



NUTRITION & NUTRITIONAL ASSESSMENT

NUTRITION- DEFINITIONS
NATIONAL NUTRITION WEEK – 1ST – 7TH
SEPTEMBER



- **Nutrition:** The process by which the organism utilizes food.
- **IYCN:** infant & Young Child Nutrition
- Special emphasis on **1st 1000 Days of Life** (prenatal to 2yrs/minus 9 to plus 24 months)
- **Weaning/Complementary Feeding:** The systematic process of introduction of suitable food at the right time in addition to mother's milk in order to provide needed nutrients to the baby (UNICEF 1984).

FOOD ITEMS & FOOD GROUPS



- Cereals, Pulses (legumes), Vegetables, fruits, Milk & milk products, Meat group & Fish, Sugar, Oils & Fats
- **Energy yielding:** Carbohydrates, Fats & Oils
- **Body building:** Protein
- **Protective foods:** Vitamins & Minerals
- **Micronutrients:** those required in small quantities; mg/mcg

FOOD ITEMS & FOOD GROUPS CONTD...



- **Trace Elements:** present/required in trace quantities: $<0.01\%$ body weight
- **Balanced Diet:** Optimum quantity of all food groups and food items needed for physical activity, growth & development, repair or worn out/ageing tissues and maintenance of body functions.

NEW FOOD GUIDE PYRAMID



TYPE I AND TYPE II NUTRIENTS

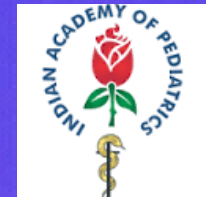


- Over 40 nutrients are essential to health
- If any one is deficient then the person will not be healthy and resist disease
- Many are ignored by practitioners and their deficiency is not recognized
- They are divided into two groups in terms of the response to a deficiency

NORMAL



DEFICIENT



Type I



Type II

Type 1

- Iron
- Iodine
- Copper
- Calcium
- Selenium
- Thiamin
- Riboflavin
- Pyridoxine
- Niacin
- Folate
- Cobalamin
- Vitamin A, D, E, K

Type 2

- Nitrogen
- Essential amino acids
- Potassium
- Magnesium
- Phosphorus
- Sulphur
- Zinc
- Sodium
- Chloride





Type 1

Functional nutrients

- has a body store
- reduces in concentration with deficiency
- Specific signs of deficiency
- Growth failure not a feature
- variable in breast milk

Type 2

Growth nutrients

- has no body store
- stable tissue concentration
- no specific signs of deficiency
- Growth failure the dominant feature
- stable in breast milk

ENERGY



- **Unit of Energy:** 1 kilocalorie (kcal./Cal.)
- Heat required to raise temperature of 1 kg of water from 14.5 to 15.5°C.
- Unit in international system: Joule
- (1 cal.= 4.184 joule)

CARBOHYDRATES: 1 G = 4 KCAL.



- Provide energy, taste, preserve foods
- Types: Starch, sugars
 - Monosaccharides: glucose
 - Disaccharides: sucrose, lactose, fructose
 - Complex: Maltodextrins, Polysaccharides, glycogen
- Glucose*
 - Fuel for brain and muscle
 - Converted to glycogen, stored in liver & muscles
 - * Heart & RBCs use only glucose for energy
- 55 – 60% of total calories

FIBER- UNABSORBABLE CARBOHYDRATES



- Constituent of plant cell wall: **cellulose, pectins, gums, lignins**
- Contribute to the bulk, very little to energy
- Water holding capacity, bile binding capacity, promotes growth of normal intestine microflora
- Lowers cholesterol, limits glucose absorption
- Reduces constipation, colon cancers,
- Softens stool, accelerates bowel movement
- High fiber may reduce bioavailability of minerals, cause flatulence and decreased appetite

PROTEIN: 1 G =4 KCAL.



- Protein means of 'prime importance'
- 24 amino acid, 8 essential in all & 3: cysteine, arginine, taurine essential in LBW babies
- Helps in growth, tissue repair, formation of body fluids and enzymes
- **RDA:**1.8-1.5 in child & 0.7 g/kg/day in adults
- To supply up to 15% of energy
- **Complete protein** supply all the essential aa.
- **Reference protein** : provides aa. pattern close to tissue protein, Egg with Digestibility quotient (DQ), Biological value (BV) & Net protein utilization (NPU) = 96.

