

PROTEIN ENERGY MALNUTRITION



ERIC DSOUZA

MD

Associate Prof.

MIMER Medical College

HUMAN NUTRITION

- ⌘ Nutrients are substances that are crucial for human life, growth & well-being.**
- ⌘ Macronutrients (carbohydrates, lipids, proteins & water) are needed for energy and cell multiplication & repair.**
- ⌘ Micronutrients are trace elements & vitamins, which are essential for metabolic processes.**

HUMAN NUTRITION/2

- ⌘ Obesity & under-nutrition are the 2 ends of the spectrum of malnutrition.**
- ⌘ A healthy diet provides balanced nutrients that satisfy the metabolic needs of the body without excess or shortage.**
- ⌘ Dietary requirements of children vary according to age, sex & development.**

Assessment of Nutr status

⌘ Direct

- ☑ Clinical
- ☑ Anthropometric
- ☑ Dietary
- ☑ Laboratory

⌘ Indirect

- ☑ Health statistics
- ☑ Ecological variables

Clinical Assessment

- ⌘ Useful in severe forms of PEM**
- ⌘ Based on thorough physical examination for features of PEM & vitamin deficiencies.**
- ⌘ Focuses on skin, eye, hair, mouth & bones.**
- ⌘ Chronic illnesses & goiter to be excluded**

Clinical Assessment/2

⌘ **ADVANTAGES**

- ☑ **Fast & Easy to perform**
- ☑ **Inexpensive**
- ☑ **Non-invasive**

⌘ **LIMITATIONS**

- ☑ **Did not detect early cases**
- ☑ **Trained staff needed**

ANTHROPOMETRY

- ⌘ Objective with high specificity & sensitivity**
- ⌘ Measuring Ht, Wt, MAC, HC, skin fold thickness, waist & hip ratio & BMI**
- ⌘ Reading are numerical & gradable on standard growth charts**
- ⌘ Non-expensive & need minimal training**

ANTHROPOMETRY/2

⌘ LIMITATIONS

- ☒ **Inter-observers' errors in measurement**
- ☒ **Limited nutritional diagnosis**
- ☒ **Problems with reference standards**
- ☒ **Arbitrary statistical cut-off levels for abnormality**

LAB ASSESSMENT

⌘ Biochemical

☑ Serum proteins,
creatinine/hydroxyproline

⌘ Hematological

☑ CBC, iron, vitamin levels

⌘ Microbiology

☑ Parasites/infection

DIETARY ASSESSMENT

- ⌘ Breast & complementary feeding details**
- ⌘ 24 hr dietary recall**
- ⌘ Home visits**
- ⌘ Calculation of protein & Calorie content of children foods.**
- ⌘ Feeding technique & food habits**



DEFINITION

A range of pathological conditions arising from coincident lack in varying proportions of protein and calories occurring most frequently in infants and young children and commonly associated with infections

