Assessment of Nutritional Status

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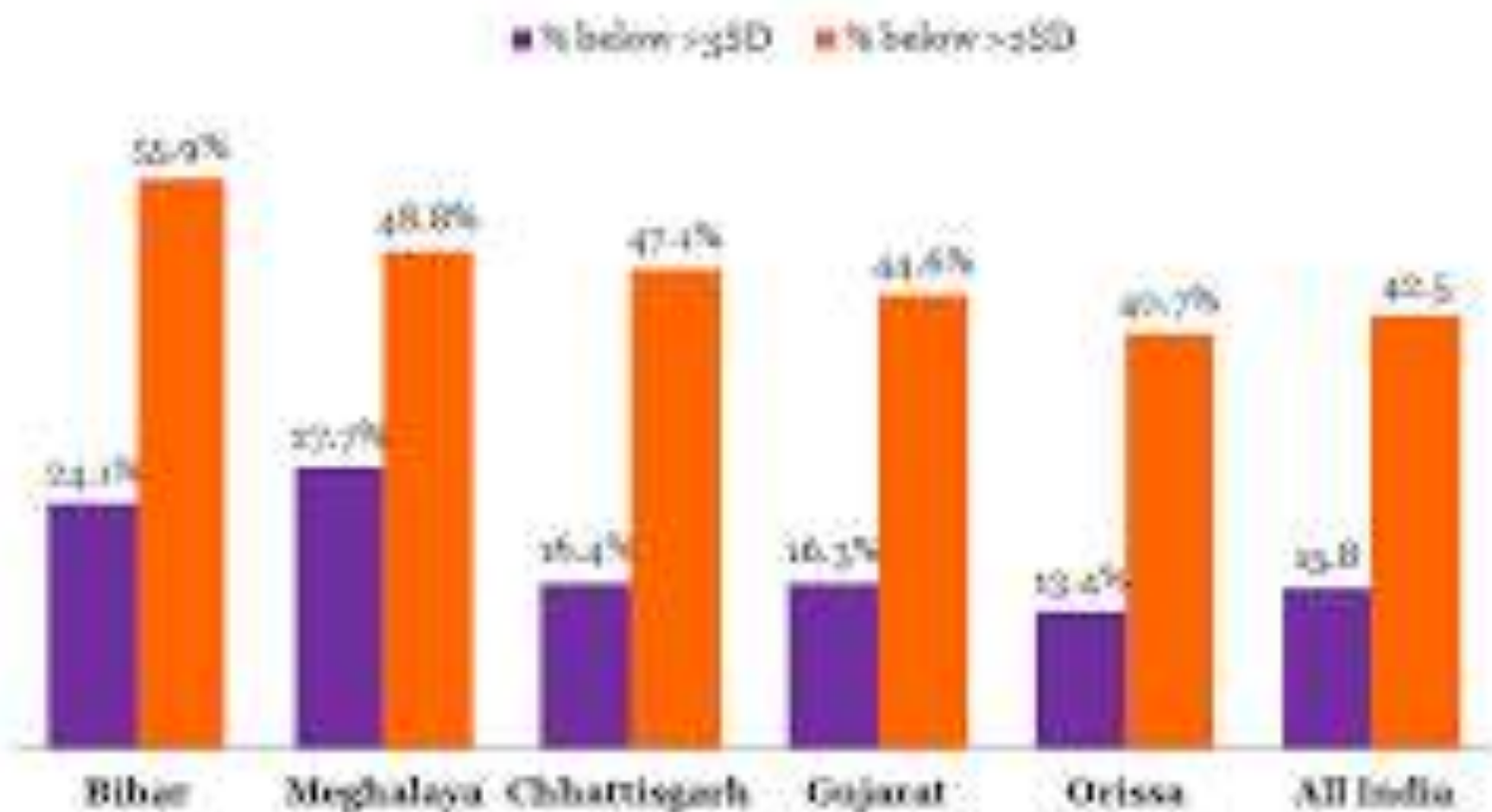
Objectives of Nutritional survey

- Prevalence & geographic distribution of Nutritional problems.
- Identification of population groups
  "AT RISK"
- All activities that are undertaken to know the extent of malnutrition and its cause
- The purpose is to develop H.Care Program so that corrective and preventive action can be taken
- Evaluation of effectiveness of such program

The world map of overnutrition

Prevalence of obesity in adults (BMI ≥30)
in the population of a country

Source: WHO (2010), data for the year 2008

States With Worst Malnutrition Figures

■ % below >3SD   ■ % below >2SD

	Bihar	Meghalaya	Chhattisgarh	Gujarat	Orissa	All India
% below >3SD	24.1%	25.7%	16.4%	16.3%	13.4%	15.8
% below >2SD	55.9%	48.8%	47.4%	44.6%	40.7%	42.5

NOTE: >3SD: Severe Malnutrition, >2SD: Mild Malnutrition
Source: Planning Commission Report

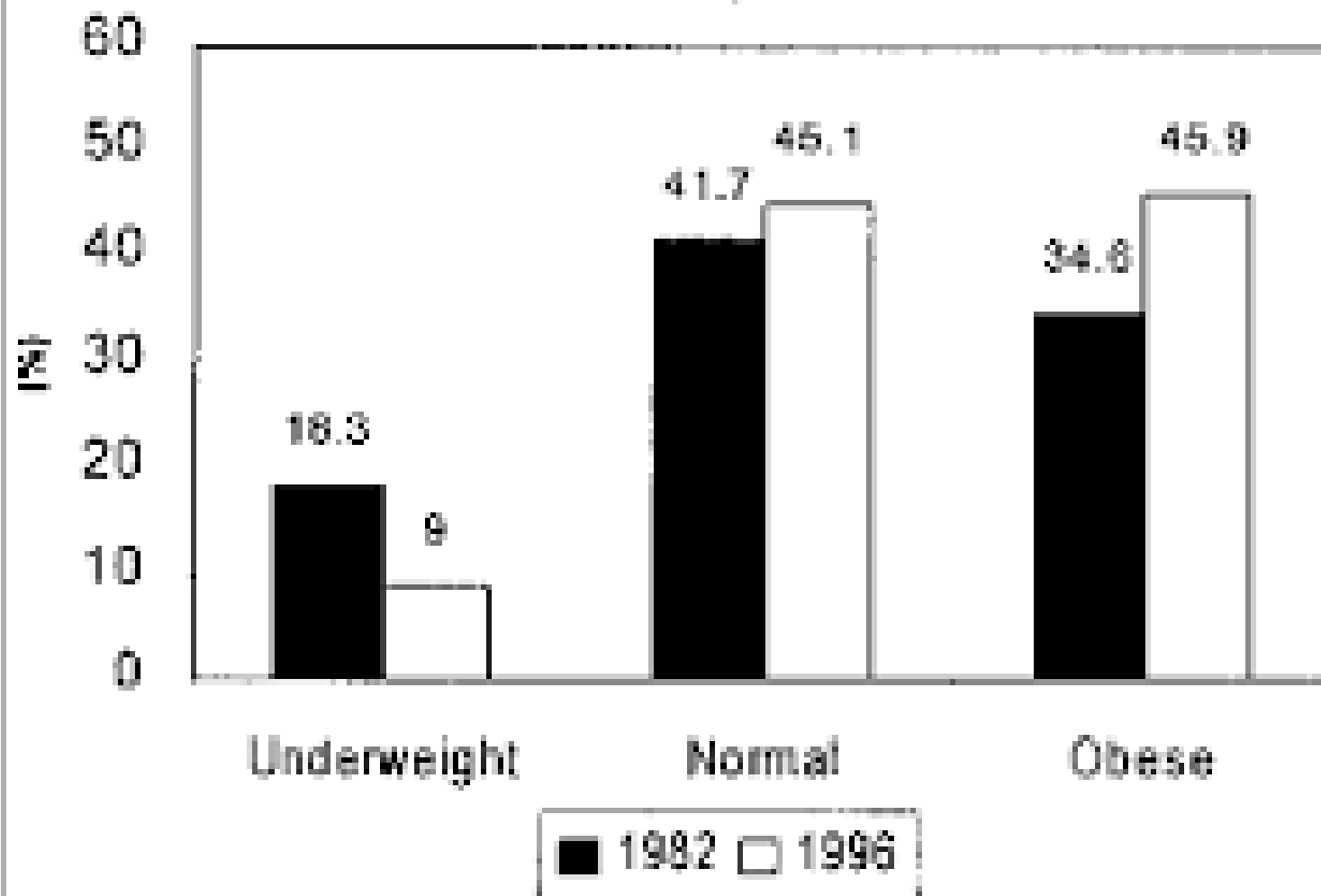Figure 1: Indian States in the Global Hunger Index

(Source: IFPRI, Global Hunger Index 2010)