LIPIDS/FAT: LONG CHAIN 1 G = 9 KCAL



- Concentrates of energy, Both Visible & non visible, transports fat soluble vitamins
- Saturated, Monounsaturated & Polyunsaturated (Ideal ratio 1:1:1)
- Long chain: 12 or more, Medium: 7-11 & Short: 6 Carbons
- Triglycerides, phospholipids (lecithin), sterols (cholesterol: HDL (good cholesterol), LDL, VLBL)
- Cis. Vs. Trans fat (trans fat unhealthy)



LIPIDS/FAT: LONG CHAIN 1 G = 9 KCAL CONTD...

- EFA- Polyunsaturated to supply 3% of energy →
- Derived Long Chain polyunsat. (LCPs)
- Omega 6: Linoleic → Arachidonic & Adrenic acid
 - Proinflammatory, health of skin
- Omega 3: Alpha Linolenic → Eicosa pentaenoic acid (EPA) & Docosa hexaenoic acid (DHA)
 - Anti inflammatory, EPA for heart & DHA for brain & vision
 - (ideal ratio of Omega 6: omega 3 = 5-10:1)

MINERALS- MACRO & MICRO MINERALS



- Elements, Minerals, Electrolytes
- Calcium, Phosphorous, Magnesium, Sodium, Potassium, Chloride,,
- Trace elements
 - Essential – iron, iodine, zinc, selenium, copper, molybdenum, cobalt, chromium, manganese, silicon, nickel, boron
 - Potentially toxic – fluorine, lead, cadmium, mercury, arsenic



PERIODS OF GROWTH

- Prenatal period
 - Ovum: 0–14 days
 - Embryo: 2 to 9 weeks
 - Fetus: 9 weeks to birth
- Perinatal period
 - 28 wks gestation (>1000 g) to 7 days after birth,
 - Extended: 22 wks to 7 days.

PERIODS OF GROWTH



- Postnatal period
 - Newborn: first 28 days after birth
 - Infancy: first year
 - Toddler: 1 – 3 year
 - Preschool: 3 – 6 years
 - School child: 6 – 10 years & more
 - Adolescence: 10-19 yrs..
 - LBW: <2500 irrespective of gestational age, VLBW: <1500 & ELBW: < 1000 g