OVERVIEW OF PEM

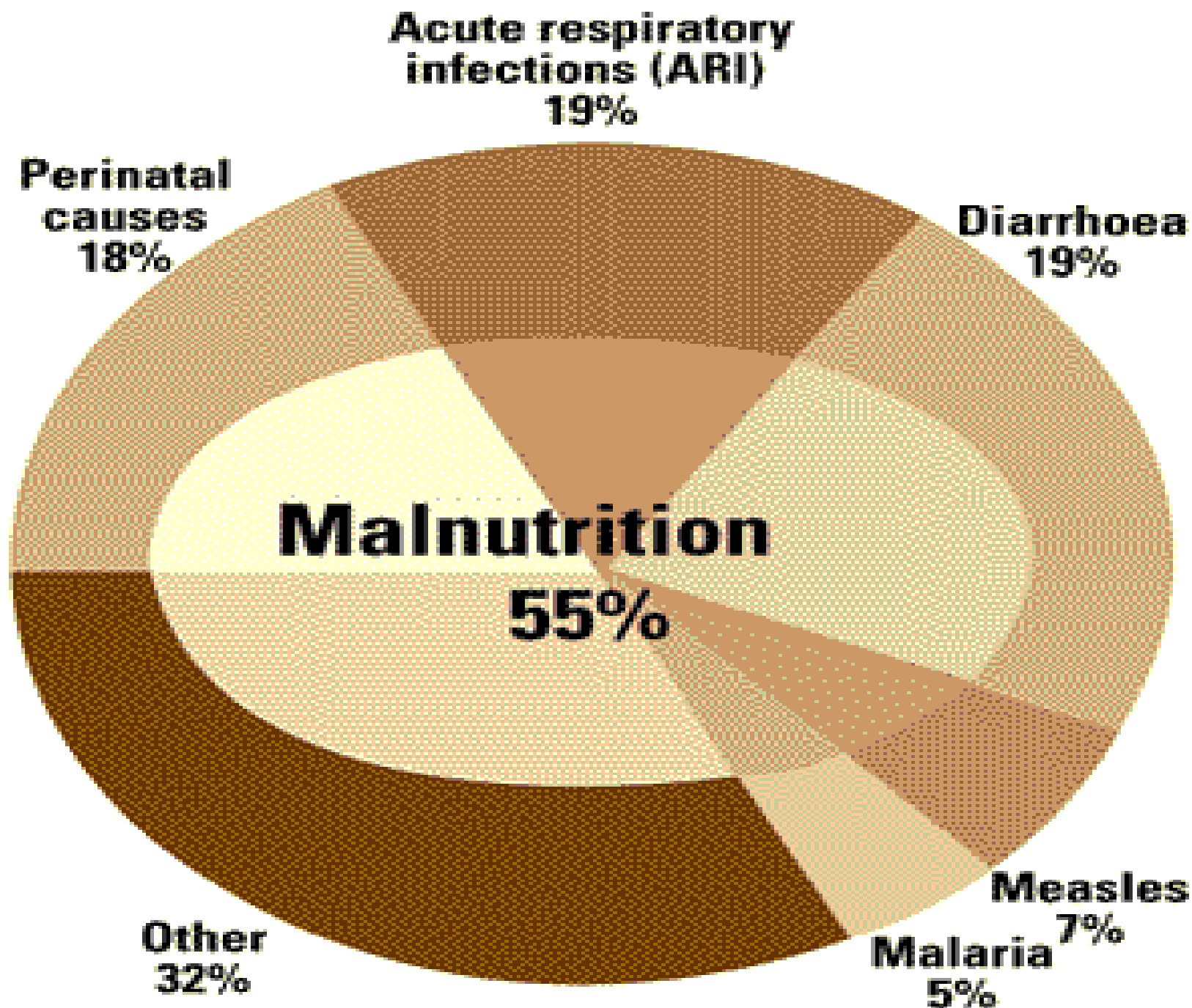
- ⌘ The majority of world's children live in developing countries**
- ⌘ Lack of food & clean water, poor sanitation, infection & social unrest lead to LBW & PEM**
- ⌘ Malnutrition is implicated in >50% of deaths of <5 children (5 million/yr)**

