARATROPHY, OBESITY



Hypostature

- This means short stature.



Hypotrophy (=undernutrition, malnutrition) is the chronic disturbance of nutrition and digestion, characterized by lag of growth and weight and accompanied by disorders of metabolic and trophic processes, decrease of immunity and development of micronutrient deficiency.

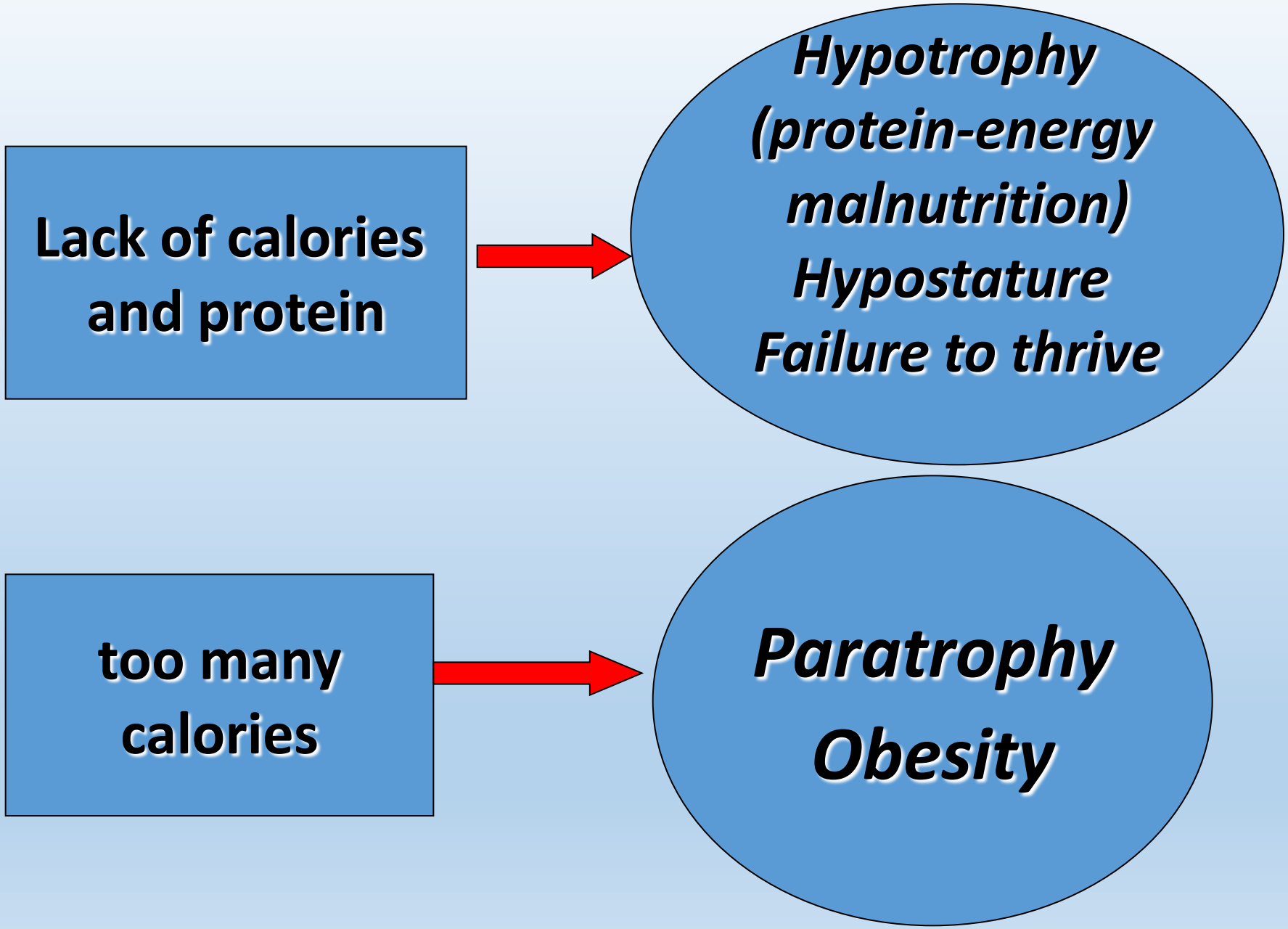
Hypostature

is the dystrophy which is characterized by approximately uniform reduction of body weight and growth of the child beside satisfactory state of nourishment and turgor of tissue.

Past the first year of life it is called alimentary nanism.