ASSESSMENT OF NUTRITIONAL STATUS

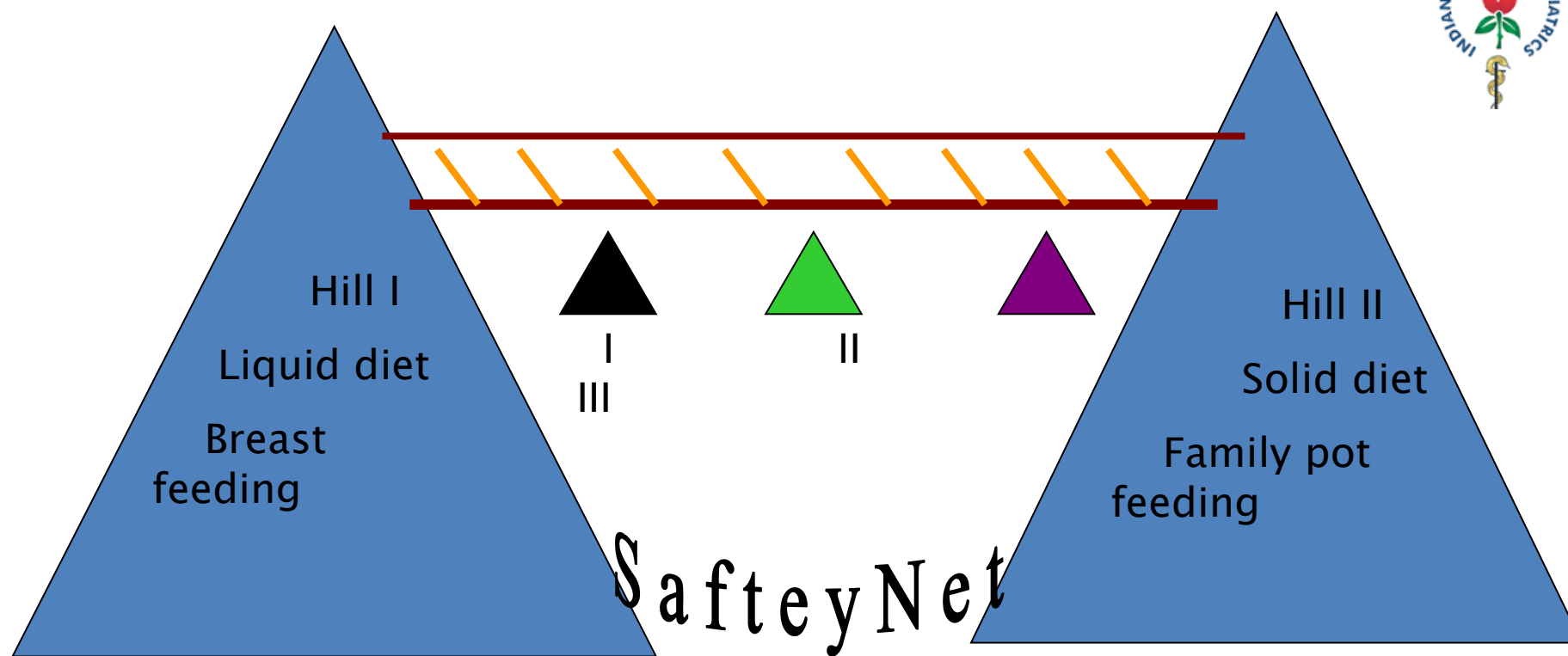


- Dietary History
- Anthropometry/Auxology*
(* preferred term than anthropometry for human measurements)
- Clinical features of Malnutrition/ specific deficiencies
- Biochemical Assessment
- Radiological Assessment: Bone, Teeth etc.
- Morphological & Histological
- Epidemiological: Vital statistics

DIETARY EVALUATION



- Record **IYCF practices: Exclusive breast feeding**, total duration of breast feeding,
- **Complementary feeding**: time of introduction, type, adequacy,
- Empowerment to **Family pot feeding**,
- Access to any **safety net** in the form of Supplementary feeding, Group eating/ small frequent special feeding (Akshayapatra concept)
- Present diet: **24 Hrs. dietary recall**
- Adequacy with respect to energy, protein, micronutrients & comparison with RDA
- Any H/o exclusion diet, diet during illness, any supplements



Pit of malnutrition

Safety Net :
 Supplementary Feeding,
 Group Eating,
 Akshayapathra

RDA



- **Energy Requirement: ICMR Recommended Dietary Allowances (RDA)** almost on par with American RDA for reference child/ ideal weight
 - **Bedside Calculation- bare minimum:** 1 Yr. old 1000 kcal +100 kcal/each Yr. Adol. Boy 2400 & Girl 2200.
 - **Holliday & Segar formula for both energy & fluid *:**
 - 1 – 10 kg:100 kcal/ kg/day
 - 11 – 20 kg:1000 + 50 kcal/kg/day
 - > 20 kg:1500 + 20 kcal/ kg/day
 - Adult: 40 kcal/kg/day
- * Use ideal weight for energy & observed weight for fluid calculation

FOOD VALUES



- Ideally Standard measuring equipments should be demonstrated during dietary evaluation.
- 1 teas spoon: 5 ml or 5 g
- 1 table spoon: 15 ml or 15 g (3 teaspoon)
- 1 glass: Usually 8 oz – 240 ml/g
- 1 cup: Usually 6 oz- 180 ml/g



Food item	Protein g	Kilocalories
Idly – one	2	50
Puri – two	2	70
Wheat chappati 1	2	70
Bread slice 1 1oz	2	70
Dosa	2	70
Uppma 1 cup	6	250
Ragi 6 tsp	2	100
Cooked dhal 1 tsp	0.5	15
Oil/ghee 1 tsp	0	36
Butter 100 g	0	720



Food item	Protein gms	Kilocalories
Cooked rice 1 cup	4	175
Honey 1 tsp	0	15
Rasam 1 cup	0	20
Coconut water 1 cup	1.4	24
Coffee 1 cup	1.8	80
Tea 1 cup	1.0	60
Butter milk 100 ml	0.8	15
Ragi flour 6 tsp	2	100
Ragi 100 g	7.3	328
Rice 100 g (Par boiled)	6.4	346
Wheat 100 g	11.8	346