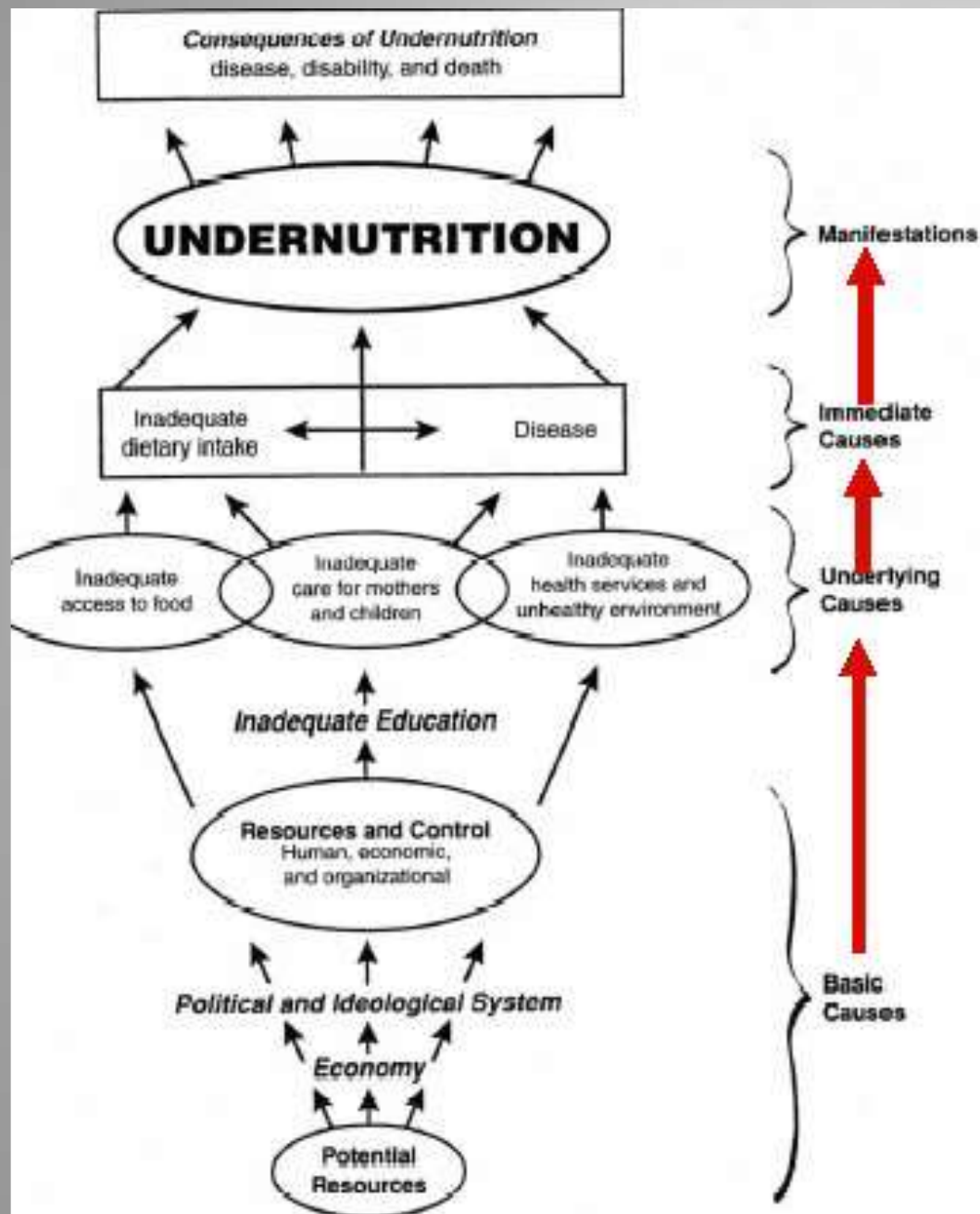
CHILD MORTALITY

⌘ **The major contributing factors are:**

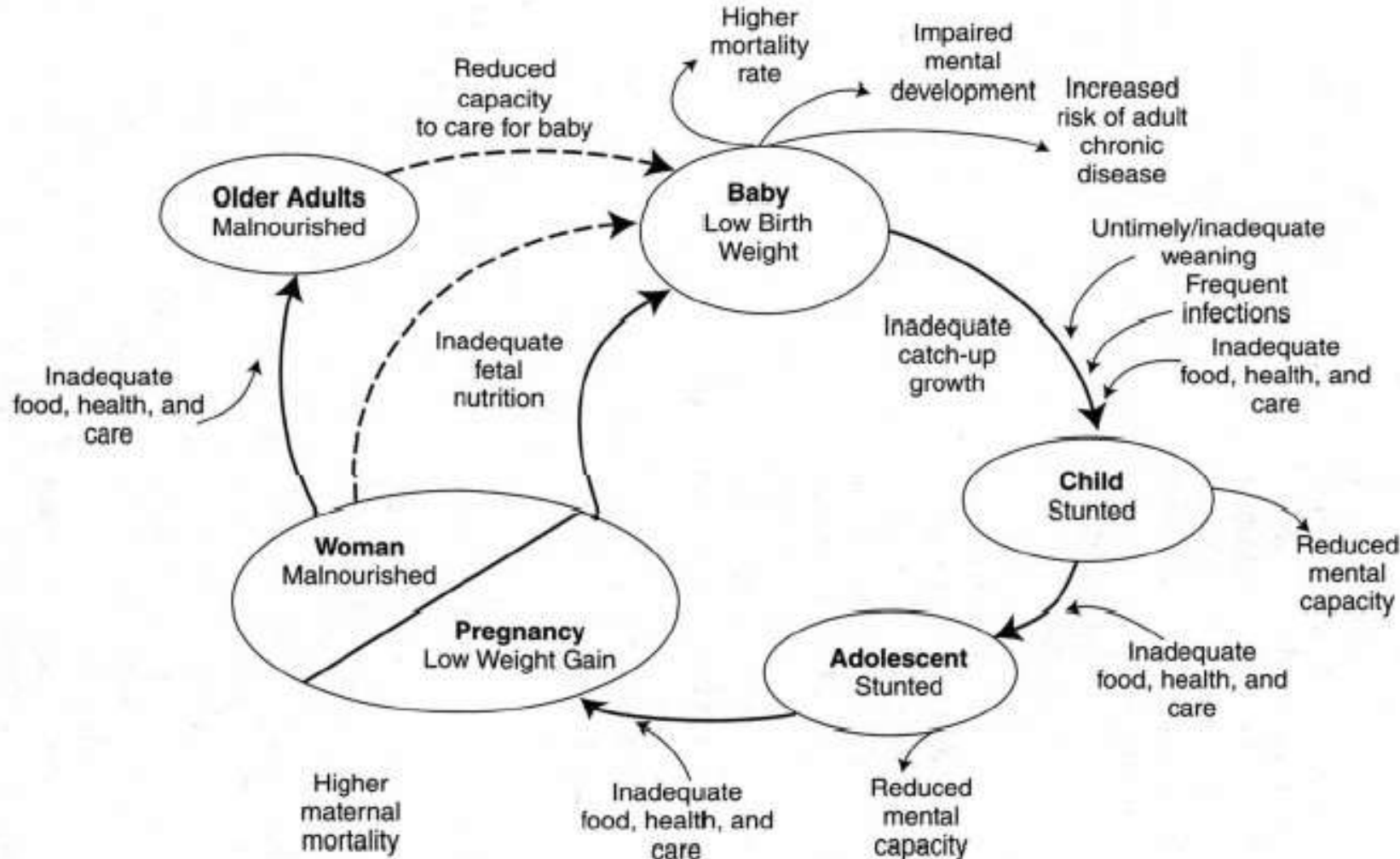
<input type="checkbox"/> Diarrhea	20%
<input type="checkbox"/> ARI	20%
<input type="checkbox"/> Perinatal causes	18%
<input type="checkbox"/> Measles	07%
<input type="checkbox"/> Malaria	05%