«Failure to thrive» is a term typically used to describe infants and young children whose weight is **persistently below the third percentile for age** on an appropriate standardized growth chart, **or less than 80% of ideal weight for age.**

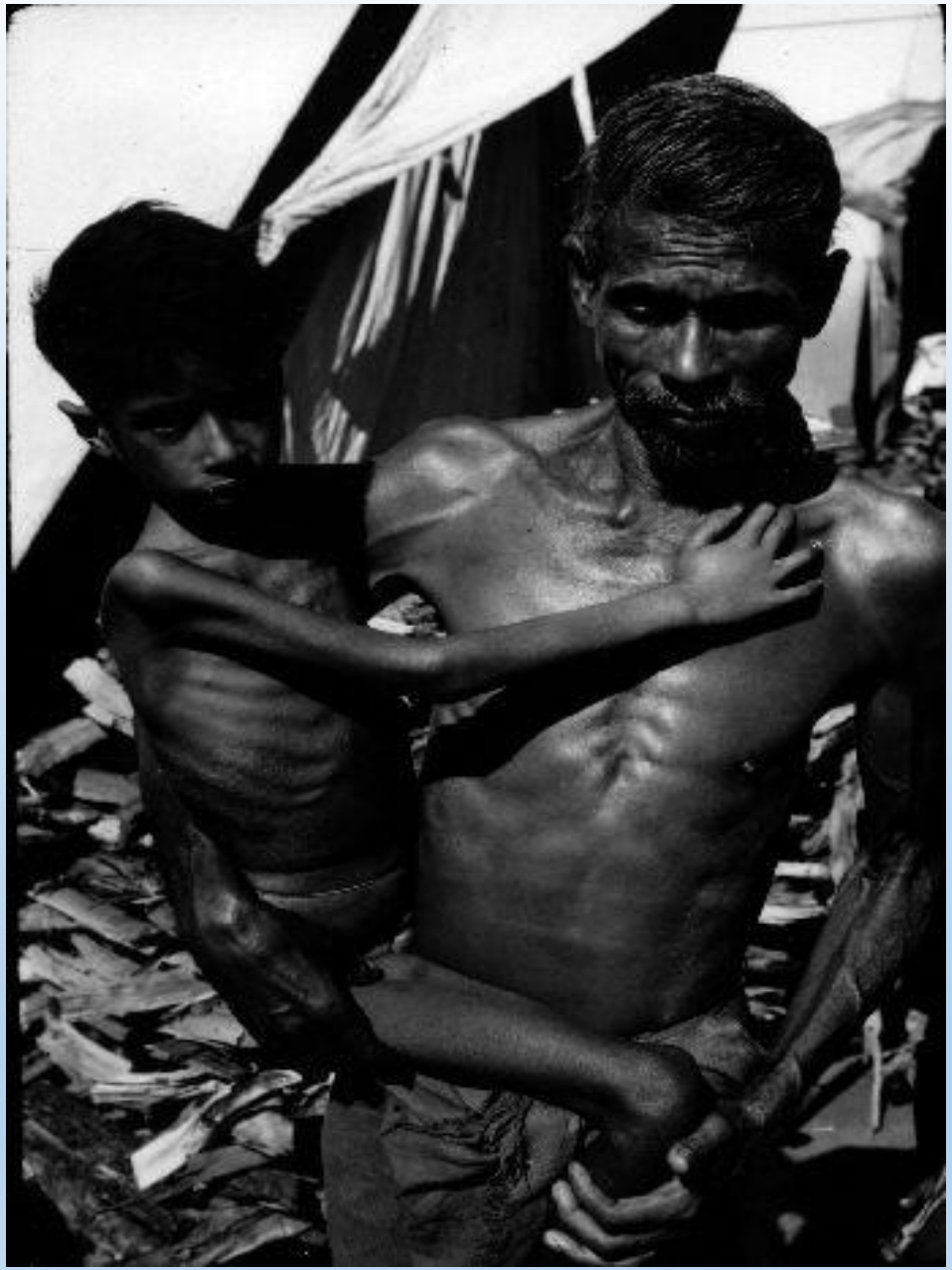
- **Paratrophy,** and obesity are the conditions which are characterized by the superfluous body weight of the child.
- **Paratrophy** is specified to breastfed and early age children with the superfluous body weight which is no more then 10-20% of norm and characterized by increased hydrolability of tissue. The term obesity is used for older children


Lack of calories and protein
Hypotrophy (protein-energy malnutrition)
Hypostature
Failure to thrive
too many calories
Paratrophy
Obesity