Food item	Protein gms	Kilocalories
Mashed potato 1 tsp	-	40
Bengal gram 100 g	22.5	369
Black gram Dhal 100 g	24	347
Green gram dhal 100 g	24.5	348
Red gram dhal 100 g	22.3	335
Mutton 1 oz (8 bits)	6	50
Egg Hen 1	6	80
Fish 1oz (10 cm)	6	80
Biscuit 1	0.5	25
Papadam 1	0.5	25
Banana 1	0.6	50

Food item	Protein gms	Kilocalories
Spinach 100 g	2	26
Cow's milk 200 ml	6	120
Curd 30 ml	1	20
Papaya ripe 100 g	0.6	32
Tomato 100 g	1.4	21
Ground nut 100 seeds	10	200

ITEMS THAT GIVE 6 G OF PROTEIN



- 1 egg
- 3 slice bread
- 3 idlis
- 3 chappatis
- 3 dosas
- 6 puris
- 6 vada/bonda
- 12 tsp cooked dhal
- 18 tsp ragi
- 1 glass milk
- 1 ounce (30 ml) meat / fish
- 60 groundnuts
- 15 cashew nuts
- 1 ½ cup cooked rice
- 6 tsp bengal gram
- 12 Biscuit
- 12 pappadam

AGE DEPENDENT & AGE INDEPENDENT ANTHROPOMETRIC CRITERIA



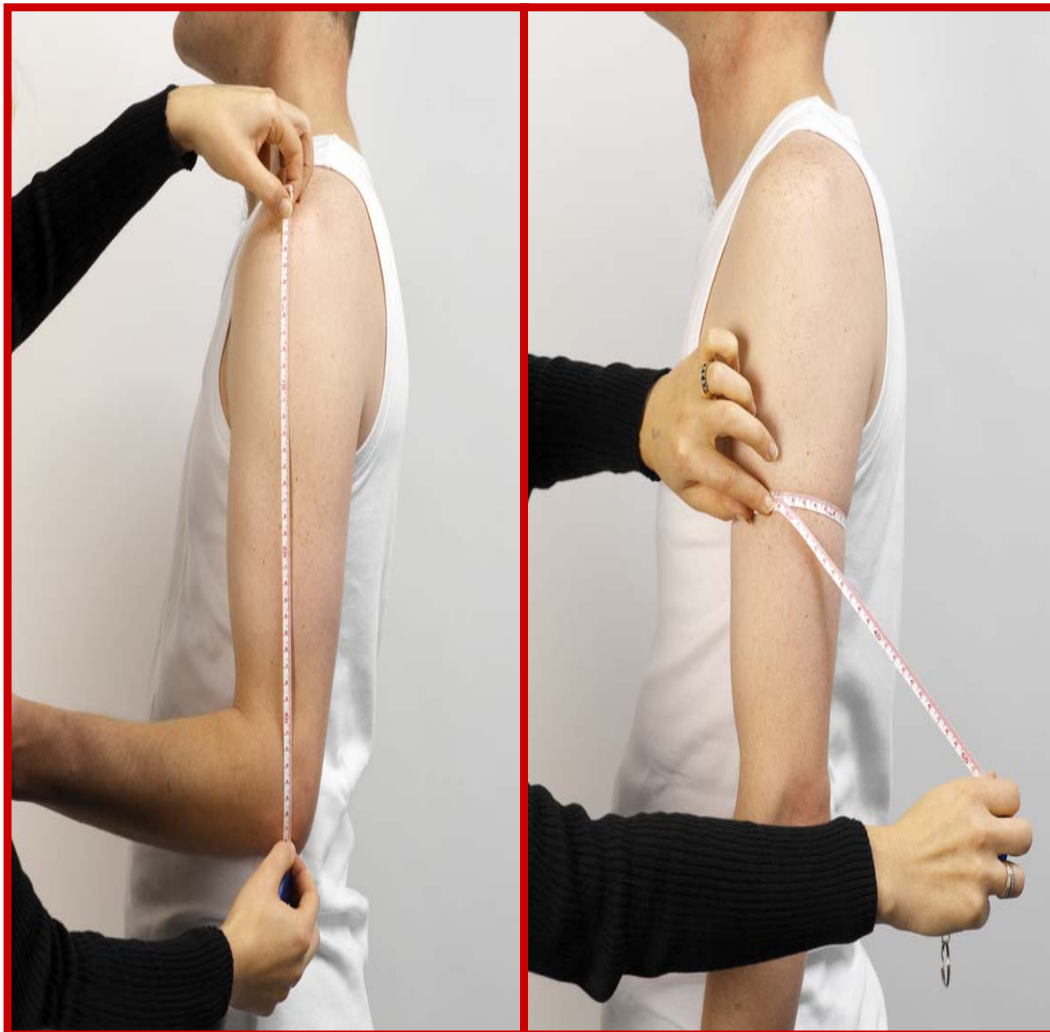
- Weight & Height for age, Length up to 2 Yrs
- & Height after 2 Yrs. (Anthropometric rod)
- Weight for Height
- Head circumference
- Chest circumference
- Mid Upper Arm circumference (MUAC Tape)
- Skin fold thickness- Harpenden Caliper
- Upper segment: Lower segment ratio
- Arm span
- Mid parental height (MPH: average of father's & mother's height) & predicted adult Target Height (MPH + 6.5 in boys & MPH- 6.5 cm in girls)