Objectives of Nutritional survey

- Geographic distribution of Nutritional problems.
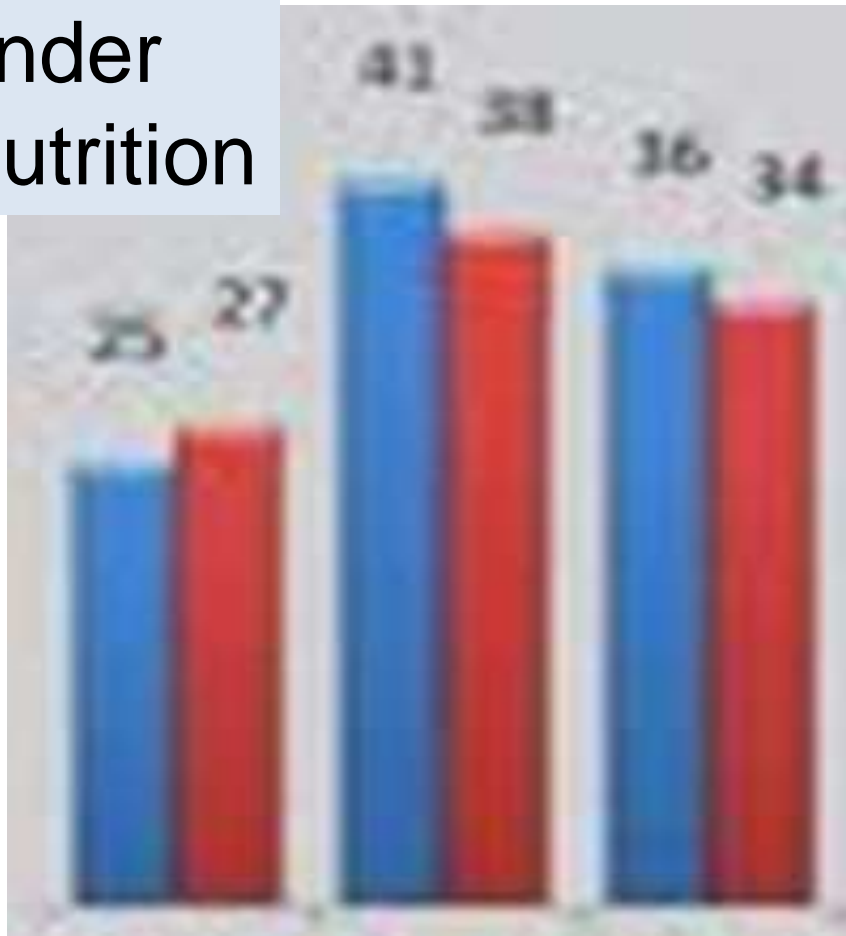- Identification of population groups
  "AT RISK"

Nutrition status in Women Aged 20-44y according to BMI

	Underweight	Normal	Obese
1982	16.3	41.7	34.6
1996	9	45.1	45.9

Legend: ■ 1982 □ 1996

Nutritional Status Of Adults
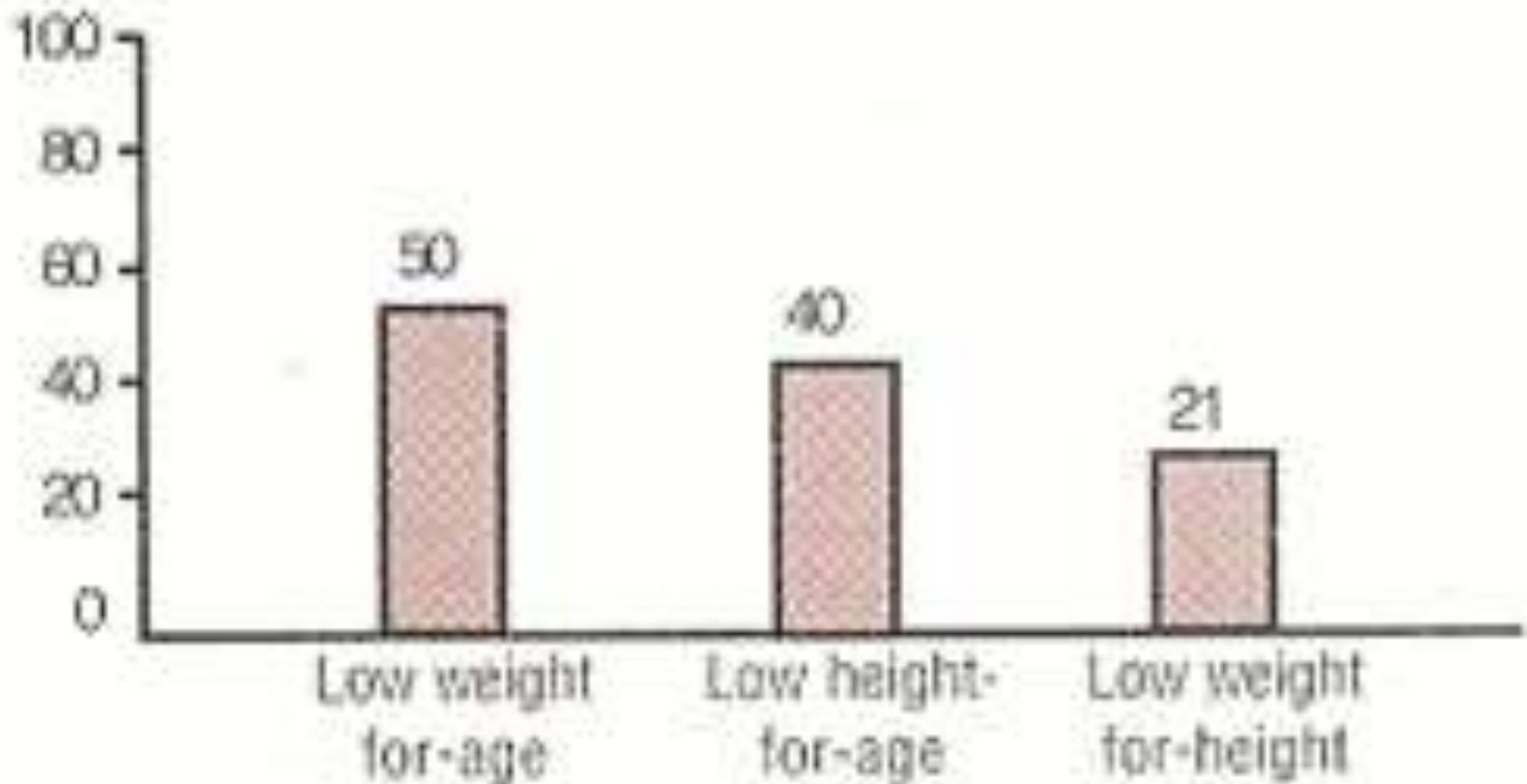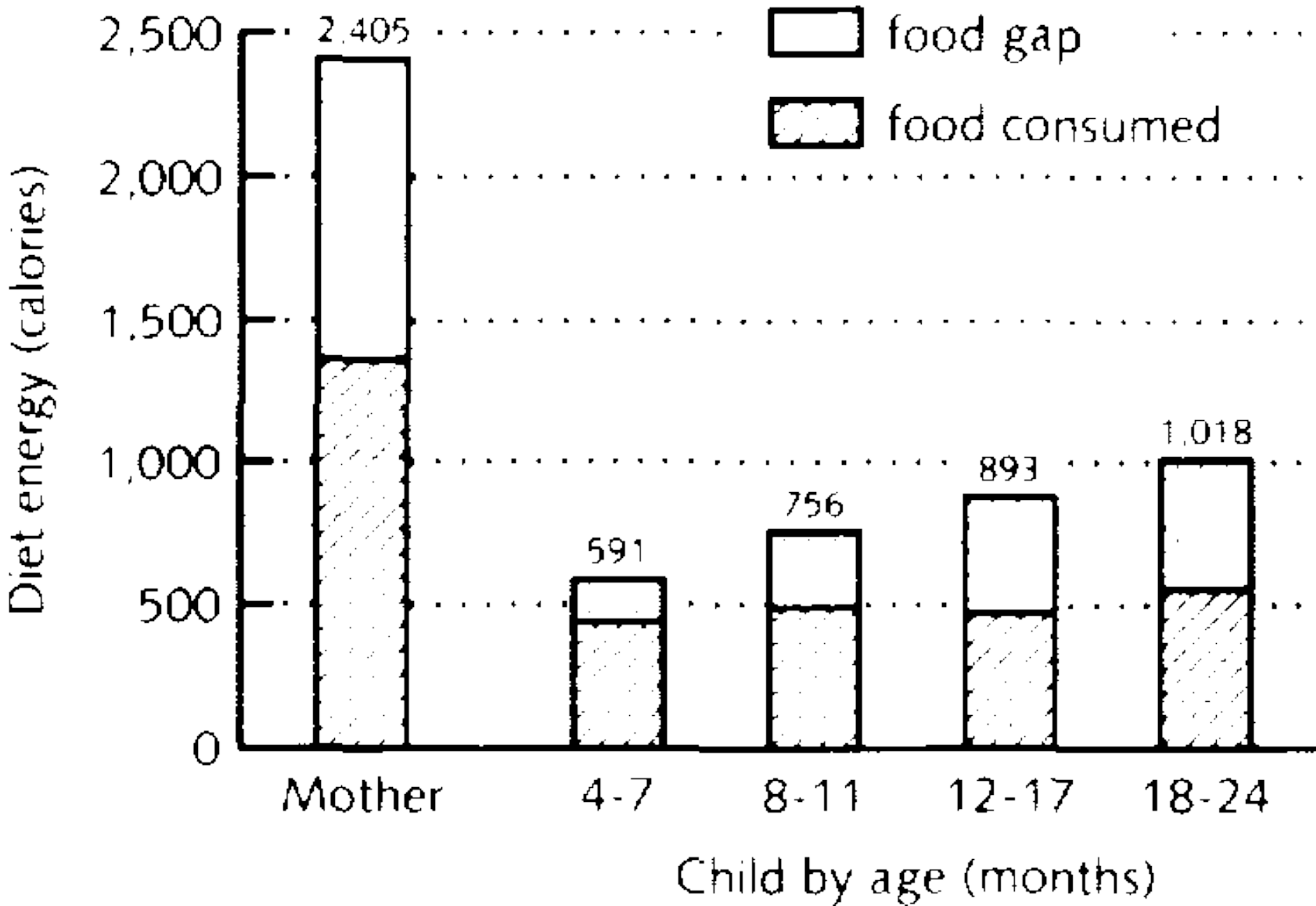
Malnutriton in Chidren

- Stunting indicated chronic malnutrition

Objectives of Nutritional survey

- Prevalence & geographic distribution of Nutritional problems.