- ***Malnutrition*** = *undernutrition*
- ***Hypotrophy*** = *undernutrition*
- **Hypotrophy = Malnutrition**
- ***Failure to thrive = Hypostature***
- ***Severe Malnutrition*** = ***protein-energy malnutrition*** **(PEM) (marasmus, kwashiorkor)**

MALNUTRITION

- Malnutrition plays a huge role in child mortality because the immune systems of these children are less resistant to common childhood diseases.
- 925 million undernourished people is 13.6 % of the world population (FAO, 2010)



- Malnutrition is implicated in >50% of deaths of <5 years children (5 million/yr.)
- The reciprocal interaction between protein-energy malnutrition & infection is the major cause of death & morbidity in young children.
- Even mild degrees of malnutrition double the risk of mortality for respiratory and diarrheal disease mortality and malaria.

With 95 % of all malnourished peoples living in the sub-tropics and tropics.

More than 70% of children with PEM live in Asia and 26% in Africa, and 4% in Latin America and the Caribbean (WHO 2000).

Etiology

PEM
(protein-energy malnutrition)

Prenatal or **congenital hypotrophy (malnutrition) or intrauterine growth retardation**

Postnatal hypotrophy (malnutrition)

Prenatal factors:

- A defective nutrition of pregnant women
- Acute and chronic diseases of pregnant women
- In utero toxin exposure (professional factors, unfavorable factors of surroundings, bad habits – smoking, alcohol and\or drugs abuse)
- Intra-uterine infections of fetus (TORCH)
- Chromosomal aberrations of fetus
- Preterm delivery

Postnatal factors

PEM
(protein-energy malnutrition)

Primary (non organic)
Insufficiency of food, Inadequate or unbalanced diet

Secondary (organic)
Problems with digestion or absorption, Chronic illnesses

Causes of Primary (non organic) Malnutrition

Parents are not giving their child enough food because:

- **they can't afford to** (they are poor, unemployed);
- **they don't want to** (in cases when parents abuse or neglect their children);
- **they don't know** (they are too young or uneducated).

Defective assimilation

(problems with digestion or absorption):

1. Malabsorption

- infections;
- celiac disease;
- chronic diarrhea for whatever reason (from allergies, immune deficiencies to chronic diseases)

- Hereditary anomalies of metabolism (galactosemia, leycinosis, fructosemia, phenylketonuria, and others),
- Malformations of gastrointestinal tract (pylorostenosis, etc.)
- Syndrome of “short bowel” after extensive intestinal resections

Chronic illnesses:

- Cystic fibrosis;
- Chronic renal failure;
- Chronic heart or lung disease
- Childhood malignancies;
- Chronic inflammatory bowel diseases (Crohn disease and ulcerative colitis);
- Hereditary primary immunodeficiencies
- Endocrine disease (adrenogenital syndrome, diabetes mellitus, etc.)

Metabolic Changes

❖ *Protein metabolism:*

- Total plasma proteins, albumin ↓
- gamma globulins ↑

❖*Carbohydrate metabolism:*

- The glucose level ↓
- glycogen stores ↓

❖*Fat metabolism:*

- Blood lipid levels ↓

Main Diagnostic Criteria

- Poor weight gain and deficit of weight
- Slowing of linear growth and lag of length/height

❖ **Expression of the clinical signs depends on degree of malnutrition (hypotrophy)!**