55% of the total have malnutrition



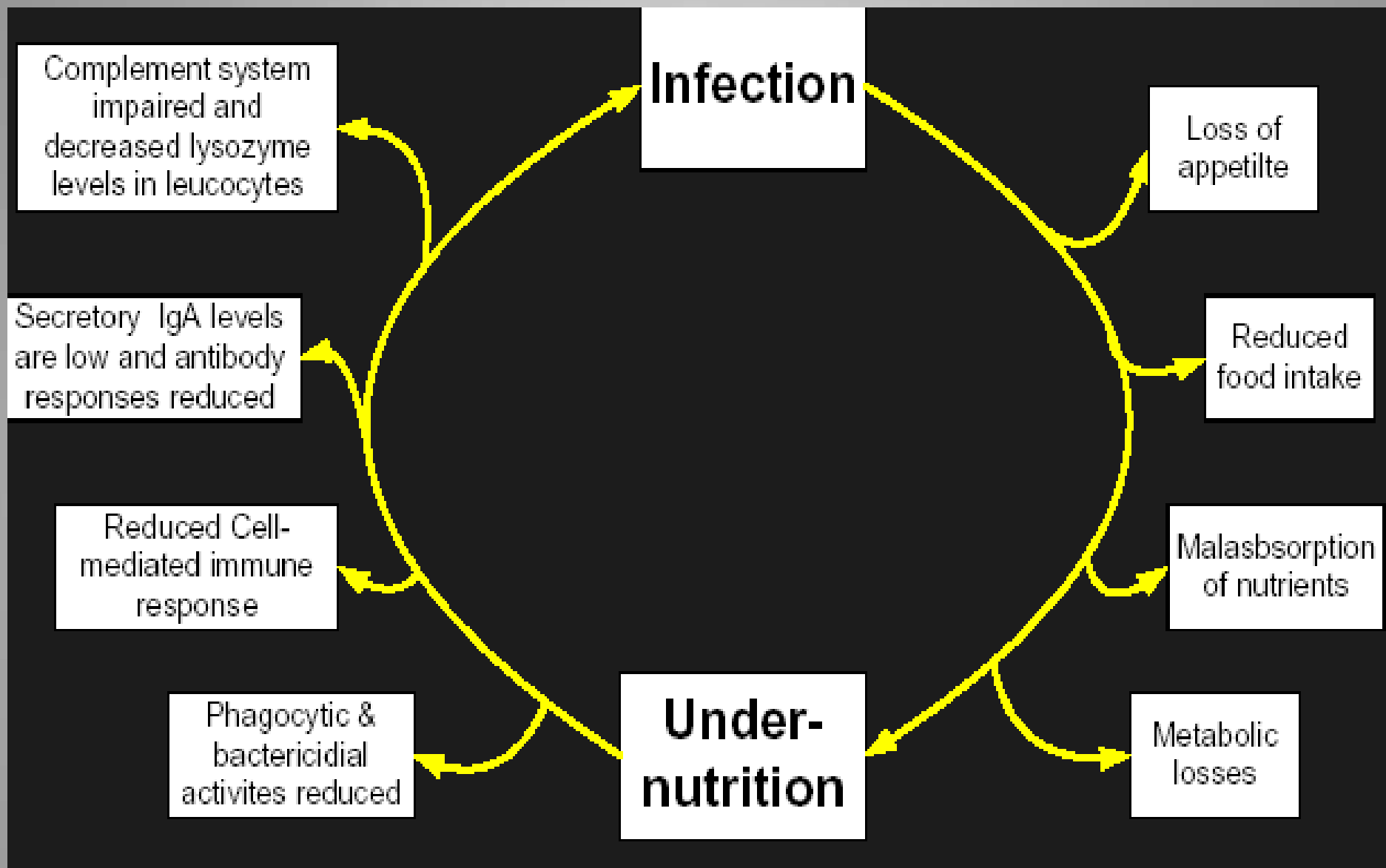


UNICEF
conceptual
model of
causation of
CHRONIC
undernutrition



Conceptual Model of the Effects of Undernutrition throughout the Life Cycle

ACC/SCN, 4th Report on the World Nutrition Situation, 2000



Anthropometric assessment

- Weight [WHO Growth Charts]
- Height/ Length [WHO Growth Charts]
- Wt for ht: $\text{Act Wt} / \text{Expected wt for ht} \times 100$
- Ht for age: $\text{Act Ht} / \text{Exp ht for actual age} \times 100$
-

Midarm circumference (MAC)

- Head circumference
- Chest circumference
- Skin Fold Thickness- Herpenden Calipers
- Midparental height
- Upper segment-lower segment ratio

Anthropometry :