- Identification of population groups
  "AT RISK"

Diet energy (calories)

2,405

1,018

893

756

591

Mother   4-7   8-11   12-17   18-24

food gap
food consumed

Child by age (months)

Objectives of Nutritional survey

- All activities that are undertaken to know the extent of malnutrition and its cause

- The purpose is to develop H.Care Program so that corrective and preventive action can be taken

Many children remain malnourished

Prevalence of acute malnutrition (%)

Mortality rate (/10,000/day)

May 2006   November 2006

Acute malnutrition
× Under-five mortality rate
◆ Crude mortality rate

Objectives of Nutritional survey
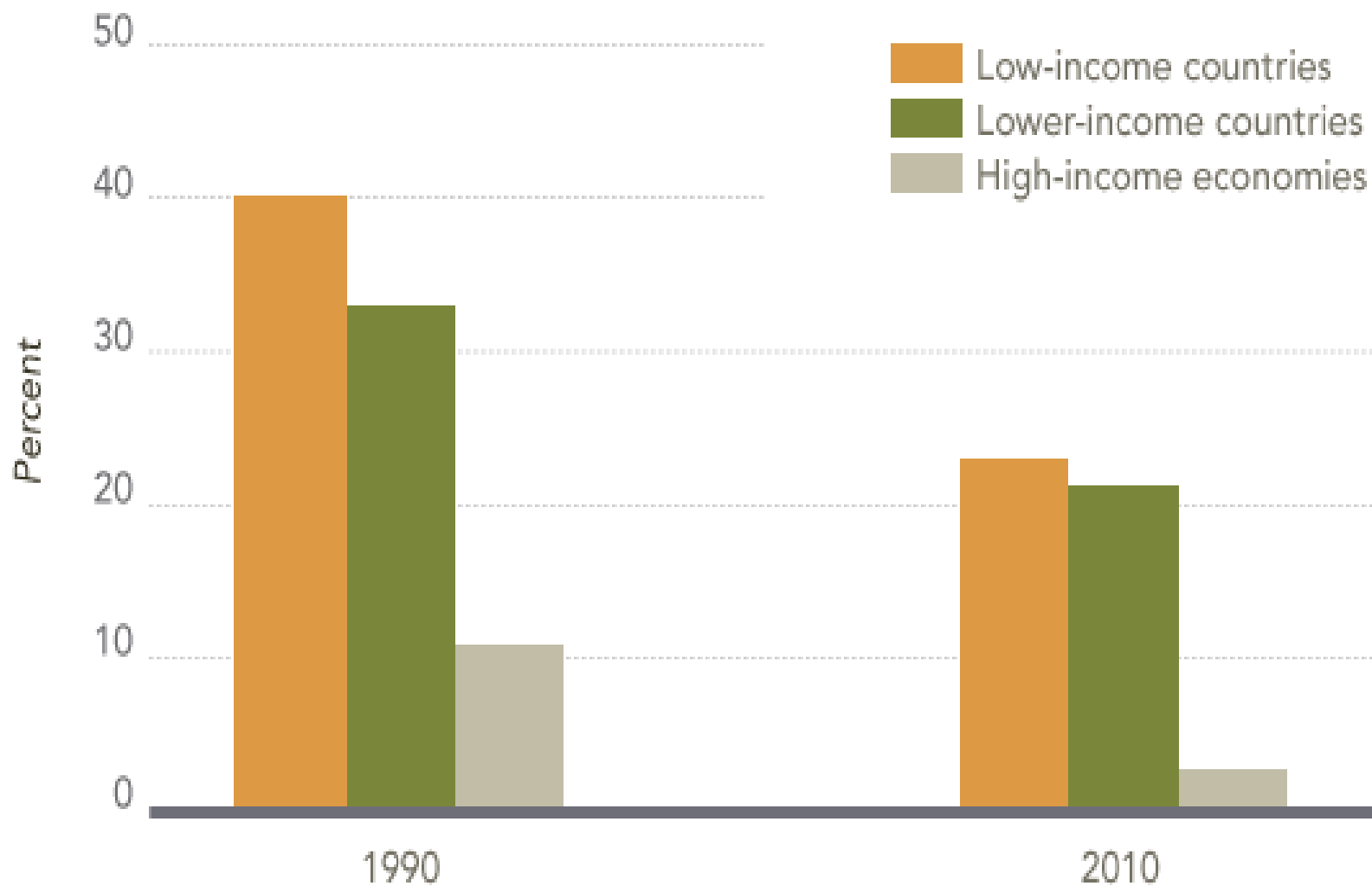
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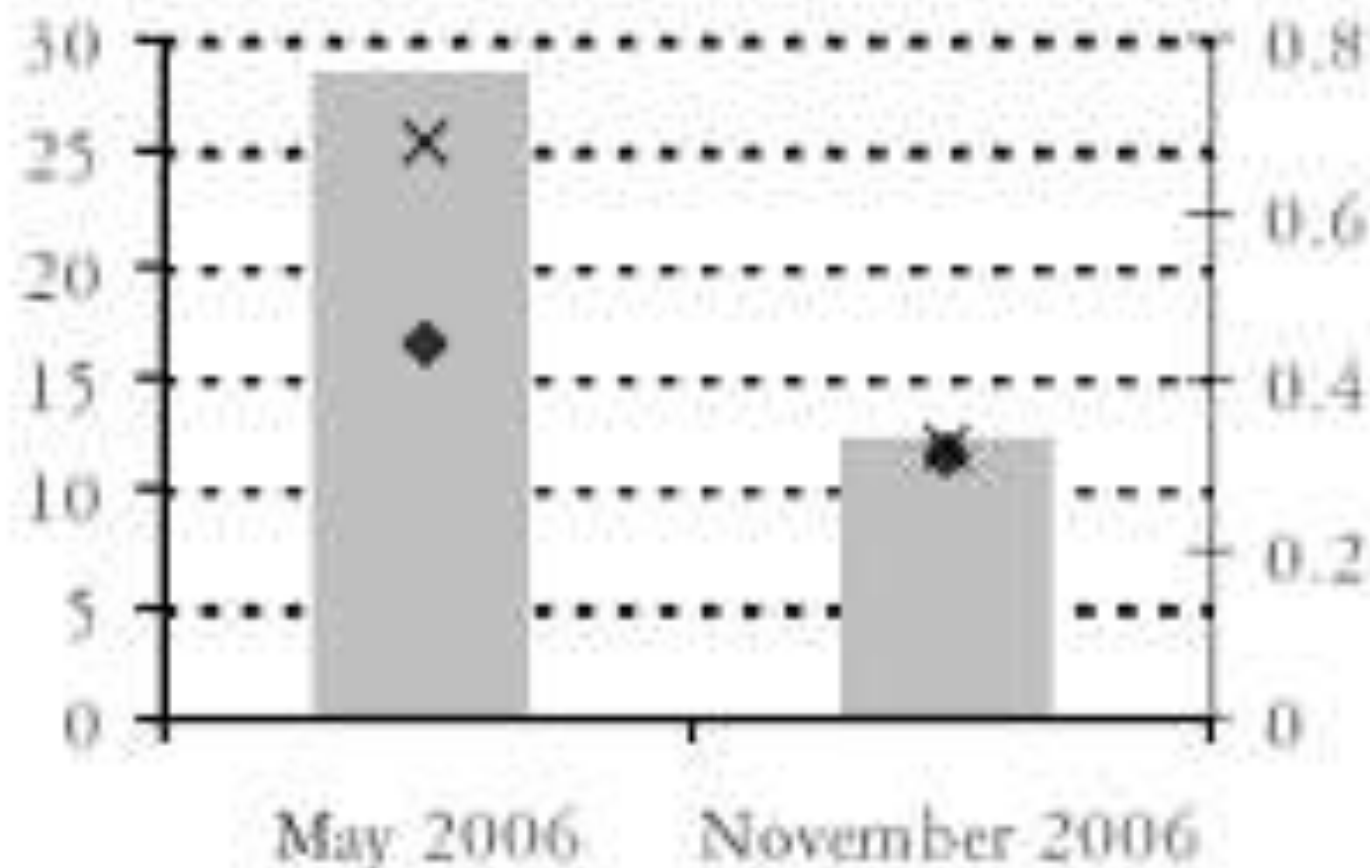- Identification of population groups
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Levels of nutritional assessment

At Individual level:

At Community level:

Levels of nutritional assessment

At Individual level:

1. Clinical assessment

2. Anthropometry

3. Laboratory investigations

4. Diet history/ investigations

At Community level:

1. Clinical examination

2. Anthropometry

3. Nutritional survey

4. Diet surveys

5. Assessment of dietary intake

6. Vital & Health statistics

7. Ecological studies

Clinical assessment

- many nutritional disorders manifest in the form of characteristic clinical signs and symptoms

- individual level : give clue to the diagnosis of disorder

- community level : clinical assessment is done as a part of nutritional assessment