AGE INDEPENDENT ANTHROPOMETRIC MEASUREMENTS



- MUAC: Left upper arm
- Bangle test: Internal diameter 4 cm
- Shakir's tape: Colored (green, yellow, red) MUAC tape
- Quac stick*: Relates height to MUAC (* Of historic importance only)
- Body mass index (BMI): very good to define both obesity & chronic energy deficiency
- Ponderal index: Used in newborns, relates weight to height.

CLASSIFICATION BASED ON MID UPPER ARM CIRCUMFERENCE



Between 1-5 yrs. constant

16.5-17.5 cm

MUAC (cm)	
>13.5	Normal
$13.5-12.5$	Mild/moderate malnutrition
<12.5 <11.5	Severe malnutrition SCAM

WEIGHT FOR AGE – GOMEZ INTERNATIONAL CLASSIFICATION



Wt / age (%)	Degree of malnutrition
>90	Normal
75 – 90	I degree
60 – 75	II degree
<60	III degree

WEIGHT FOR AGE– WELLCOME TRUST CLASSIFICATION



60-80%	Edema +	Kwarshiorkor
60-80%	-	Underweight
<60	-	Marasmus
<60	Edema +	Marasmic Kwashiorkor

WEIGHT FOR AGE- IAP CLASSIFICATION OF MALNUTRITION



>80%	Normal
71-80%	Grade I
61-70%	Grade II
51-60%	Grade III
<50%	Grade IV

HEIGHT FOR AGE: CLASSIFICATION OF STUNTING (WATERLOW)



> 95%	Normal
90-95%	1 degree stunting (mild)
85-90%	II degree stunting (moderate)
> 85%	III degree stunting (severe)



1. Remove the child's shoes and socks. Loose or baggy socks may disguise the fact that a child's heels are lifting off the ground.

2. The child should stand with heels together, legs straight and shoulders relaxed.

3. Heels, buttocks and, if possible, scapulae should be against the wall.

4. Place the headboard on the top of the head and check that the head is in the correct position. The child should look straight ahead with the lower margins of the eyes in the same horizontal plane as the external auditory meati.

5. Tell the child to "breathe in and stand tall". Apply gentle but firm pressure to the mastoid processes to help the child stretch. Ensure the heels are not lifted from the ground. Tell the child to "breathe out and relax" while the measurer maintains pressure on the head.

6. Read the height to the last complete millimetre (do not round up!).

7. Plot the height reading on a standard centile chart of height for age and sex. Use a simple dot to mark the height.

WEIGHT FOR HEIGHT: CLASSIFICATION OF WASTING (WATERLOW)



> 90 %	Normal
80 -90 %	1 degree wasting (mild)
70-80 %	II degree wasting (moderate)
< 70%	III degree wasting (severe)