Classification of Hypotrophy

- **I degree (mild)**

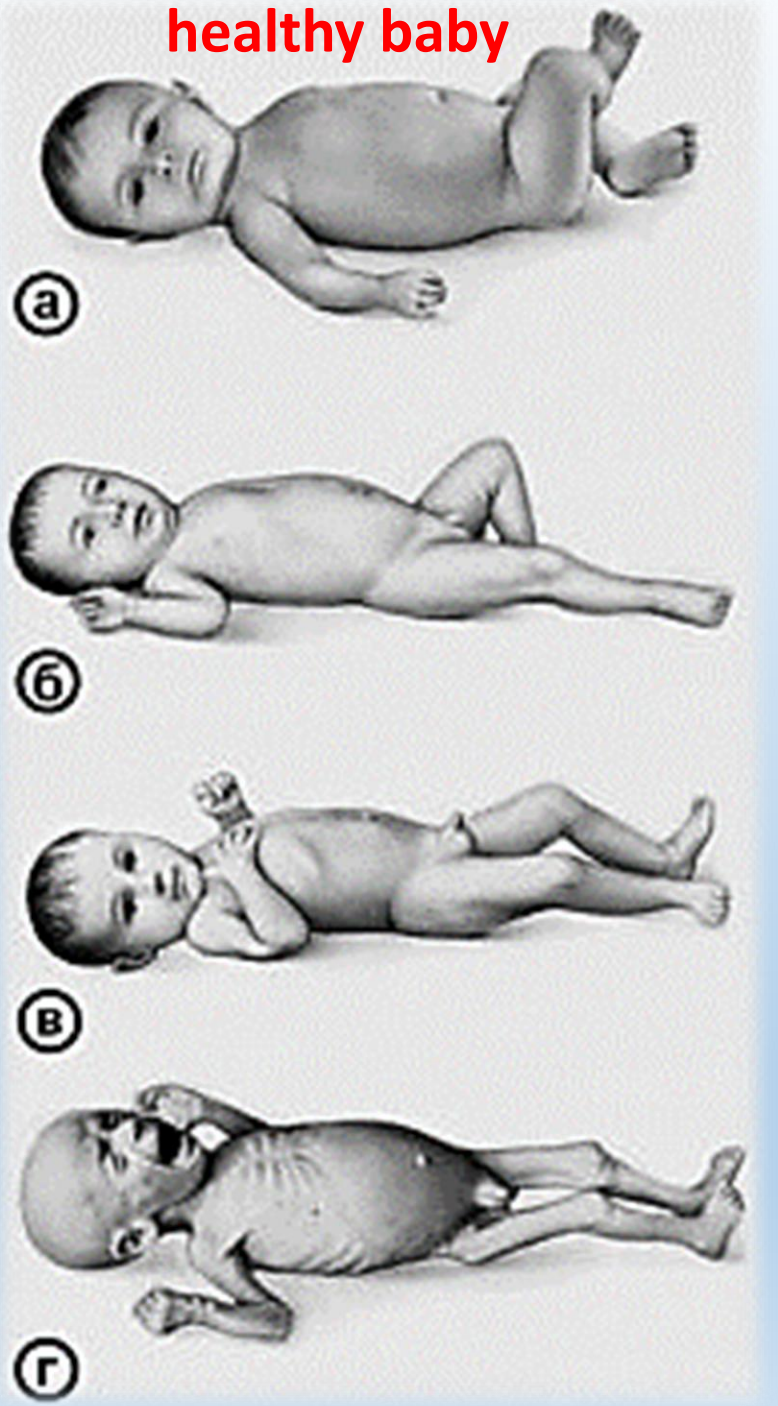
– the deficiency of 10-20% of the body weight,

- **II degree (moderate)**

– the deficiency of 21-30% of the body weight,

- **III degree (severe)**

– the deficiency more than 31% of the body weight.



Classification of Malnutrition (WHO)

	Moderate Malnutrition	Severe Malnutrition
Weight for height or length	Between -2 and -3 SD or 70^{th} to 79th percentile	Less than -3 SD or below the 70^{th} percentile
Mid-upper Arm Circumference	Less than 12.5 cm	Less than 11 cm
Edema	Not	Bilateral

Severe malnutrition

The World Health Organization defines severe malnutrition as "a very low weight for height, by visible severe wasting, or by the presence of nutritional oedema."

2 forms of Severe Malnutrition

MARASMUS
"waste away"

- wasting
- no edema

KWASHIORKOR
"displaced child"

- wasting
- +edema

MAIN SYNDROMES OF MALNUTRITION

1. Syndrome of trophic disorders
2. Syndrome of gastrointestinal disorders
3. Syndrome of CNS dysfunctions
4. Syndrome of immunological disorders

Syndrome of trophic disorders:

- Decreased subcutaneous tissue. Subcutaneous fatty layer is thinned on the abdomen in the mild malnutrition, it is decreased from the body and the extremities in the moderate malnutrition, and subcutaneous fat is absent in the severe PEM, buccal fat pads (clots of Bichaut) may be preserved only.
- Decreases of tissue's turgor, muscles are wasting, flabby, thinned.
- Sings of deficiencies of micronutrients (polyhypovitaminoses).

