Etiology of Malnutrition

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Maternal and Child Health.

Healthy children need healthy mothers.
Causes of malnutrition

Child malnutrition
death and disability

Inadequate Diet

Disease

Insufficient access to food

Poor water/sanitation
inadequate health services

Inadequate maternal and child care
Baby Low Birth Weight

Elderly Malnourished

Higher mortality rate

Impaired mental development

Increased risk of adult chronic disease

Untimely/inadequate weaning

Frequent Infections

Inadequate food, health & care

Reduced mental capacity

Inadequate food, health & care

Reduced mental capacity

Inadequate fetal nutrition

Inadequate food, health & care

Higher maternal mortality

Inadequate food, health & care

Reduced mental capacity

Start here
Countries at risk of malnutrition
Respiration and Under nutrition

• Respiration:
  food + oxygen = energy + waste

• Energy sources are macronutrients:
  fats, carbohydrates and protein (plus alcohol)

• Respiratory processes need micronutrients:
  vitamin B – for energy releasing enzymes liver and muscles
  magnesium – for the same enzymes
  iodine – controls rate of metabolism through thyroid hormones
  iron and vitamin B – haemoglobin for oxygen transport in the blood

• Deficiency = fatigue and loss of many functions
Excretion and Under nutrition

- Excretion eliminates the waste products of respiration, drugs, toxins and some nutrients

- Waste is excreted by:
  kidneys – water-soluble compounds: urea, drugs, sodium & other minerals
  liver – fat-soluble drugs, hormones and some minerals
  and also the lungs, intestines and skin

- Excretion processes need:
  water – adequate blood volume and urine output
  vitamins B, C and potassium – many enzyme processes in kidneys and liver
  zinc – in cells for CO₂ excretion (enzyme carbonic anhydrase)
  excretion process require lots of energy

- Deficiency = reduced renal function
  altered liver function
  accumulation of waste products especially drugs
Movement and Under nutrition

• **Movement requires:**
  muscles, bones and nerves to muscles

• **Muscles, bones and motor nerves need:**
  protein – 0.8g of dietary protein per kg body weight per day
  vitamin B - energy release in muscles
  calcium, sodium and potassium - muscle contraction
  magnesium – muscle relaxation
  calcium and vitamin D – bone formation
  vitamin B – motor nerve function

• **Deficiency =** loss of muscle bulk and weakness
  osteoporosis
  loss of motor nerve function
  resulting in reduced mobility, falls and fractures
Nutrition and Under nutrition

• The metabolism of nutrients are interlinked

• Being adequately nourished makes it easier to obtain food and maintain a healthy metabolism:
  vitamin D - absorption of calcium
  zinc - metabolism of vitamin A
  copper - absorption of iron

• Deficiency = changes in:
  Appetite:  iron - loss or alteration in appetite (pica),
    zinc - loss of taste
    vitamin B1 - nausea and delayed stomach emptying
  Growth:  protein/energy – reduced child growth and adult size and
    reduced lifelong demand for all nutrients
  Metabolism:  one nutrient deficiency can cause another
  Mobility:  reduced ability to obtain food and feed themselves
Sensitivity and Under nutrition

• Awareness of the external environment requires an intact nervous system and specialized organs

• The sensory functions require different nutrients:
  vitamin A – retinal function and health of the cornea
  iodine - hearing and mental development in infants
  zinc – taste and vision
  vitamin B1 - touch sensitivity
  vitamin B12 – vibration sense and position sense
  iron, essential fats and vitamin B – higher mental function

• Deficiency = loss of sensory or neurological function

The loss is often characteristic of the specific nutrient
Reproduction and Under nutrition

• Reproduction is a vital biological goal and mammals have only a few (high quality) offspring

• Successful reproduction needs many nutrients
  protein-energy, body weight (>40 kg) - age of menarche
  protein-energy - regularity of periods
  folic acid and vitamin B12 - miscarriage
  folic acid and vitamin B12 – birth defects
  protein-energy and iron – low birth weight
  many nutrients in maternal diet - breast milk quality and infant nutrition
  zinc and folic acid - male sperm quality

• Deficiency = infertility, reduced fertility
  poor pregnancy outcome

The full consequences of nutritional deficiency on reproduction and growth may take several generations to undo
Growth and Under nutrition

- Growth is one of the four main uses of nutrients (reproduction, maintenance and storage)

- Many nutrients are essential for good growth:
  - protein-energy essential at all ages for good growth
  - calcium and vitamin D – for skeletal growth from birth to early 20s
  - vitamin A – influences production of growth hormone in infants
  - iodine – deficiency results in reduced height and poor mental development
  - zinc – deficiency causes poor longitudinal growth and delayed puberty

- Deficiency = smaller birthweight
  - reduced growth
  - increased health risks in adult life

Catch-up growth is possible if deficiencies are corrected quickly
Defence and Under nutrition

• Defence is a life characteristic for most organisms

• Defence mechanisms involve different organs:
  protein-energy, vitamin A, vitamin B, zinc, copper – immunity (antibody production and white cells)
  vitamin C, zinc, essential fatty acids – skin quality and wound healing
  iron, vitamin B – healthy gut wall
  vitamin A - reduces the ability of bacteria to adhere to the respiratory tract
  many nutrients - physical defence (muscles, skeleton, nerves)
  many nutrients – needed for internal protection against cancer developing