MID PARENTAL HEIGHT



Boy

- $$\frac{\text{paternal height} + \text{maternal height} + 6.5}{2}$$

Girl

- $$\frac{\text{paternal height} + \text{maternal height} - 6.5}{2}$$

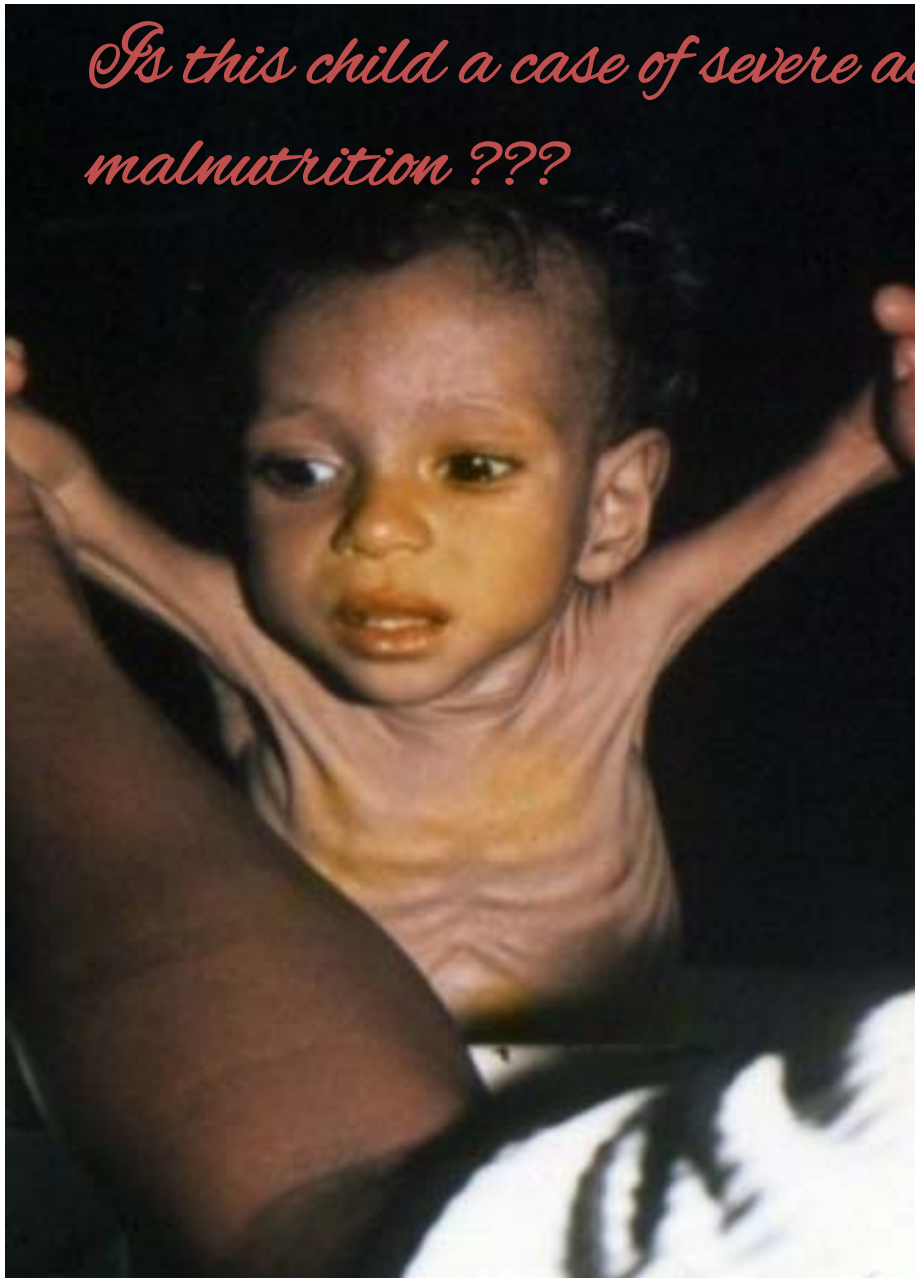
- Predicted target height is MPH +/- 2.5 cm

SEVERE ACUTE MALNUTRITION



Is this child a case of severe acute malnutrition ???

Is this child a case of severe acute malnutrition ???