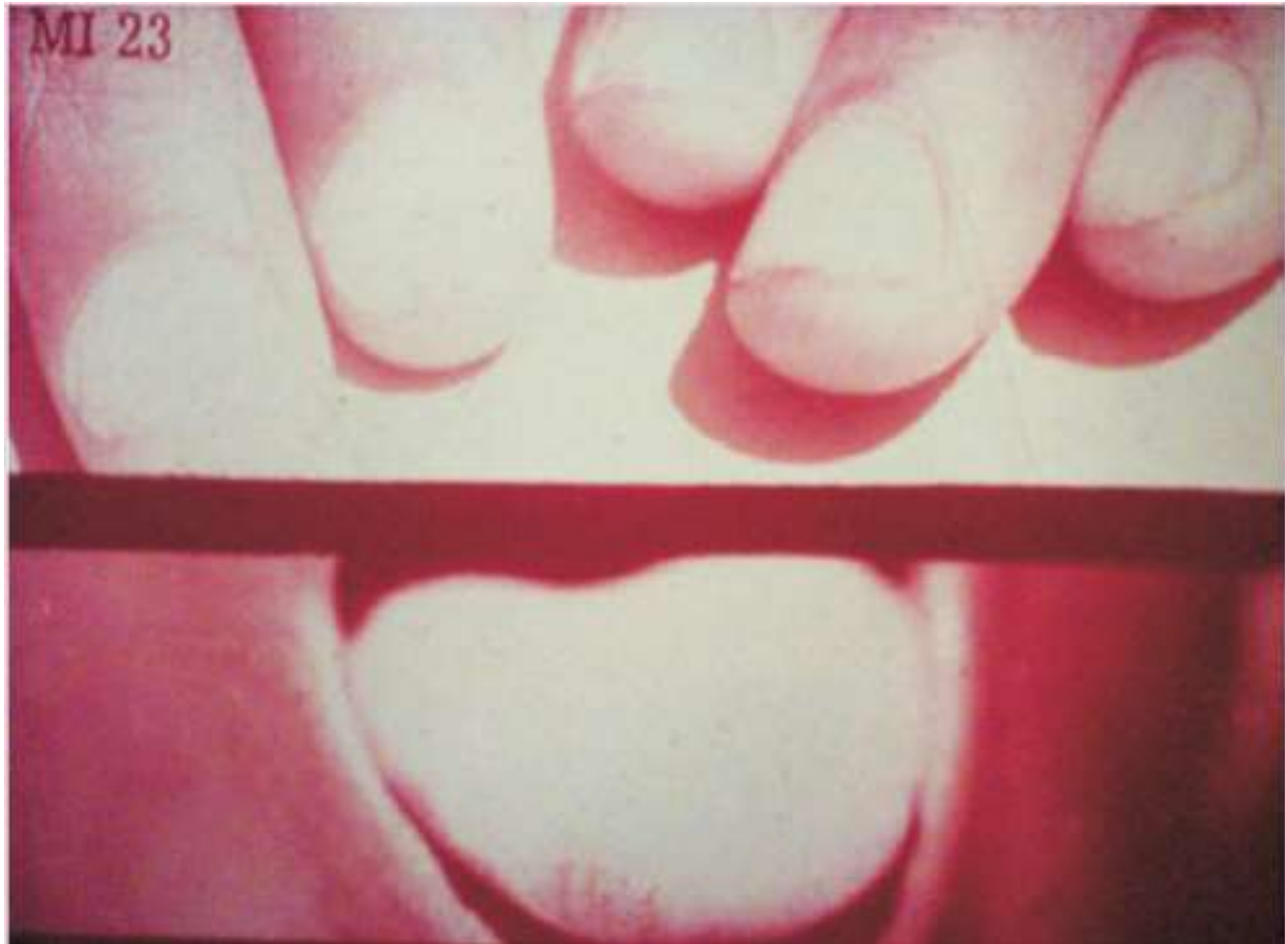# Bitot's spot- Vitamin A deficiency

Nails with Iron Deficiency

SPOON-SHAPED NAILS WITH IRON DEFICIENCY ANAEMIA

Pallor   Anemia

Iodine deficiency

Cretinism – Iodine deficiency in Intrauterine life >> Maternal iodine deficiency

Rickets- Vitamin D deficiency

Signs of Rickets
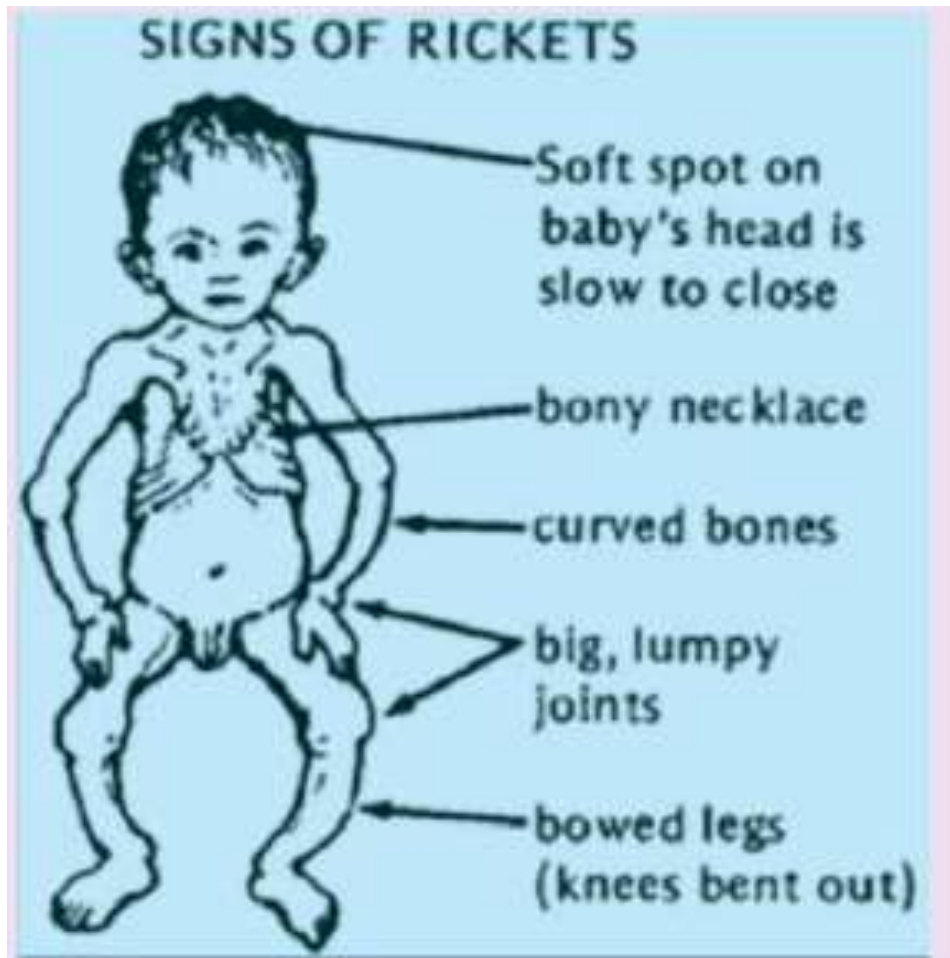
Angular Stomatitis- Riboflavin Deficiency

Glositis- Geographic Tongue
Riboflavin Deficiency

Deficiency Sign	Suggested nutrient abnormality
Pale conjunctiva	Iron
Bitot's spots	Vitamin A
Angular stomatitis	Riboflavin
Spongy, bleeding gums	Vitamin C
Bilateral edema (young children)	PEM
Thyroid enlargement	Iodine
Bilateral epiphyseal enlargement of wrists	Vitamin D
Sign of Excess	*Suggested nutrient abnormality*
Mottled enamel	Fluoride
Dental caries	Sugar

How to do Clinical assessment survey:

To minimize subjective error

surveyers are trained and provided with a list of standard signs which they can record appropriately

Clinical assessment also used to classify cases

eg: Vitamin A deficiency

WHO Expert committee classified in 3 categories based on Clinical signs:

1. Not related to nutrition:-

   e.g. Alopecia, pyorrhoea, pterygium

Clinical assessment

2. That need further investigation:

 Malar pigmentation, geographic tongue,

3. Known to be of value:

 e.g.Angular stomatitis, Bitot's spots, Calf tenderness, absence of knee jerks (Beri-Beri),Endemic goitre, etc.

Anthropometry: Introduction

- Anthropos - "man" and Metron "measurement"
- A branch of anthropology that involves the quantitative measurement of the human body.

- It is the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body.

- It is used to evaluate both under & over nutrition.
- The measured values reflects the current nutritional status & don't differentiate between acute & chronic changes

Anthropometry

- Body weight
- Height
- Skin fold thickness
- Mid Upper Arm Circumference(MUAC)
- Head circumference
- Chest Circumference

Weight

The measurement of weight is most reliable criteria of assessment of health and nutritional status of children.

