NUTRITION.

'proximate principles'
↳ Proteins 10-15%.
Fats 15-30%.
Carbohydrates 50-80%.

- Visible fats → those that can be seperated from natural source.

Invisible fats — present in all foods, not visible to eye.

Vitamin A.

2 forms → retinol and beta carotene.
Carotene converted to retinol in intestine, stored in liver as retinol palmitate (for 6-9 months).

- **Functions:**
  - normal vision (Rhodopsin synthesis)
  - Maintains integrity & normal functioning of glandular & ep. tissue of GI, resp, UT & skin & eyes
  - support skeletal growth.
  - anti infective.
  - protect against epithelial cancers (eg: CA bronchus).

- **Sources:**
(a) Animal foods — liver, eggs, butter, cheese, whole milk, fish, meat, fish liver oil.

(b) Plant → green leafy veg papaya, mango pumpkin, carrot.

(c) Fortified foods vanaspati, margarine milk.

- **Deficiency:**
1. Night blindness.
2. Conjunctival xerosis
3. Bitot spots.
4. Corneal xerosis. } (prenonal vision lost)
5. Keratomalacia.

Extra ocular:
1. hypokeratosis.
2. Anorexia.
3. growth retardation.
4. Increased respiratory and intestinal infections.
5. urinary calculi.

Treatment:
Xerophthalmia → massive dose (200,000 IU or 110mg of retinol palmitate) oral on 2 successive days.

- **Prevention**

2 forms:
(a) improvement of diet.
(b) reduce frequency & severity of factors contributing to deficiency (PEM, RTI, diarrhoea, measles)

National Institute of nutrition at Hyderabad.
↓
community based intervention.
↓
Vit A prophylaxis.
2 lakh IU orally every 6 months to preschool children (1-6 years)

1 lakh IU to children b/w 6 months to 1 year of age.

Hypervitaminosis A
- anorexia
- vomiting ; Nausea
- sleep disorders
- skin desquamation
- enlarged liver, papilloedema

Progrms:
→ Vit A prophylaxis programme 1970 (NIP for prev. of nutritional blindness)
aim: to prevent nutritional blindness & ↓ child mortality due to vit A def.

target popn → children 6 months - 5yrs.

→ 9 doses
1st dose 1 lakh IU (9 months)
next 16-24 month → 2 lakh IU
then every 6 months
till 5 years old.

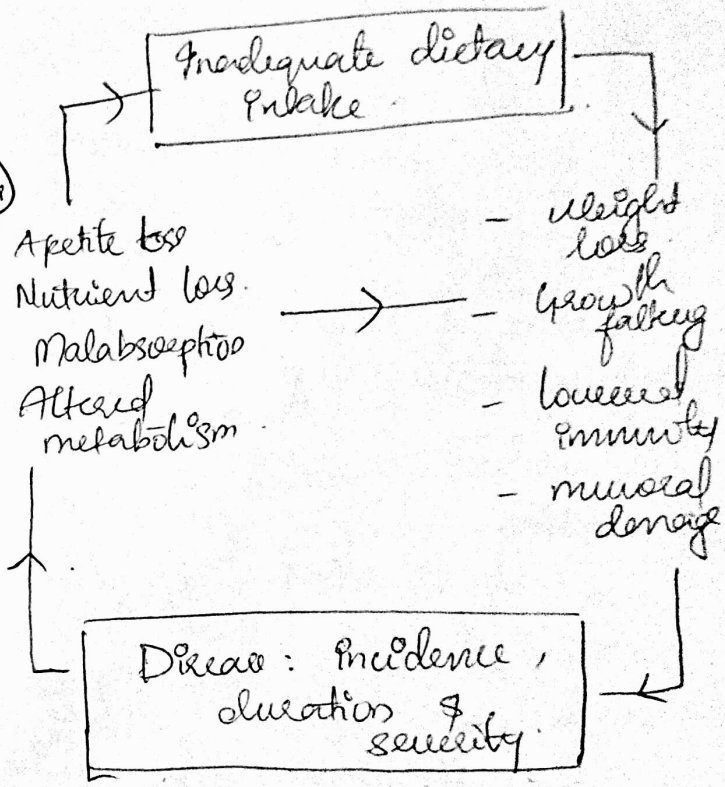
→ Syrup, 2ml.