One cannot tell by just looking, Take measurements, Test for edema-finger pressure for 3 seconds



MARASMUS



- Severe wasting of muscle & s/c fats
- Severe growth retardation
- No edema or hair changes or fatty liver
- Alert but miserable
- Hungry

MARASMUS – GRADE IV



KWASHIORKOR



Cardinal features

Oedema

Psychomotor
changes

Growth retardation

Muscle wasting

Associated features

Moon face

Hair changes

Skin changes

Depigmentation

Anemia

Hepatomegaly

Flaky paint dermatitis

Cardiac failure

Dehydration

Vitamin deficiencies

KWASHIORKOR- GRADE IV



GRADING OF SEVERITY



Marasmus

I: loose skin folds axilla & groin

II. Wasting of Thigh & buttocks

III. Wasting of Chest & back

IV. Wasting of Buccal pad of fat

Kwashiorkor

I. Pedal edema

II. Facial edema

III. Chest & body edema

IV. Ascites

MARASMIC KWASHIORKOR



- Syndrome seen in marasmic children, with severe muscle & fat wasting who suddenly develop edema, due to increased protein deficiency than before.
- Thus clinical features, combination of Marasmus & Kwashiorkor .
- Anemia is moderate & one/ more Vitamin deficiencies may be evident.

MARASMIC KWASHIORKOR





INFECTION & IMMUNITY IN PEM

- Infection & Immunity interrelated to PEM
- Infectious disease worsens PEM & vice versa
- PEM usually weakens resistance to infection → high mortality among toddlers & under 5 children
- These children may present with recurrent attacks of diarrheal diseases, pneumonia, septicemia, measles, tuberculosis and malaria.



INFECTION & IMMUNITY IN PEM

- Urinary tract infection often occur but may go undetected,.
- Intestinal helminthiasis & giardiasis frequent
- All these impair nutritional status leading to growth retardation & overt PEM & contribute to high mortality

PEM & IMMUNITY



- Skin & mucus membrane barrier disrupted → infection
- Non specific defenses macrophages, tears, gastric acidity depressed
- Humoral : Ig G, IgM not significantly affected in mild to moderate PEM, hence host respond well to bacterial challenges & viral vaccines.
- Secretory Ig A → Surface tract infections, GIT & Rep. Tract

PEM & IMMUNITY



- Cell Mediated Immunity (CMI) : is impaired in all grades
- This explains –ve Tuberculin (Mantoux) test in Marasmus & Kwashiorkor in spite active TB
- Following dietary treatment when the patient improves, Test may convert to +ve.
- Serum C reactive Protein & Complement C3 are depressed in severe PEM, but rise in presence of infection & behave as acute phase reactants.

ECOLOGY/ETIOLOGY OF MALNUTRITION

- Conditioning influences
 - Low birth weight
 - Infections - eg., Diarrhea,
 - Respiratory infections,
 - VPDs: Measles / Whooping cough, Tuberculosis,
 - Helminthiasis
- Socio economic factors
 - Poverty, Ignorance
 - Illiteracy
 - Lack of knowledge regarding food values
 - Unhygienic environment
 - Large family size
 - Over crowding
- Cultural practices
 - IYCF practices,
 - Undue delay in rice giving ceremony
 - Alcoholism
 - Food habits
 - Customs and belief
 - Tradition
 - Religion
 - Food fads (personal likes & dislikes)
 - Cooking practices
 - Child rearing practices
 - Superstitious belief

ECOLOGY/ETIOLOGY OF PEM – CONTD..



- Food production & intake
 - abrupt withdrawal of breast milk
 - Delayed and inadequate complementary food
 - Lack of food supplementation for target group
- Availability and utilization of health/other services
 - Lack of health education, Nutritional surveillance
 - Nutritional rehabilitation, Primary health care
 - Immunization, Early diagnosis, Prompt treatment
 - Referral services

EVIDENCE BASED HIGH IMPACT NUTRITION INTERVENTIONS FOR PREVENTION OF MALNUTRITION



1. Timely initiation of breast feeding within 1 hour of birth
2. Exclusive breastfeeding during the first six months of life
3. Timely introduction of complementary foods at six months
4. Age-appropriate foods for children six months to two years
5. Hygienic complementary feeding practices
6. Immunization and bi-annual Vitamin A supplementation with deworming

STRATEGIES FOR PREVENTION



7. Appropriate feeding for children during and after illness
 8. Therapeutic feeding for children with severe acute malnutrition
 9. Adequate nutrition and support for adolescent girls to prevent anemia
 10. Adequate nutrition and support for pregnant and breastfeeding mothers
- These 10 essential interventions could halve the proportion of undernourished children over the next 10 years.

THANK YOU