Age independent indicators

- Bangle test- inner diameter of 4 cms
- Shakir's tape- green, yellow & red zones
- Quacker arm circumference stick- 2 sets of markings- for Ht & MAC

□ Modified Quac Stick

□ Nabarrow's thinness chart: graphic

representation of W f H – Save the Children Fund

□ MAC/HC (Kanawati's) -

Mild - 0.28 - 0.314

Moderate - 0.25-0.279

Severe - <0.249

Anthropometry:

Age independent indicators

- HC/CC : >1 -normal in >9 mths age
- Rao's $W(\text{kg})/H^2(\text{cm})$: Normal - >0.0015

Severe - <0.0013

- Ponderal index $[W/H^3]$: Normal - >2.5

Severe PEM - <2

□ Dughdale W/H 1.6: Normal – >0.79

Malnutrition - <0.79

□ BMI (kg/m²): Normal 18.5-25

Overweight >25

Obese >30

Underweight <13

□ Quetlet Index: $W(\text{kg}) / H(\text{cm})^2 \times 100$: Normal >0.15

□ Mid arm muscle circumference: MAC-(3.14xSFT) cms

Classification:

Gomez's (wt/age) Wellcome Trust (wt/age)

Nut Status % of exp

(Harvard)

Normal >90

1st deg PEM 75-90

2nd deg PEM 60-75

3rd deg PEM <60

% of exp

(Boston)

Edem

a

Type of

PEM

60-80 + Kwasi

60-80 - Underwt

Classification:

Gomez's (wt/age) Wellcome Trust (wt/age)

Nut Status % of exp
(Harvard)

Normal >90

1st deg PEM 75-90

2nd deg PEM 60-75

3rd deg PEM <60

% of exp
(Boston)

Edem

a

Type of

PEM

60-80 + Kwasi

60-80 - Underwt

<60 - Maras

<60 + MarasKwas

IAP Classification:

Nutritional Status Wt for Age (% of exp)

Normal >80

Gr I PEM 71-80

Gr II PEM 61-70

Gr III PEM 51-60

Gr IV PEM <50

Alphabet K is post fixed in presence of edema

Clinical Features:

Organ Signs

1. Hair Lustreless, thin, sparse, straight, depigmented, Flag Sign, easily pluckable
2. Face Pigmentation, moon facies
3. Eyes Pallor, bitot's spot, conjunctival & corneal xerosis, keratomalacia
4. Lips Angular stomatitis, cheilosis

5. Tongue Oedema, scarlet raw tongue, atrophic papillae

6. Teeth & gums Mottled enamel, spongy & bleeding gums

7. Glands Thyroid & parotid enlargement





MARASMUS

- Gross wasting of muscles and subcutaneous tissues resulting in emaciation and old man appearance
- Marked stunting
- No edema
- Alert with voracious appetite
- Grades: as per progression of wasting
- Gr I: axilla & groin
- Gr II: Gr I + thighs & buttocks
- Gr III: Gr II + chest & abdomen
- Gr IV: Gr III + buccal pad of fat