PEM.

- undernutrition - major health prob
- childhood morbidity & mortality permanent impairment of physical and mental growth.
- PEM results due to def. of proteins & calories over a long period of time.
- common in children <5yrs & infants

Most serious form → Kwashiorkor and marasmus.

PEM is due to:
(a) Inadequate intake of food (in quantity & quality)
(b) Infections. (Diarrhoea, esp TB, measles, intestinal worms)



Other causes:
- poor envt. cond.
- large family size
- poor maternal health
- failure of lactation
- premature termination of BF

Measurement of undernutrition:
- Weight for age.
- length/height for age.
- weight for height / length.

Types of Undernutrition:

(1) Underweight
- weight for age
- stunting & wasting
- c/c & a/c malnutrition
- below -2SD on weight for age Z score.

(2) Stunting
- height for age ↓
- linear growth retardation
- c/c malnutrition / recurrent infection
- delayed psycho-social & cognitive devpt
- -2SD.

(3) Wasting
- a/c malnutrition, a/c diarrhea, a/c illness
- failure to gain wt / wt loss
- inadequate food intake, feeding problem, infection
- (-2SD)

(4) Severe Acute Malnutrition
- defined by very low WH for Ht (Z score below -3SD.), MUAC <115mm or presence of nutritional edema
- SAM ↑ risk of death <5yrs
- ↑ case fatality rate of common illnesses
- children with SAM are 9 times likely to die than well nourished children

(5) Kwashiorkor & Marasmus

Kwashiorkor
↳ low protein energy intake
- edema, wasting, liver enlargement, hypoalbuminemia, irritable, depigmentation of skin and hair

Marasmus
↳ low protein & energy intake
- cachexia with wt loss
- no edema
- mon. s/c fat, severe muscle wasting, non-normal sex albumin

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Early detection:
→ underweight for age.
→ 4cm circumference
- 13.5 → normal
- 12.5 - 13.5 → mild & moderate
- <12.5 → severe malnutrition

Preventive measures:

(a) Health promotion
+ preg. & lactating mothers (education, distribution of supplements)
2. promotion of BF
3. Devpt of low cost measuring tools
4. Methods to improve family diet
5. Nutrition education
6. Home economics
7. family planning, spacing of births
8. family empt

(b) Specific protection
1. Diet
2. Immunisation
3. Food fortification

(c) Early diagnosis & treatment
1. Periodic surveillance
2. Early diagnosis of Hag in pregnancy
3. Early " of infection & diarrhoea.
4. Deptt. of rehydration programme for D
5. Deptt of supplementary feeding programme during epidemics
6. Deworming

(d) Rehabilitation
1. Nutritional rehabilitation services
2. Hospital treatment
3. Follow up care

Nutritional Anemia

"Condition in which the Hb content of blood is lower than normal as a result of a deficiency of one or more of essential nutrients, regardless of cause of such deficiency".

cause → iron, def, folate def, vit B_{12} def

Problem
- Worldwide problem
2/3rd of pregnant & 1/2 of non pregnant women in developing countries
- Silent emergency in India
prevalence 57% in 15-49 yr. women.
72.6% among adolescent girls.

Effects:
→ (a) pregnancy
↑ maternal & foetal morbidity and mortality
abortion, premature, PPH, LBW

(b) infection
malaria, intestinal parasite
Impair cellular fn.

(c) Work capacity ↓

Prevention

severe → <10 g/dL → blood transfusion
10-12 g/dL the following.

(1) Iron and folic acid supplementation

National ~~Nutrient~~ Nutritional Anemia Prophylaxis Program
↳ GoI.

beneficiaries: pregnant women, lactating mothers, children <12y
Hb ~~<~~ 10-12 g/dL

Dosage:

Mother (300mg $FeSO_4$) → 1 tab IFA
100mg elemental iron
0.5mg folic acid
daily once, 2-3 months.

