ASSESSMENT OF NUTRITIONAL STATUS

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WHAT IS NUTRITIONAL STATUS?

The nutritional status of an individual

- **is a balance between the intake of the nutrients and the expenditure of these in processes of growth, reproduction and health maintenance.**
- **is influenced by food intake , quantity , quality and physical health.**

The spectrum of nutritional status spreads from obesity to severe malnutrition.

Nutritional Assessment Why?

- **To obtain precise information on *prevalence* and geographic *distribution of nutritional problems* of given community.**
- **To *identify individuals or populations***

  ~who are at risk of becoming malnourished &

  ~who are already malnourished
- **To *develop* health-care programs.**
- **To *measure* the effectiveness of nutritional programs and interventions once initiated.**

METHODS of Nutritional Assessment

- **Direct – deal with the individuals and measure the objective criteria**
- **Indirect – use community health indices that reflect nutritional influences**

1. Direct methods of nutritional Assessment

These can be summarized as ABCD

- **Anthropometric methods**
- **Biochemical, laboratory methods**
- **Clinical methods**
- **Dietary evaluation methods**

2. Indirect methods of Nutritional Assessment

These include three categories

- **Ecological variables**
- **Economic factors**
- **Vital health statistics**

Direct methods
A. Anthropometric methods

Anthropometry is the measurement of

- **Height**
- **Weight & other measurements like**
- **Mid Upper-arm circumference**
- **Skin fold thickness**
- **Head and chest circumference**
- **Hip/waist ratio**

A. Anthropometric methods

1. **Height measurement**

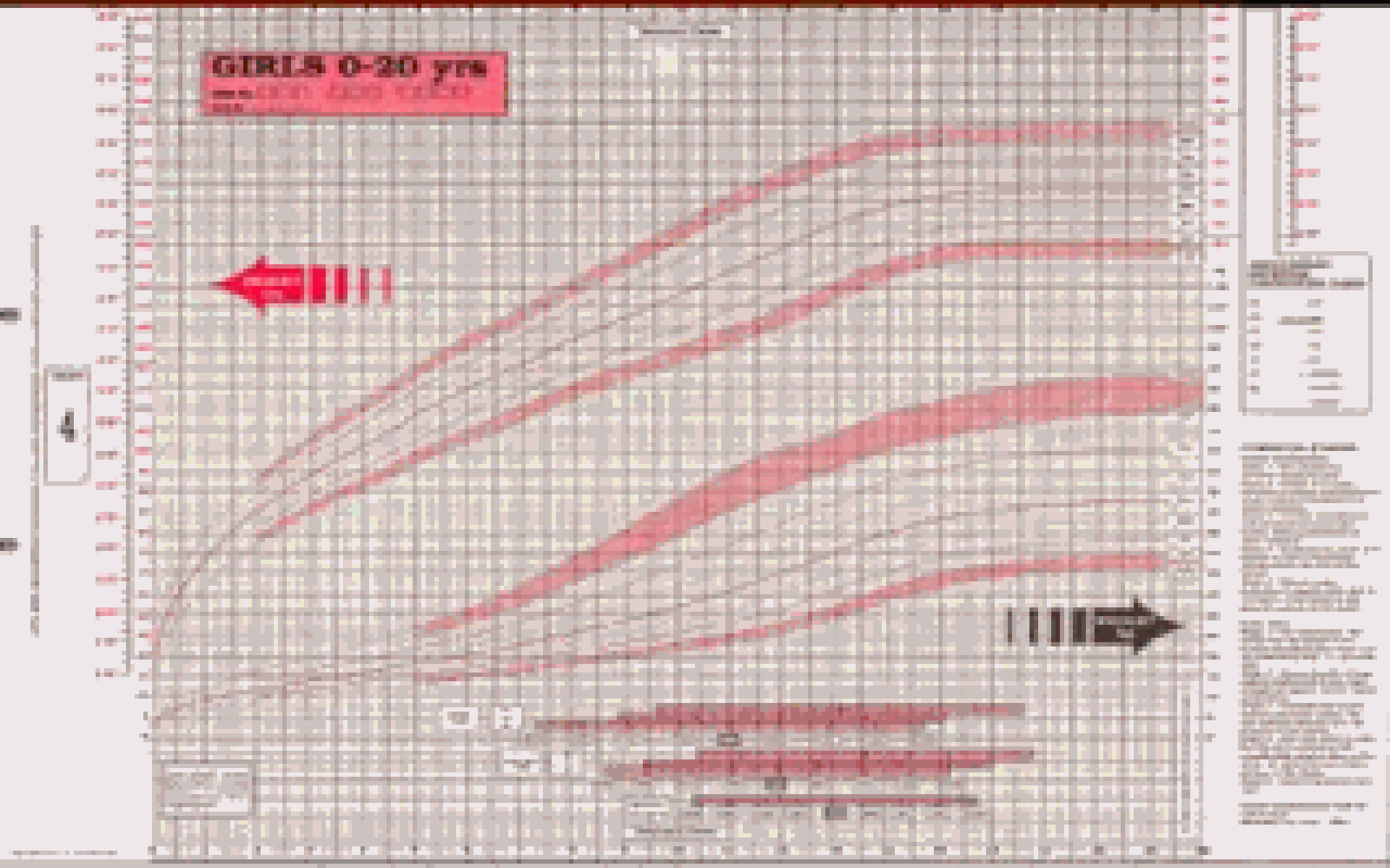
- The subject stand erect on stadiometer
- The movable head piece is leveled with head vault
- Height is recorded to nearest 0.5 cm.
- For infants infantometer is used.