The weight can be recorded using a :

- ❖ Beam type weighing balance
- ❖ Electronic weighing scales for infants and children
- ❖ Bathroom type of mechanical scale (very unreliable)
- ❖ Salter spring machine (in field conditions)
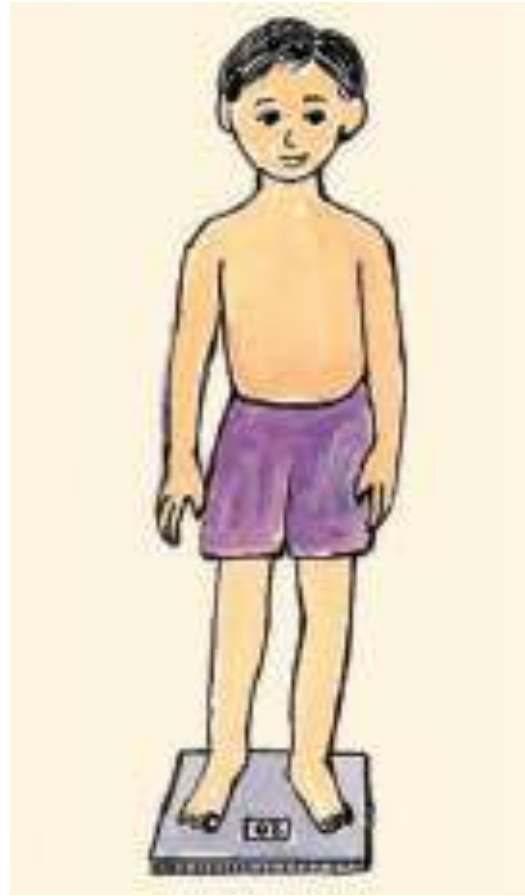
Precautions while measuring the weight

Use the right balance. Avoid bathroom scales.
Weight must be taken in minimum clothing.
Remove shoes before weight is recorded.
The zero-error must be checked and corrected before using a machine.
It is advisable to record weight in the morning (in basal conditions)
These precautions must be applicable in a standardized manner for all subjects (within a study group)

Weight of Infant

Salter's Weighing Scale Sensitivity- 100 gms

In this scale each kilogram is divided into 100 gm markings.
This needle is at 3700 gm.

Long line =Kilogram

Medium line = 500 gm

Short line = 100 gm

SALTER

25 kg x 100 g
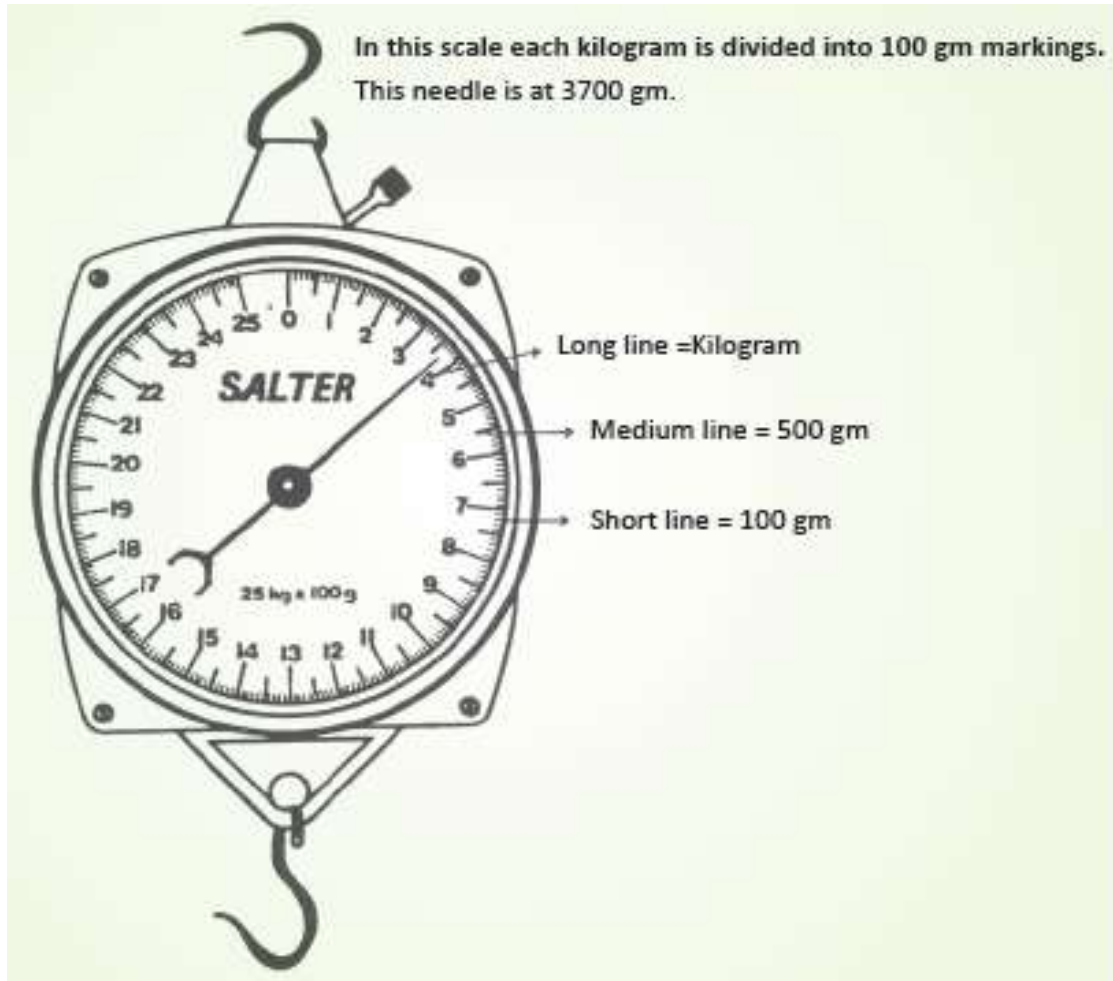
Weight of children (< 5 years age)

GIRL : Weight-for-age – Birth to 5 years
(As Per New WHO Child Growth Standards)

display   Solar Panel

UNISCALE
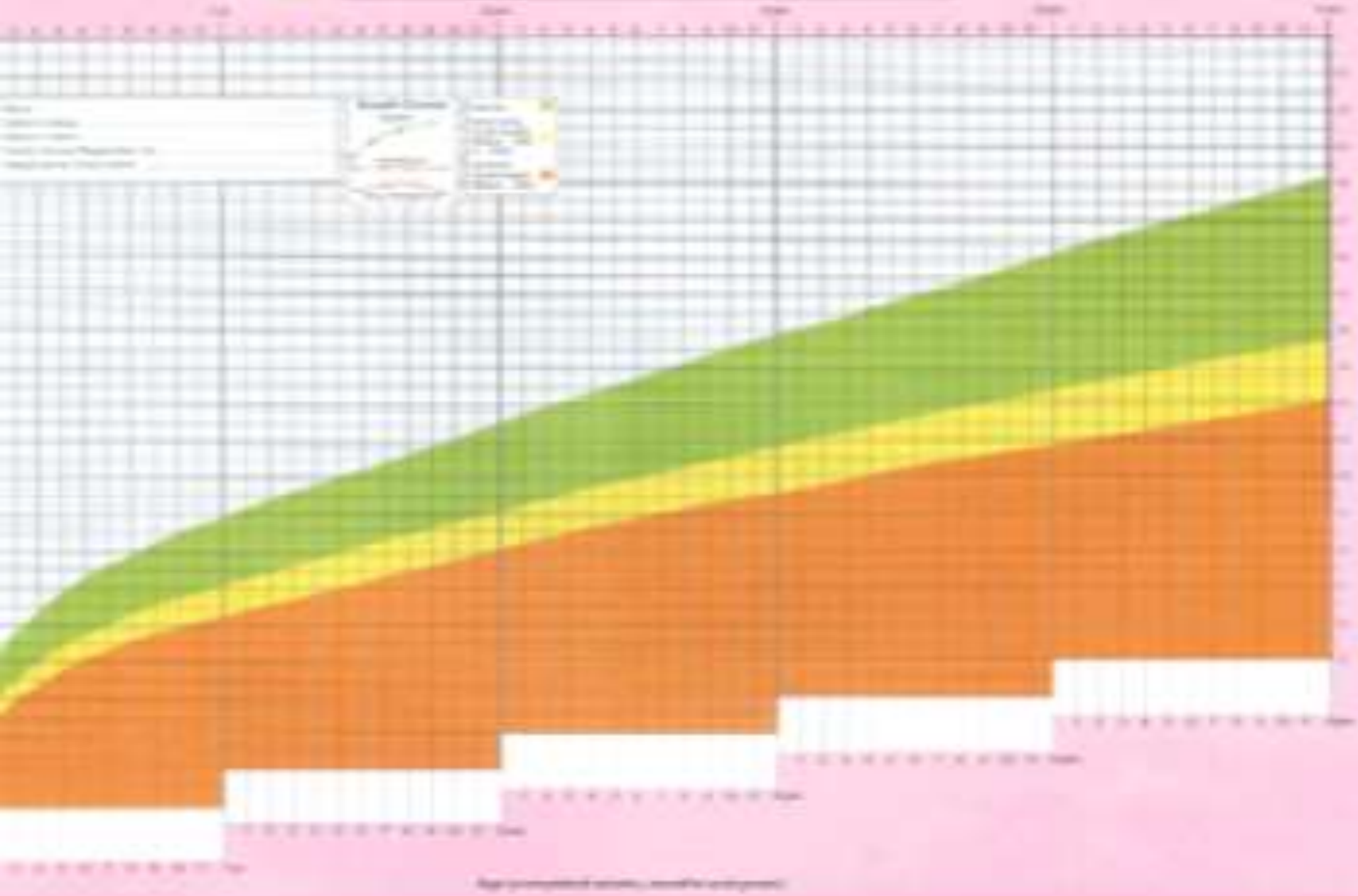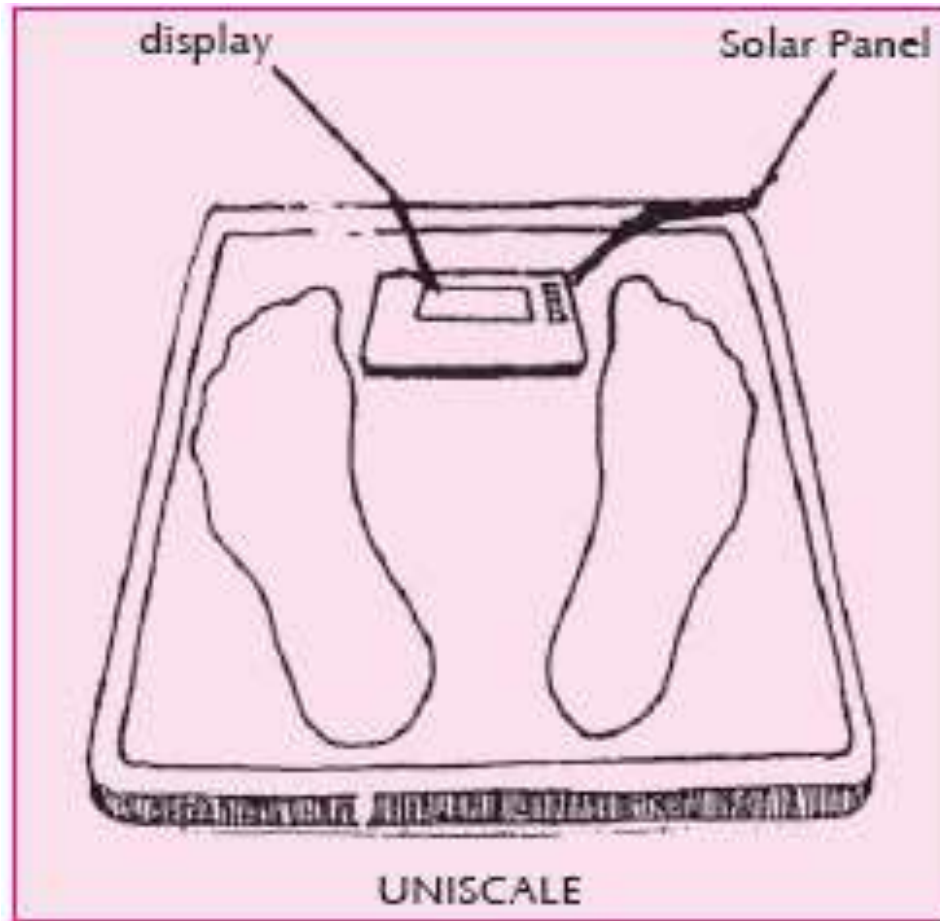
PICTURE 3.19: A TARING WEIGHING SCALE