• Deficiency = decline in defence mechanisms
dead from infection, injury or cancer
Life Functions and Overnutrition

- **Movement**
  - Obesity reduces mobility
  - Vitamin A excess increases the risk of osteoporosis

- **Respiration**
  - Obesity increases energy need by 9 kcal for each kg of weight/day

- **Sensitivity**
  - Water excess can lead to sodium deficiency, mental confusion or a stroke

- **Nutrition**
  - Dietary sugar causes dental caries and loss of teeth

- **Excretion**
  - Salt and soft drinks increase calcium losses in urine
  - Obesity + high fructose intake cause liver disease

- **Reproduction**
  - Vitamin A excess can cause birth defects

- **Growth**
  - Obesity increases the risk of small-for-date babies

- **Defence**
  - High doses of vitamins may increase cancer risk
  - High dose zinc supplements may reduce immunity
Specific Nutritional Deficiencies

• Iodine Deficiency
• Iron Deficiency
• Vitamin A
• Vitamin D
Summary: Micronutrient deficiency

- Iodine is critical for thyroid function – deficiency results in cretinism & goiter
- Iron is critical for blood and muscles – deficiency results in anemia
- Vitamin A is critical for visual development – deficiency results in blindness
- Vitamin D is critical for bone development – deficiency results in rickets
Iodine deficiency - thyroid
Iodine Deficiency Disorders

![Map showing countries affected by iodine deficiency disorders.](image)
Causes of Iodine Deficiency

• Mountainous areas at risk (soils leached by high rainfall, melting snow, flooding)

• Culturally induced behavioral change
  – Tasmanian Aboriginals migrated every season until European invasion, became sedentary and had incidence of thyroid problems
Iodine Deficiency: Severe

- **Goiter**: most commonly recognized consequence (enlarged thyroid)
  - Occurs when thyroid gland is unable to meet the metabolic demands of the body through sufficient hormone production – thyroid compensates by enlarging (works in short term)

- **Cretanism**: proximal pyramidal signs, intellectual impairment, primitive reflexes
  - Only occurs with severe fetal iodine deficiency
Iodine Deficiency: Moderate

• Studies comparing 2 Villages
  – Consistent results: meta-analysis showed 13.5 IQ point difference between groups

• Intervention Studies
  – Prenatal supplementation (esp. 1st trimester): clear impact – prevents cretenism, and affects mental development in children
  – Childhood supplementation: many mediocre studies, but positive impact
Underlying causes of Child illness and death.

under five live in absolute poverty, on less than $1 per day.

• Under-nutrition and malnutrition: At least 200 million children under five are malnourished.

• High fertility and short birth intervals.
Unsafe Water

11% urban and 38% rural households do not have access to safe water
21% urban and 75% rural households do not have access to adequate sanitation
Poor Education

25% of girls and 19% of boys do not enter primary school;

54% of girls and 45% of boys do not enter secondary school
Poverty

28% of the population lives at below Poverty line

Average GNP per capita is 20 times less than USA
Poor Stimulation

39% of females and 21% of males over the age of 15 cannot read or write.

199 radios per 1000 population; 154 TV’s per 1000 population.
About 30% of 1-year olds are not fully immunized for TB, DPT (Diptheria, Pertussis, and Tetanus), polio and measles
Life style changes between 1972-2000

Increase in Sedentary Life style

Decrease Physical activities

Intake of calories remaining same

Increase in Fat intake

Most manual jobs have been replaced by mechanized jobs

Transportation to school / work place universally by use of motor car / Bus / Bicycles

Increase in hours for activities : TV viewing / Computer
Nutritional requirements

- Fats, Oils & Sweets
  - Use sparingly

- Milk, Yogurt & Cheese Group
  - 2-3 servings

- Vegetable Group
  - 3-5 servings

- Meat, Poultry, Fish, Dry Beans, Eggs & Nuts Group
  - 2-3 servings

- Fruit Group
  - 2-4 servings

- Bread, Cereal, Rice & Pasta Group
  - 6-11 servings

*KEY:
- ▼ Fat (naturally occurring and added)
- □ Sugar (added)

These symbols show fats and added sugars in foods.
• Activity
• Moderation
• Personalization
• Proportionality
• Variety
• Gradual improvement
A balanced diet

A balanced diet is based on the guidelines of The eatwell plate.

The eatwell plate
Use the eatwell plate to help you get the balance right. It shows how much of what you eat should come from each food group.

An unbalanced diet can lead to dietary related diseases.
Role of Physical Activity

According to WHO at least 30 minutes of cumulative moderate exercise (equivalent to walking briskly) for all ages plus for children, an additional 20 minutes of vigorous exercise (equivalent to running) three times a week.

(These recommendations are basically for prevention of CHD).

The prevention of obesity may require combination of both: more Physical Activity and Dietary interventions.
Where do we go from here?

- Improved child nutrition
  - Poverty reduction
  - Economic growth
  - Social sector investments
  - Enhanced human capital
  - Increased productivity
Thank You!