A. Anthropometric methods

- **growth monitoring of a child by comparing with international / national standards using growth charts over a period of time.**

Growth Monitoring Chart

Percentile chart



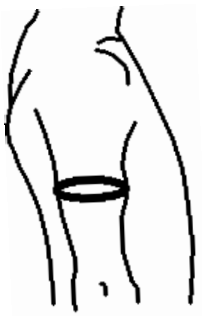
A. Anthropometric methods

2. Weight measurement

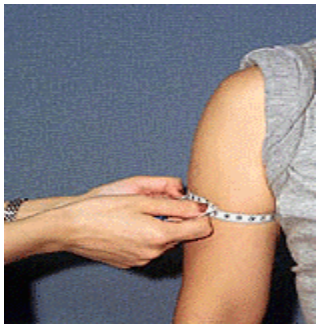
- Can be used to assess infants, children, pregnant women and adults.
- Uses a regularly calibrated electronic or balanced-beam scale.
- Measured in light clothes nearest to 100g.

A. Anthropometric Methods

3. Mid Upper-arm Circumference



- Circumference left upper arm at mid point between acromion process and olecranon process
- Fiber-glass tape which does not stretch



A. Anthropometric Methods

4. Skin-fold thickness

- skin fold calipers are used (Harpenden and Lange)
- measures the thickness of the skin and subcutaneous fat using constant pressure applied over a known area
- Common sites: triceps and in the sub-scapular region
- It has value in assessing the amount of fat and therefore the reserve of energy in the body

MID ARM CIRCUMFERENCE

-Used for below 5 years of age

- <13.5 cm : Malnutrition

-Shakir tape is used to measure MAC

>13.5 cm	**Green**	Normal
12.5-13.5	Yellow	Borderline malnutrition
< 12.5 cm	**Red**	Wasted

A. Anthropometric Methods

5. **Head and chest circumference**

A. Anthropometric Methods

6. Waist/hip ratio

- **Waist measurement**
- **Measured at the level of umbilicus nearest to 0.5cm**
- **Subject stands erect with relaxed abdominal muscles, arms at the side and feet together**
- **Measurement taken at the normal expiration**

A. Anthropometric Methods

- **Hip measurement**
- **Measured at the point of greatest circumference around hips to nearest 0.5cm**
- **Close contact with the skin without indenting the soft-tissues**
- **Subject should be standing and measurer beside him.**
- **Interpretation of WHR**
- **High-risk WHR=>0.8 in females and =>0.95 in males indicates central obesity and considered high-risk for diabetes and cvs disorders.**

A. Anthropometric Methods

Advantages

- Objectives with high specificity and sensitivity.
- Measures many variables of nutritional Significance. (ht, wt, MUAC, WHR , BMI)
- Readings are numerical and gradable on standard growth charts.
- Readings are reproducible.
- Non-expensive and needs minimal training.

A. Anthropometric Methods

Limitations of Anthropometry

- Inter-observers error in measurement.
- Limited nutritional diagnosis.
- Problems with reference standards i.e. local versus international.