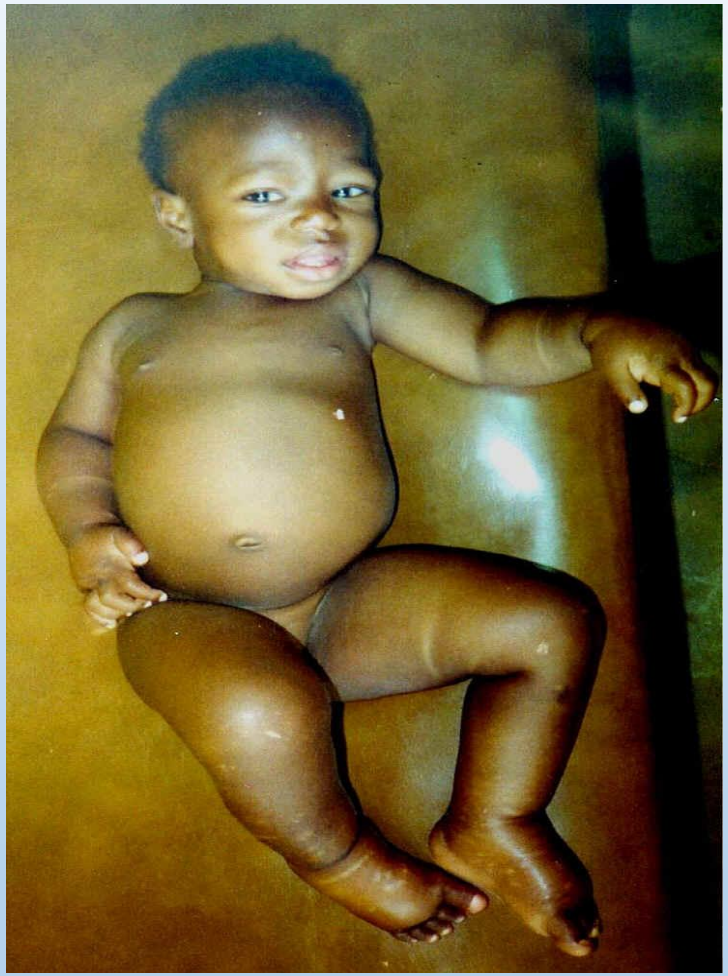
In marasmus, the child appears emaciated. Monkey faces are characteristic to this disorder because of loss of buccal fat pads.

A child with marasmus has the appearance of an old person trapped in a young person's body.

Edema

Kwashiorkor typically presents edema, moon faces

Edema



most of all the distal extremities are affected, but anasarca (generalized edema) can be met too

Skin changes:

skin is pale, flabby; in severe PEM it is xerotic, wrinkled, and loose.

- Kwashiorkor typically presents with dry peeling skin with raw exposed areas, hyperpigmented plaques.
- This feature is called the classic "mosaic skin" and "flaky paint" dermatosis.

Hair changes:

Hair is dry, lusterless, thin, sparse, brittle. It easily pulls out, sometimes may result in alopecia.

Syndrome of gastrointestinal disorders

- Anorexia
- Usually loss of appetite, but in marasmus may be voracious appetite.
- Instability of stool with tendency to constipation, often the diarrhea.

All severely malnourished children have vitamin and mineral deficiencies (Fe, Zn, Co, I, Vitamins A, B1, B2, B12, C, D)

Angular stomatitis

Syndrome of CNS dysfunctions

- Behavioral changes:
  - **domination of negative emotions (irritability, anxiety),**
  - **small activity, apathy, lethargy**
  - **Developmental delay and psychomotor retardations, delayed mental development, and may have permanent cognitive deficits.**
- Disorders of thermoregulation (tendency to hypothermia).

Abdominal findings:

- abdominal distension secondary to poor abdominal musculature.
- enlarged liver (hepatomegaly)

Kwashiorkor

Swollen abdomen (potbelly)

Syndrome of immunological disorders

- Frequent severe and chronic infections, recurrent episodes of respiratory and skin infections, diarrhea and other.
- Tendency to asymptomatic and atypical course of frequent infections diseases.

In severe malnutrition the usual signs of infection, such as fever, are often absent !!!

Laboratory tests:

- CBC (complete blood count)
- Urine examination
- Urine culture
- Stool examination by microscopy
- Blood glucose
- Serum protein and albumin
- HIV test
- Serum electrolytes
- A sweat test
- Chest radiograph

Treatment

1. Detection of causes and their elimination
2. Diet therapy
3. Rational regimen, care, hygienic educations
4. Detection and treatment of infections, complications and accompanying diseases
5. Ferment-therapy, vitamin-therapy and symptomatic therapy

- **Therapeutic nutrition** of infants with malnutrition (hypotrophy) includes 3 stages:
- I stage – period of food tolerance estimating (discharging and minimal nutrition);
- II stage – increasing nutritional loading (the transition period);
- III stage – optimal nutrition.