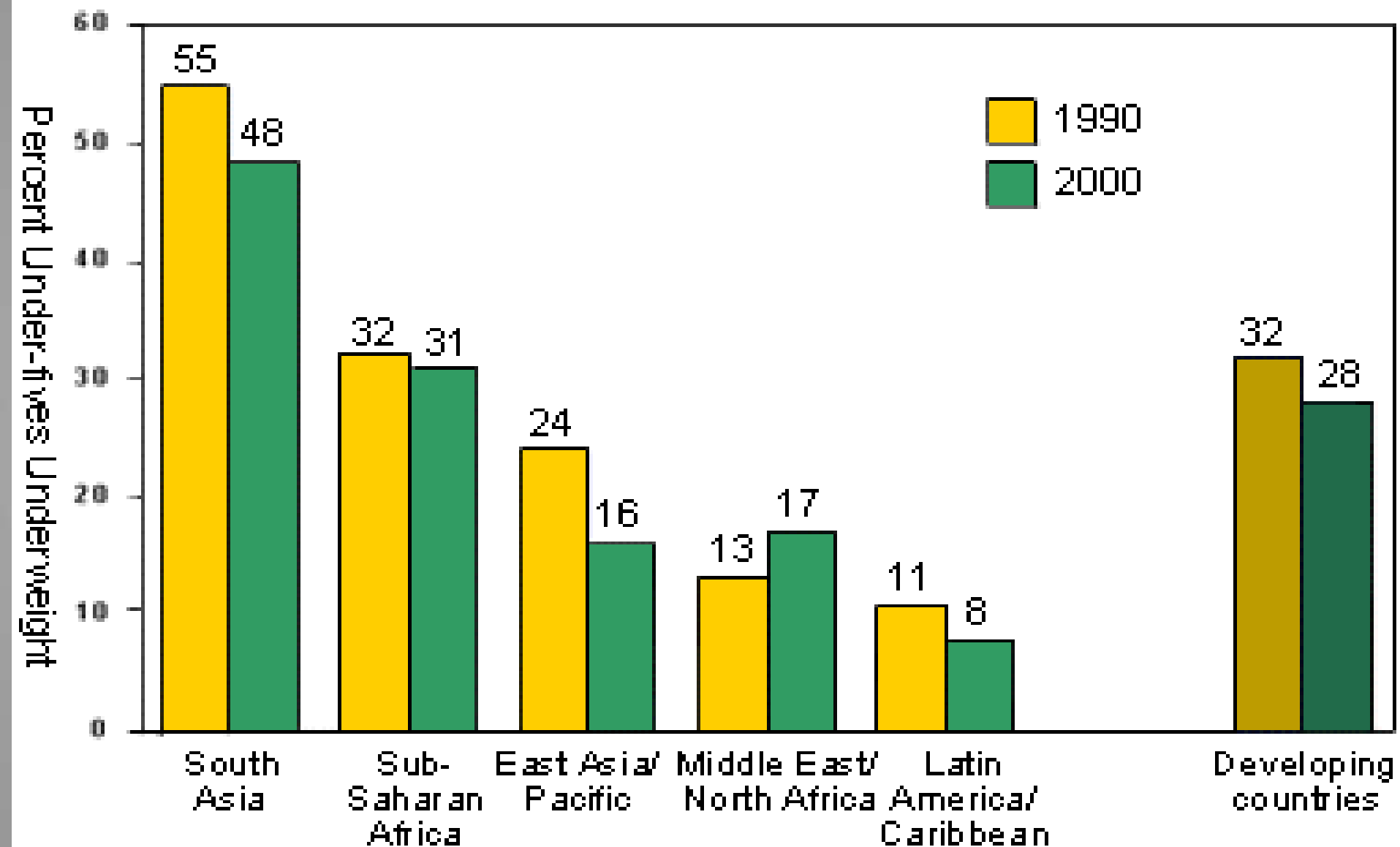
KWASHIORKOR

- 1st recognized by Prof Cicely Williams in 1933 denotes “deposed child”
 - Apathetic, miserable, stunted, oedema, hepatomegaly, anemia, hair and skin changes
- Grd I- Pedal edema
- Grd II- I + Facial edema
- Grd III- II + paraspinal & chest edema
- Grd IV- III + ascitis

EPIDEMIOLOGY

- ⌘ The term protein energy malnutrition has been adopted by WHO in 1976.**
- ⌘ Highly prevalent in developing countries among <5 children; severe forms 1-10% & underweight 20-40%.**
- ⌘ All children with PEM have micronutrient deficiency.**

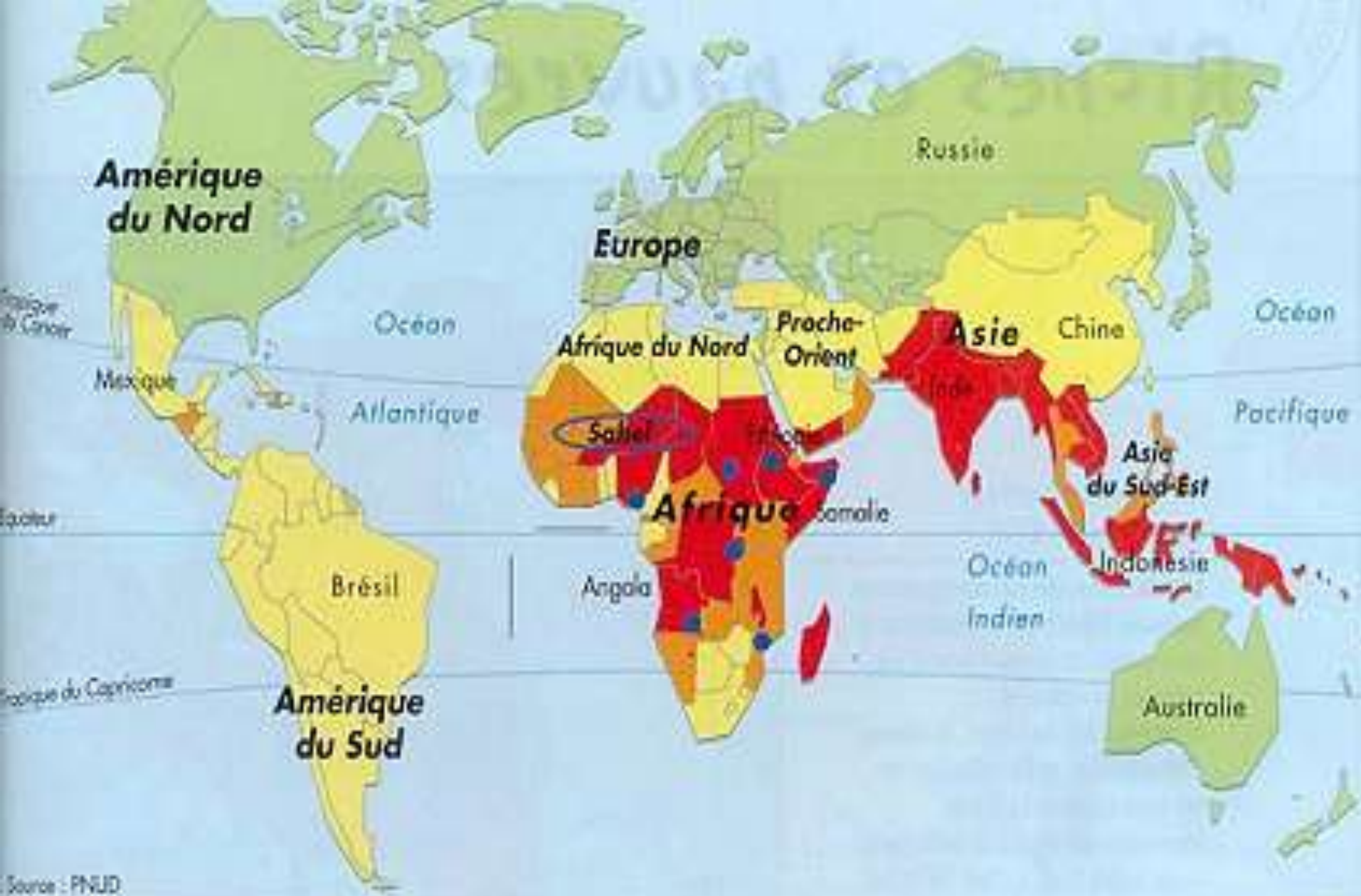
Malnutrition declines from 32 to 28 percent