Direct methods
B. Biochemical & laboratory methods

I. INITIAL LABORATORY ASSESSMENT

- **Haemoglobin estimation**
- most important test when accurately measured, tells about overall state of nutrition (anemia, and also protein and trace element nutrition)
- Blood is collected from a finger, ear lobe or heel prick
- Haemoglobinometres which are simple, cheap and reasonably accurate are used

B. Biochemical & laboratory methods

2. Haematocrit or packed cell volume (PCV)

- **percentage of the blood volume composed of red cells.**
- **important in the diagnosis of anemia.**

3. Red cell counts and blood films

- **the size and uniformity of the red blood cells can be seen.**
- **Use of such slides may facilitate the diagnosis of malaria and the haemoglobinopathies.**
- **Parasites if present can be seen.**

B. Biochemical & laboratory methods

4. Stool examination

- For presence of ova and/ or intestinal parasites
- When assessed quantitatively parasite load can be known

5. Urine examination

- Dipstick and microscopy for albumin, sugar and blood

B. Biochemical & laboratory methods

II. **SPECIFIC LAB TESTS**

6. **Measurement of nutrients in body fluids**

- **e.g. serum retinol, serum iron**

7. **Measurement of abnormal metabolites**

- **e.g. urinary iodide, urinary creatinine/ hydroxyapatite ratio**

B. Biochemical & laboratory methods

Advantages

- Useful in detecting early changes in body metabolism and nutrition
- precise , accurate and reproducible.
- Useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion.

B. Biochemical & laboratory methods

Limitations of biochemical & laboratory methods

- Time consuming and expensive
- Cannot be applied on large scale
- Reveal only current nutritional status

Direct methods

C. Clinical methods

- Essential feature of all nutritional surveys
- Simplest and most practical method
- Utilizes a number of physical signs (specific and non-specific) that are known to be associated with malnutrition and deficiency of vitamins and other micro-nutrients.

C. Clinical methods

- General Clinical examination with special attention to organs like hair, angles of mouth, gums, nails, skin, eyes, tongue, muscles, bones & thyroid gland.

- Detection of relevant signs helps in establishing the nutritional diagnosis.

C. Clinical methods

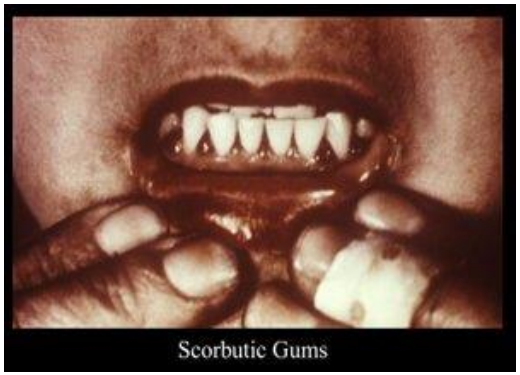
Clinical signs of nutritional deficiencies.

1. **Hair**

Spare and thin		***Protein, Zinc, Biotin, deficiency***
Easy to pull out		***Protein deficiency***
Cock-screw coiled		***Vit A and Vit C deficiency***
Depigmentation		***Protein deficiency***

C. Clinical methods

2. Mouth

Bleeding and spongy gums	 Scorbutic Gums	**Deficiency of Vit C, A, K, Folic acid, Niacin**
Glossitis , Cheililitis		**Deficiency of Riboflavin, Niacin, Folic acid, B12 and proteins.**

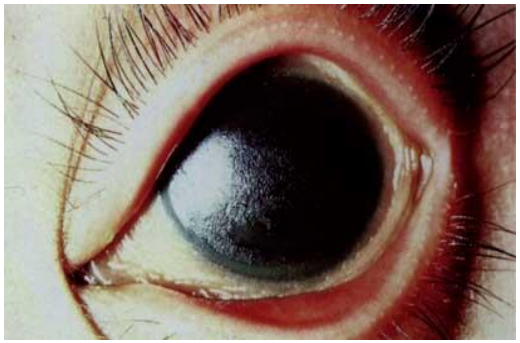
C. Clinical methods

2. Mouth

Angular stomatitis, cheilosis and fissured tongue		B2, 6 & Niacin deficiency
Leukoplakia		Vit A, B12, B-complex, Folic acid and Niacin deficiency

C. Clinical methods

3. Eyes

Xerosis of conjunctiva or Xerophthalmia		First clinical sign Vit A deficiency
Bitots spots		Moderate deficiency of Vit A deficiency

C. Clinical methods

3. Eyes

Corneal ulceration and keratomalacia		Severe Vit a deficiency – medical emergency
Night blindness, photophobia, blurring of vision		Vit A and Vit B2 deficiency

C. Clinical methods

4. Nails

Spooning of nails		**Iron deficiency**
Transverse lines		**Protein deficiency**

C. Clinical methods

6. Glands

Goiter		Iodine deficiency

C. Clinical methods

7. Skeletal system

Beading of ribs (rickety rosary), bow legs		Vit D deficiency
Epiphyseal enlargement, skeletal deformities, bone tenderness	Fig. 1: Photograph of the child with Type 1 RTA showing rickety changes. 	Vit D deficiency