THE SCALE WEIGHS WITH A PRECISION TO THE NEAREST 0.1 KG.

PICTURE 3.20: MOTHER'S WEIGHT ALONE IN THE TARING SCALE

PICTURE 3.21: TARING THE SCALE

PICTURE 3.22: CHILD'S WEIGHT ON THE TARING SCALE

Bady's weight appears on display
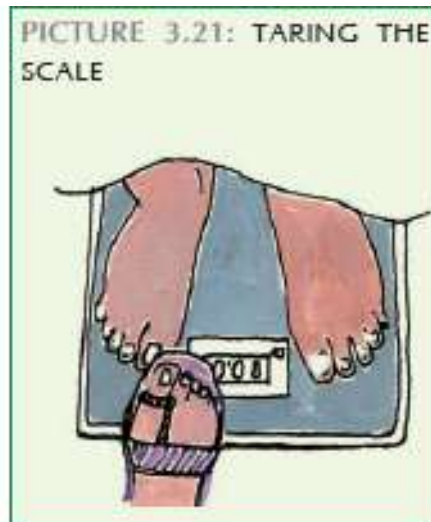
Height

Length or Height/Stature Measurement Technique

- Upto 2 years of age Recumbent Length is measured with the help of an Infantometer .

- In older children Standing Height or Stature is recorded. It is convenient to use an Inbuilt Stadiometer affixed on the wall which provides a direct read out of height with an accuracy of +/- 0.1cm.

- Nutritional deprivation over a period of time affects the stature or linear growth of the child .

Technique of length measurement

- The infant is placed supine on the infantometer.

- Assistant or mother is asked to keep the vertex or top of the head snugly touching the fixed vertically plank.

- The leg are fully extended by pressing over the knee, and feet are kept vertical at 90°, the movable pedal plank of infantometer is snuggly apposed against soles and length is read from scale.

MEASURER ON KNEES **3**

ASSISTANT ON KNEES **2**

ARMS COMFORTABLY STRAIGHT **5**

HAND ON KNEES OR SHINS; LEGS STRAIGHT **8**

FEET FLAT AGAINST FOOTPIECE **9**

HANDS CUPPED OVER EARS; HEAD AGAINST BASE OF BOARD **4**

CHILD FLAT ON BOARD **7**

LINE OF SIGHT PERPENDICULAR TO BASE OF BOARD **6**

90°

QUESTIONNAIRE AND PENCIL ON CLIPBOARD ON FLOOR OR GROUND **1**

11
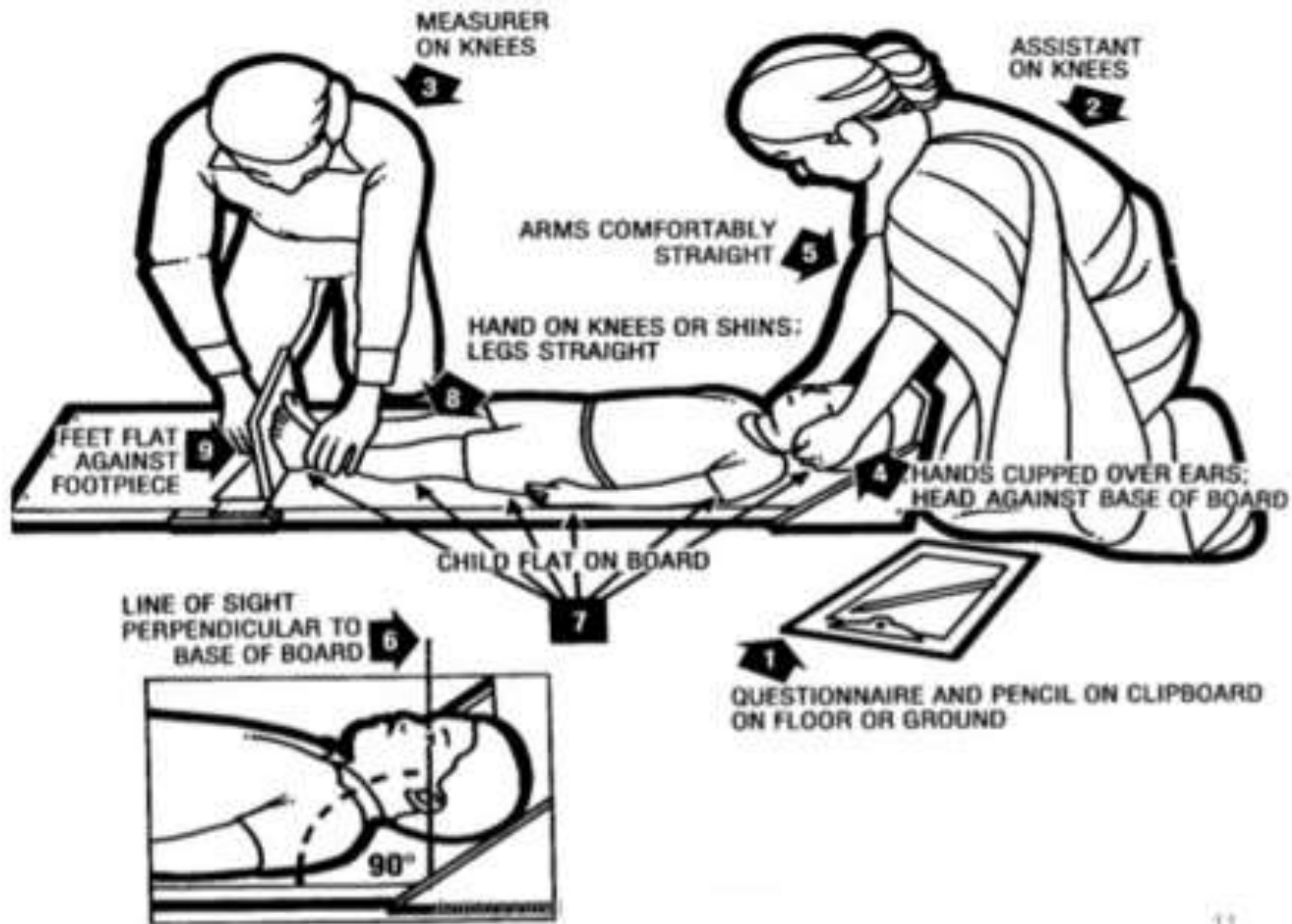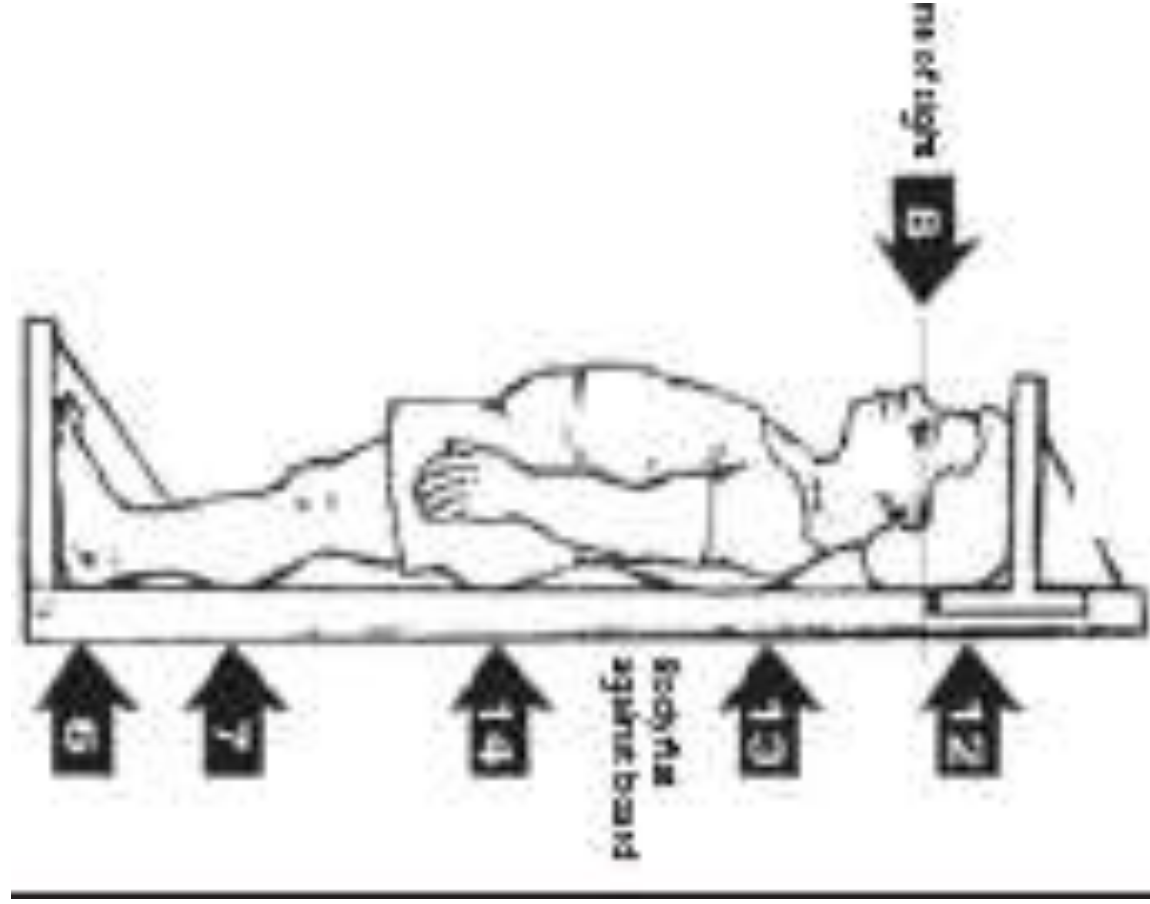
The term Macrocephaly refers to OFC of more than 2SD above the mean while Microcephaly refers to OFC more than 3SD below the mean for age , sex , height and weight.