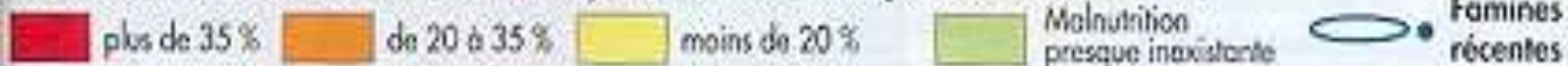
Source: UNICEF, 2001

PEM

- ⌘ **In 2000 WHO estimated that 32% of <5 children in developing countries are underweight (182 million).**
- ⌘ **78% of these children live in South-east Asia & 15% in Sub-Saharan Africa.**
- ⌘ **The reciprocal interaction between PEM & infection is the major cause of death & morbidity in young children.**



Part des enfants de moins de 5 ans dont le poids est inférieur au poids normal (en 1997)



PEM in Sub-Saharan Africa

⌘ PEM in Africa is related to:

- ☒ The high birth rate**
- ☒ Subsistence farming**
- ☒ Overused soil, draught & desertification**
- ☒ Pests & diseases destroy crops**
- ☒ Poverty**
- ☒ Low protein diet**
- ☒ Political instability (war & displacement)**

PRECIPITATING FACTORS

- **LACK OF FOOD (famine, poverty)**
- **INADEQUATE BREAST FEEDING**
- **WRONG CONCEPTS ABOUT NUTRITION**
- **DIARRHOEA & MALABSORPTION**
- **INFECTIONS (worms, measles, T.B)**

CLASSIFICATION

☒ A. CLINICAL (WELLCOME)

☒ Parameter: weight for age \pm oedema

☒ Reference standard (50th percentile)

☒ Grades:

☒ 80-60 % without oedema is under weight

☒ 80-60% with oedema is Kwashiorkor

☒ < 60 % with oedema is Marasmus-Kwash

☒ < 60 % without oedema is Marasmus

CLASSIFICATION (2)

B. COMMUNITY (GOMEZ)

Parameter: weight for age

Reference standard (50th percentile) WHO chart

Grades:

I (Mild) : 90-70

II (Moderate): 70-60

III (Severe) : < 60

ADVANTAGES

- **SIMPLICITY (no lab tests needed)**
- **REPRODUCIBILITY**
- **COMPARABILITY**
- **ANTHROPOMETRY+CLINICAL
SIGN USED FOR ASSESSMENT**

DISADVANTAGES

- **AGE MAY NOT BE KNOWN**
- **HEIGHT NOT CONSIDERED**
- **CROSS SECTIONAL**
- **CAN'T TELL ABOUT CHRONICITY**
- **WHO STANDARDS MAY NOT REPRESENT LOCAL COMMUNITY STANDARD**

KWASHIORKOR

⌘ **Cecilly Williams, a British nurse, had introduced the word Kwashiorkor to the medical literature in 1933. The word is taken from the Ga language in Ghana & used to describe the sickness of weaning.**

ETIOLOGY

- ⌘ Kwashiorkor can occur in infancy but its maximal incidence is in the 2nd yr of life following abrupt weaning.**
- ⌘ Kwashiorkor is not only dietary in origin. Infective, psycho-social, and cultural factors are also operative.**

ETIOLOGY (2)