Stage I

- volume of feeding is 2/3-1/2 of the full volume,
- the rest of volume is given to the patient with liquids (orally or in a parenteral way).
- Number of feedings on this stage is usual or plus 1-2 feedings (in severe malnutrition – 10-12 time/day).
- Duration of stage I is from 1-2 to 8-10 days.

Stage II

- Increasing of the feeding volume and decreasing of frequency
- Breast milk is optimal base food. If there is lack of breast milk, special hydrolyzed formulas or easily digestible formulas with high quantities of protein and calories can be used.

Treatment

- If any organic illness is identified, treatment specific for that disorder should be undertaken.
- Malnutrition is considered a medical emergency in infants or toddlers who weigh less than 70% of the predicted weight for length.

The Treatment of Severe Malnutrition

initially stabilization phase
1 week

- Correction of acute medical conditions
- Cautious feeding
- Correction of micronutrient deficiencies

rehabilitation phase
2-6 weeks

- Feeding
- Emotional and physical stimulation

Medical care

Keep the malnourished child:

- **Dry** (change wet nappies, clothes and bedding)
- **Warm** (cover and take away from draughts. Avoid exposure (e.g. bathing, prolonged medical examinations). Let the child sleep with the mother for warmth at night, use a kangaroo position if possible at day.

Monitor

- The axillaries (rectal) temperature,
- If hypothermia is found, check blood glucose
- Weight gain
- Each week calculate and record weight gain as g/kg/d.
- Control pulse rate, respiratory rate, urine frequency and stool/vomit frequency, especially if patient has rehydration therapy.

Essential features of feeding in the initially phase:

- small, frequent feeds of low osmolarity and low lactose (2-hourly feeds, day and night)
- oral or NG feeds (never parenteral preparations)
- 100 kcal/kg/d
- 1-1.5 g protein/kg/d
- 130 ml/kg/d of fluid (100 ml/kg/d if the child has severe oedema)
- if the child is breastfed, continue to breastfeed but make sure the prescribed amounts of starter formula are given (except in case of shock or coma).

The WHO had recommended

- For enteral hydration use special Rehydration Solution for Malnutrition (ReSoMal)
- For feeding use the liquid products, such as the starter milk-based formulas F- 75 containing 75 kcal/100ml and 0.9 g protein/100ml

Correct of micronutrient deficiencies

- **Vit A orally on Day 1** (if aged >1 year give 200,000 iu; age 6-12m give 100,000iu; age 0-5m give 50,000 iu)

Give daily for at least 2 weeks:-

- **Multivitamin supplement**
- **Folic acid 1mg/d (give 5mg on Day 1)**
- **Zinc 2mg/kg/d**
- **Copper 0.3mg/kg/d**
- **Iron 3mg/kg/d but only when gaining weight.**

Essential features of feeding in the rehabilitation phase:

- frequent feeds (at least 4-hourly) of unlimited amounts of a catch-up formula
- 150-220 kcal/kg/d
- 4-6 g protein/kg/d
- to encourage the child to eat as much as possible
- to restart breastfeeding as soon as possible
- to stimulate the emotional and physical development
- to actively prepare the child and mother to return to home and prevent recurrence of malnutrition

- The recommended milk-based F-100 contains 100 kcal and 2.9 g protein/100 ml
- rapid weight gain of >10 g gain/kg/d.

Further Inpatient Care

- Child
  - Appropriate weight for height (-1 standard deviation [SD])
  - Eating well and gaining weight
  - Infections properly treated
  - Immunization started

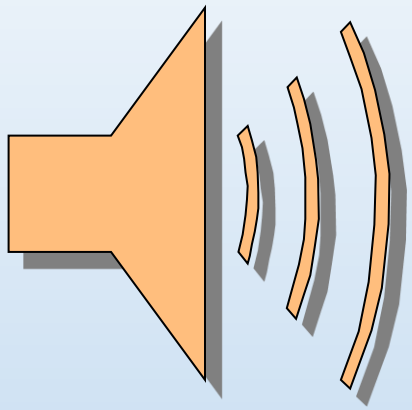
Further Inpatient Care

- Mother
  - Able to look after the child
  - Able to prepare appropriate food
  - Able to provide home treatment for diarrhea
  - Able to recognize the signs that mean she must seek medical assistance

A child who is 90% weight-for-length (equivalent to -1 SD) can be considered to have recovered.

Prevention

- careful assessment and monitoring of all families
- monitoring of growth of the child
- parents education



Thanks