C. Clinical methods

8. Muscles

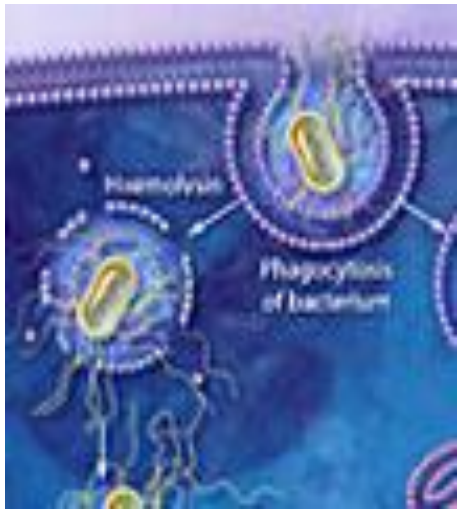
Wasting of muscles	PEM, severe protein deficiency

Functional Indicators

Also-'physiological indicators'

These reflect the ***functional consequence*** of a deficiency

particularly useful for detecting early perturbations in nutritional status



Functional Indicators

	System	nutrients
1.	Structural integrity	
	RBC fragility	Vit E, Se
	capillary fragility	Vit C
	tensile strength	Cu
2.	Host defense	
	WBC chemotaxis	P/E, Zn
	WBC phagocytic capacity	P/E , Fe
	WBC bactericidal capacity	P/E , Fe, Se
	T cell blastogenensis	P/E , Zn
	delayed cutaneous hypersensitivity	P/E , Zn

3.	Hemostasis - prothrombin time	Vit K
4.	Reproduction- sperm count	Energy, Zn
5.	Nerve function- nerve conduction dark adaptation	Vit B1, B12 Vit A, Zn
6.	Work capacity heart rate vasopressor response	 P/E, Fe Vit C

Immune function: malnutrition leads to a decline in immune function

These immune changes predispose children to severe and chronic infections, infectious diarrhea, which further compromises nutrition

Studies of malnourished children showed changes in the developing brain, including,

- a slowed rate of growth of the brain,
- lower brain weight,
- thinner cerebral cortex,
- decreased number of neurons,
- insufficient myelinization, and changes in the dendritic spines.

Assessment of dietary intake

- This is actually an assessment of food consumption through dietary surveys.
- It provides information about dietary intake patterns, specific foods consumed and estimated nutrient intakes.
- Reviewing dietary data may suggest risk factors for **chronic** diseases and help to prevent them.
- Diet surveys may be carried out by the following methods:
    1. weighment of raw foods
    2. weighment of cooked foods
    3. Oral questionnaire method

Other methods include

- Food records or diaries (including weighed intakes)
- Food frequency questionnaires (FFQ's)
- Dietary histories
- Observed intakes

Weighment of raw foods:

- It is the most widely used method in India.
- The survey team visits the household and *weighs all the food that is going to be cooked and eaten as well as that which is wasted or discarded.*

Duration of survey*:* varies between 1 and 21 days. Most commonly for 7 days which is called the dietary cycle.

- **Weighment of cooked foods: Foods are analyzed in the state in which they are consumed.**

- **This method is not easily acceptable.**

1. Oils and fats

How often do you eat meals that contain only **olive** or **rape seed oil?**	6	times/week
How often do you eat **fried foods**?	2	times/week
How often do you eat **butter**?	2	times/week
How often do you eat **cream**?	3	times/week
How often do you eat **mayonnaise**?	1	times/week
How often do you eat **nuts** ?	5	times/week
How often do you eat **potato chips and similar snacks** ?	1	times/week

2. Protein

How much **red meat** do you eat in a week?	5	servings
How much **poultry** do you eat in a week?	3	servings
How much **fish** do you eat in a week?	3	servings
How many **eggs** do you eat in a week?	3	servings
How often do you eat **sausage** and other **prepared meats**?	1	times/week
How often do you eat **beans**?		servings

3. Dairy

How much **whole milk** do you drink in a week?	0	servings
How much **skim milk** do you drink in a week?	3	servings
How many **yoghurts** do you eat in a week ?	3	servings

Food Frequency Questionnaires (FFQ) –

FFQ's are standardized forms inquiring about the frequency of intake of different foods or food groups.

- not as accurate as other measures but useful in large population studies
- or when studying the association of a specific food (s) and a disease.

Oral questionnaire method:

Inquiries are made about the nature and quantity of foods eaten during the previous 24-48 hours. It may also include dietary habits and practices

If taken correctly, it can give reliable results.

Thank you