Measurement of head circumference

Chest circumference

- It is usually measured at the level of nipples, preferably in mid inspiration.
- Xiphisternum
- In children

  <= 5years - lying down position

  > 5 years - standing position

Relationship between head size with Chest Circumference:

- **At birth**: head circumference > chest circumference by upto 3 cms.

- At around **9 months to 1 year** of age: head circumference = chest circumference,

- but **thereafter** chest grows more rapidly compared to the brain.

AGE INDEPENDENT CRITERIA FOR ASSESSMENT OF NUTRITIONAL STATUS

- Mid-upper arm circumference
- Thickness of subcutaneous fat
- Body ratios
- Weight for height
- Body mass index
- Upper segment/ lower segment ratio
- Arm span
- Obesity

- **Bangle test** – quick assessment of arm circumference. A fiber glass ring of internal diameter of 4 cm is slipped up the arm, if it passes above the elbow, it suggests that upper arm is less than 12.5 cm and child is malnourished.

- **Shakir tape** – is a fiber-glass tape with
  red – less than 12.5 cm
  yellow – 12.5- 13.5 cm
  green – greater than 13.5 cm

shading so that paramedical workers can assess nutritional status without having to remember the normal limits of mid arm circumference.

Anthropometry--Amarendra B. Singh
0902201263

- **QUAC stick** – Quaker Upper Arm Circumference Stick

  It is developed on the principle that acute starvation severely affects mid-arm circumference while height is unaffected.

- It is a height measuring rod, calibrated in MAC.
- Values of 80% MAC for Ht. are marked on stick at corresponding ht. levels
- The malnourished child would be taller than the anticipated height derived from the mid-arm circumference

MAC (cm)	Ht. (cm)
16.5	133.0
13.5	103.5
12.5	70.0

Skinfold thickness

- Measured with Herpenden's caliper
- Triceps or subscapular region

- The skinfold with subcutaneous fat is picked up with thumb and index finger, and caliper is applied beyond the pinch.

- Fat thickness
  >10mm - healthy children 1-6 years
  <6mm - is indicative of moderate to
       severe degree of malnutrition

Measurement sites

The most commonly used sites are:

- Tricepts skinfold (1): Mid-point of the back of the upper arm

- Bicepts skinfold: Front of the upper arm, above the center of the cubital fossa

- Subscapular skinfold (2): below and laterally to the angle of the shoulder blade, with the should and arm relaxed. The skinfold should angle 45° from horizontal, in the same direction as the inner border of the scapula

- Suprailiac skinfold (3): mid-axillary line superior to the iliac crest. Picked up obliuquely just posterior to the midaxillary line and parallel to the cleavage lines of the skin

- Midaxillary skinfold: picked up horizontally on the midaxillary line, at the level of the xiphoid process

Skin fold thickness

Skin fold thickness over triceps and subscapular region are used for nutritional assessment.
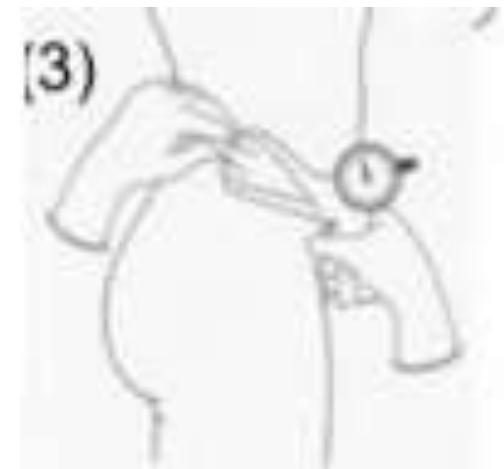
Mid arm circumference

The circumference of left upper arm at mid point of acromical process of scapula and olecranon process of ulna is measured with a tape.

ADVANTAGES OF ANTHROPOMETRY

- Less expensive & need minimal training

- Readings are reproducible.

- Objective with high specificity & sensitivity

- Measures many variables of nutritional significance (Ht, Wt, MAC, HC, skin fold thickness, waist & hip ratio & BMI).

- Readings are numerical & gradable on standard growth charts

Limitations of Anthropometry

❖ Inter-observers errors in measurement

❖ Limited nutritional diagnosis

❖ Problems with reference standards, i.e. local versus international standards.

❖ Arbitrary statistical cut-off levels for what considered as abnormal values.

Anthropometry

- Body weight

- Height

- Skin fold thickness

- Mid Upper Arm Circumference(MUAC)

Which one is the best?

Which one is the best?
For field applicability

- Standards & guideline must be their for reference
- Accurate, precise
- Sensitive- to reflect nutritional status [Increase & Decrease]
- Tool for measurement – do not require skill
- Easy by user & beneficiaries
- Cost effective, easy to carry in field
- Less error- instrumental, observer

Weight per Age Advantage

- Standards & guideline must be their for reference
- Very Sensitive- Changes with alteration in nutritional status.

  -First one to increase as well as or decrease
- Easy to measure-Tool for measurement – do not require skill
- Easy by user & beneficiaries

Weight per Age Disadvantage

- Age dependent
- Reflect overall body weight only-

  -Does not reflect fat

  - Hide under nutrition in case of water retention [oedema]

- Measurement error- Minimum clothing

Height per age
Advantage

- Standards & guideline must be their for reference

- Easy to measure-Tool for measurement – do not require skill

- Less Measurement error

Height per age
Disadvantage

- Genetic influence
- Not sensitive-

-Shows changes after long period

-Never reduce once increase

Skin fold thickness

Mid Upper Arm Circumference(MUAC)

Problems with anthropometric measurements

1. Age assessment

2. Standards of measurements

   commonly used in India are

   ICMR, WHO

Assessment of Nutritional status

- Weight for age is the most appropriate for assessment of nutritional status in children

- Height for age is an indication of duration of malnutrition

- Weight for height is an indicator where there is difficulty of age assessment

- W/H is also an indicator of current nutritional status

Individual consumption / day =

$$\frac{\text{Stocks at beginning of week - Stocks at end of week}}{\text{No. of individuals x No. of days}}$$

Laboratory investigations

Used both at individual level and community level.