- ⌘ Kwashiorkor is an example of lack of physiological adaptation to unbalanced deficiency where the body utilized proteins and conserve S/C fat.**
- ⌘ One theory says Kwash is a result of liver insult with hypoproteinemia and oedema. Food toxins like aflatoxins have been suggested as precipitating factors.**

CLINICAL PRESENTATION

- ⌘ **Kwashiorkor is characterized by certain constant features in addition to a variable spectrum of symptoms and signs.**
- ⌘ **Clinical presentation is affected by:**
 - **The degree of deficiency**
 - **The duration of deficiency**
 - **The speed of onset**
 - **The age at onset**
 - **Presence of conditioning factors**
 - **Genetic factors**

CONSTANT FEATURES OF KWASH

OEDEMA

PSYCHOMOTOR CHANGES

GROWTH RETARDATION

MUSCLE WASTING



USUALLY PRESENT SIGNS

⌘ **MOON FACE**

⌘ **HAIR CHANGES**

⌘ **SKIN DEPIGMENTATION**

⌘ **ANAEMIA**



OCCASIONALLY PRESENT SIGNS

- ☒ **HEPATOMEGALY**
- ☒ **FLAKY PAINT DERMATITIS**
- ☒ **CARDIOMYOPATHY & FAILURE**
- ☒ **DEHYDRATION (Diarrh. & Vomiting)**
- ☒ **SIGNS OF VITAMIN DEFICIENCIES**
- ☒ **SIGNS OF INFECTIONS**

DD of Kwash Dermatitis

⌘ **Acrodermatitis Entropathica**

⌘ **Scurvy**

⌘ **Pellagra**

⌘ **Dermatitis Herpiformis**



MARASMUS

- ⌘ **The term marasmus is derived from the Greek *marasmos*, which means wasting.**
- ⌘ **Marasmus involves inadequate intake of protein and calories and is characterized by emaciation.**
- ⌘ **Marasmus represents the end result of starvation where both proteins and calories are deficient.**

MARASMUS/2

- ⌘ **Marasmus represents an adaptive response to starvation, whereas kwashiorkor represents a maladaptive response to starvation**
- ⌘ **In Marasmus the body utilizes all fat stores before using muscles.**

EPIDEMIOLOGY & ETIOLOGY

- ⌘ Seen most commonly in the first year of life due to lack of breast feeding and the use of dilute animal milk.**
- ⌘ Poverty or famine and diarrhoea are the usual precipitating factors**
- ⌘ Ignorance & poor maternal nutrition are also contributory**



Clinical Features of Marasmus

- ⌘ **Severe wasting of muscle & s/c fats**
- ⌘ **Severe growth retardation**
- ⌘ **Child looks older than his age**
- ⌘ **No edema or hair changes**
- ⌘ **Alert but miserable**
- ⌘ **Hungry**
- ⌘ **Diarrhoea & Dehydration**





CLINICAL ASSESSMENT

- ⌘ Interrogation & physical exam including detailed dietary history.**
- ⌘ Anthropometric measurements**
- ⌘ Team approach with involvement of dietitians, social workers & community support groups.**

Investigations for PEM

- ⌘ **Full blood counts**
- ⌘ **Blood glucose profile**
- ⌘ **Septic screening**
- ⌘ **Stool & urine for parasites & germs**
- ⌘ **Electrolytes, Ca, Ph & ALP, serum proteins**
- ⌘ **CXR & Mantoux test**
- ⌘ **Exclude HIV & malabsorption**

NON-ROUTINE TESTS

⌘ **Hair analysis**

⌘ **Skin biopsy**

⌘ **Urinary creatinine over proline ratio**

⌘ **Measurement of trace elements levels, iron, zinc & iodine**

Complications of P.E.M

⌘ **Hypoglycemia**

⌘ **Hypothermia**

⌘ **Hypokalemia**

⌘ **Hyponatremia**

⌘ **Heart failure**

⌘ **Dehydration & shock**

⌘ **Infections (bacterial, viral & thrush)**

TREATMENT

- ⌘ **Correction of water & electrolyte imbalance**
- ⌘ **Treat infection & worm infestations**
- ⌘ **Dietary support: 3-4 g protein & 200 Cal /kg body wt/day + vitamins & minerals**
- ⌘ **Prevention of hypothermia**
- ⌘ **Counsel parents & plan future care including immunization & diet supplements**

KEY POINT FEEDING

- ⌘ **Continue breast feeding**
- ⌘ **Add frequent small feeds**
- ⌘ **Use liquid diet**
- ⌘ **Give vitamin A & folic acid on admission**
- ⌘ **With diarrhea use lactose-free or soya bean formula**

PROGNOSIS

- ⌘ **Kwash & Marasmus-Kwash have greater risk of morbidity & mortality compared to Marasmus and under weight**
- ⌘ **Early detection & adequate treatment are associated with good outcome**
- ⌘ **Late ill-effects on IQ, behavior & cognitive functions are doubtful and not proven**

THANK YOU