Lab tests recommended for NA

Deficiency	**Test**
Protein	Total serum proteins,Serum albumin' Urinary urea
Vitamin A	**Serum vitamin A**
Vitamin C	**Serum ascorbic acid Urinary ascorbic acid**
Vitamin D	**Serum alkaline phosphatase**

Lab tests recommended for NA

Deficiency	**Test**
Thiamine	Urinary thiamine Blood pyruvate
Riboflavin	Urinary riboflavin
Niacin	U. N- methyl Nicotinamide
Iron	Hemoglobin, serum iron
Iodine	Urinary iodine, Thyroid function tests

Nutritional surveys

A combination of various methods viz.

1. Clinical examination

2. Anthropometry

3. Lab tests

4. Diet surveys

- Survey can be taken on a sample or on all persons of interest

- Survey can be longitudinal or cross-sectional

DIETARY ASSESSMENT

- Nutritional intake of humans is assessed by five different methods. These are:

  - 24 hours dietary recall
  - Food frequency questionnaire
  - Dietary history since early life
  - Food dairy technique
  - Observed food consumption

Diet Survey

1. ## 24 hour recall method

    -foods consumed in previous 24 hours

    Standard measures are used to ascertain quantity consumed.

    Repeated measurements give seasonal variations in consumption patterns.

2. ## Weighing cooked food

3. Food Frequency Method

Nutritional surveys

Nutritional values of cooked foods published by N.I.N. can be used.

This method is not very accurate but useful for diet survey of large number of individuals.
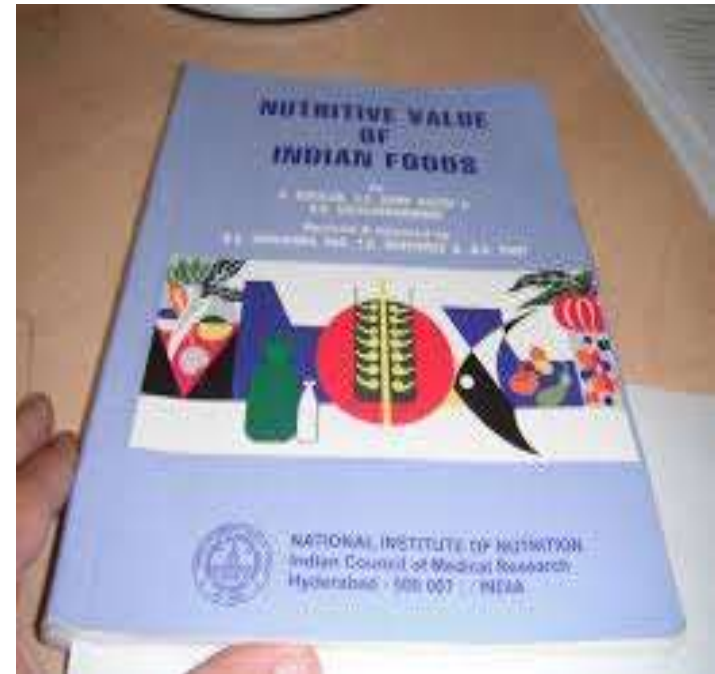
Weighing cooked food

- Weighing cooked food and calculating nutritive value is **most accurate** method.

- But it is difficult and may not be practical.

- Duplication method

Dietary assessment - Food frequency questionnaire.

- **Food frequency** questionnaires (**FFQ**) are designed to **assess** habitual **diet** by asking about the **frequency** with which **food** items or specific **food** groups are consumed a reference period (e.g. 6 months o year).

Figure 2. Example of Food Frequency Questionnaire

	Never	Once per week	2-4 per week	5-6 per week	Daily	Once per month	Once per 3 months	Once per year
Milk, yogurt, regular fat (1 cup)	○	○	○	○	○	○	○	○
Milk, yogurt, lowfat (1 cup)	○	○	○	○	○	○	○	○
Spinach, kale, other green leafy vegetables (1/2 cup)	○	○	○	○	○	○	○	○
Carrots (1 medium)	○	○	○	○	○	○	○	○
Beef (3 oz)	○	○	○	○	○	○	○	○
Rice, white (1 cup)	○	○	○	○	○	○	○	○
Rice, brown (1 cup)	○	○	○	○	○	○	○	○
Cookies (2 -2" diameter)	○	○	○	○	○	○	○	○
Ice cream, regular fat (1/2 cup)	○	○	○	○	○	○	○	○

Diet surveys

- **Weighing raw foods**
  - **Food to be cooked is weighed in its raw form.**
  - **Similarly the portion discarded/thrown is also weighed**
  - **Weighment usually done for 7 days (I diet cycle)**
  - **Nutritive value of food utilized for calculations**

Oral Questionnaire Method

- Large number in a short time
- Retrospective inquiries about nature & quantity of foods eaten in previous 24- 48 hours

Assessment of ecological factors

Factors	Indicators
Conditioning influences	Incidence, prevalence of conditioning infections
Cultural influences	infant/ child feeding practices, food habits, cooking practices, beliefs, taboos, etc.
Food production	Per capita food production of various foods. Customs related to food cultivation, storage, distribution

Assessment of ecological factors

factors	Indicators
Socio-economic factors	**Family size, occupation, income, education**
Health services	Number of hospitals, health centers as compared to norms and number of health personnel and their distribution

Vital Statistics

- Incidence, prevalence / mortality due to diarrhoea and measles

- Infant mortality rate

- Age specific mortality in 1-4 years age & their proportional mortality rate

- Ratio of 1-4 mortality rate to 1-12 months mortality (Wills-Waterloo Index)

Indicators of malnutrition

- 1. Statistical
  - IMR
  - Age specific mortality rate(1-4 years)
  - Proportional mortality rate(1-4 years)
  - 2. Anthopometric
    -birth weight
    -percentage of new-born weighing below
          2500gms.
    -height/weight standards for under-five children

Indicators of Malnutrition

3. Clinical

– **Admission of malnutrition cases in hospitals**

– **Distribution of various deficiency disorder in admitted cases**

– **Proportion of pregnant women with Hb < 10 gm/100ml blood**

4. Diet survey

-per capita intake of various food groups

-per capita intake of various nutrients

Average nutrient content of rural/urban diets in India

Nutrient	Rural	Urban	Slums
Proteins (g)	60.5	66.7	57.8
Fat (g)	NA	61.7	28.9
Calories (Kcal)	1994	2140	1825
Iron (mg)	30.1	31.7	29.6
Calcium (mg.)	368	941	546
Vit. A (mcg)	470	902	592
Thiamine	1.7	1.8	1.7

Average nutrient content of rural/urban diets in India

Nutrient	Rural	Urban	Slums
Riboflavin	0.9	1.3	0.97
Niacin	15.2	12.7	12.8
Vitamin C (mg)	42.6	103	43

Population Nutrient Intake Goals

Dietary Factor	Goal (% of total energy)
Total Fat	15-30%
Saturated Fatty acids	<10%
PUFAs	6-10%
N-6 PUFAs	5-8%
N-3 PUFAs	1-2%
Trans fatty acids	<1%
MonoUnsaturated F As	By difference

Dietary Factor	Goal (% of total energy)
Total Carbohydrate	**55-75%**
Free Sugars	<10%
Protein	10-15%
Cholesterol	<300 mg/day
NaCl (Sodium)	**< 5g /day (<2g /day)**
Fruits & Vegetables	**>=400 gms per day**
Total dietary fibre	From Foods
Non starch Polysaccharides	From Foods

Thank You

Head-place firmly on head **15**

Hand on chin **9**

Shoulders level **10**

Left hand on knees: Knees together and legs straight

5

Right hand on shins: Knees against back and base of board

4

Hands at side **11**

3

Measurer on knees

2

Assistant on knees

1

Record form and pencil on clipboard on floor or ground

Line of sight **8**

12

13

Body flat against board

14

7

6
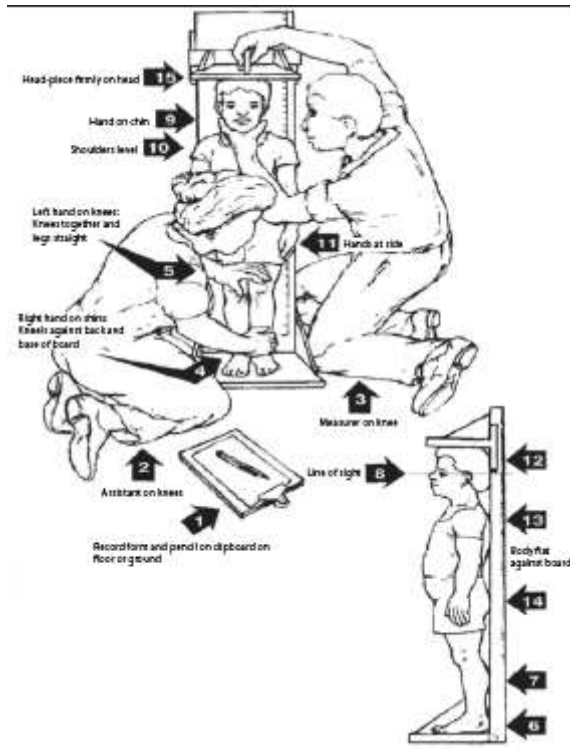
Technique for height measurement

- In older children who can stand , height can be measured by the rod attached to the lever type machine or by stadiometer.

- Child should stand with bare feet on the flat floor against a wall with fit parallel and with heels buttocks, shoulders and occiput touching the wall.
- Head should be kept in Frankfurt plane.

- With the help of a wooden spatula or plastic ruler. The topmost point of the vertex is identified on the wall.