Children (60mg $FeSO_4$) <6 yr. → 1 tab IFA
20mg iron
0.1 mg folic acid
100 days

6-10 yr → 30mg iron
250 mcg folic acid
100 days

(2) Iron fortification.

Fortification of salt with iron.
(started in 1985)

(3) Other strategies.
- changing dietary habits
- control of parasites
- nutrition education

Progcons
1. National Nutrition Anemia prophylaxis progcom (NNAPP). 1970.
2. National Iron plus Initiative (2013).
3. Twelve by twelve initiative by Federation of obstetrics & Gynec. societies of India.
4. Anemia Mukt Bharat.
5. National Deworming Day.
6. NVBDCP.
7. POSHAN abhiyaan (2018-20).

ANEMIA MUKT BHARAT.

GOI intensified National Iron Plus initiative and designed a strategy called AMB.
- helps not only in mat. & child survival rate but also achieves long term health & economic outcomes in country.

Objectives:
- reduce prevalence of anemia by 3% annually among child, adolescent, reproductive age women during 2018 - 2022
- 6 x 6 x 6 strategy.
  - 6 beneficiaries
  - 6 interventions
  - 6 institutional mechanisms

6 Beneficiaries:
1. children 6 - 59 months
2. children 5 - 10 yrs
3. adolescents 10 - 19 yrs
4. women in rep age gp
5. Pregnant women
6. Lactating mothers

6 Interventions
1. Prophylactic IFA supplementation
2. Deworming
3. Behaviour change communication
4. Test & treat approach
5. Food fortification
6. Addressing non nutritional causes of anemia.

6 Institutional Mechanisms.
1. Intraministerial coordination
2. National AMB unit
3. National Centre of Excellence & advanced research on Anemia control NCEAR-A.
4. Convergence with other ministries
5. Strengthening ~~of~~ supply chain and logistics
6. Digital dashboards

Implemented in all villages, blocks, districts of all States & UTs of India in National Iron plus Initiative & Weekly iron & folic acid Supplementation Progcom

Dewon → 400mg Albendazole Biannual dose
½ tab (12-24 months)
1 tab others

Iodine Deficiency Disorder

Iodine def → spectrum of d/o with IDL → childhood → adult life with serious health & social implications (goitre + CNS d/o).

problem

Serious health problem in third world countries esp. India & neighbours.

→ Himalayan Goitre belt.
↑ goitre & cretinism
2400km from Kashmir to Naga Hills

Disorders

Fetus → Abortion, still birth - congenital anomalies.

Neonate → cretinism
mental deficiency, deaf mutism, psychomotor defects, goitre, hypothyroidism.

child → Goitre, juvenile hypo T, dwarfism, cretinism, low IQ, personality problems.

Adult → Goitre, hypo T, myxoedema, impaired mental functions.

Prevention & Control.

Iodine supplementation.

(i) Iodized salt
(ii) Iodized oil.
(iii) Iodized water
(iv) lugol's iodine.

Iodized salt → double fortification of salt with KIO_3 & iron.

oil → iodine into vegetable oil (poppy seed oil)
lipiodol.
↳ 480 mg of iodine in 1 ml oil.
↳ I.M → effective to cover deficiency for 4 yrs.

water → I_2 / KI / KIO_3 in drinking water
Northern Thailand.

Lugol's iodine → taken directly.

program

- National Iodine deficiency disorders control program (1992)

4 components
- Iodized salt
- monitoring & surveillance
- manpower training
- mass communication.

Hazards of Iodization:
- thyrotoxicosis.
- Hashimoto's disease.
- iodism } rare.
- iodide goiter }

Lathyrism

- Paralysing disease of humans and animal.

human → neurolathyrism
animal → osteolathyrism

Neurolathyrism → spastic paralysis of limbs (lower) in adults eating the pulse Lathyrus sativus in large quantity.

problem
prevalent in MP, UP, Bihar, Odisha, Maharashtra, WB, Rajasthan, Assam, Gujarat

pulse → Khesari dhal.
seeds → triangular shape, grey colour.

toxin → Beta oxalyl amino alanine (BOAA)

host factors :
Age → 15-45 yr
M > F in men
occupation → agricultural labourers.
socioeconomic → poor pop^n.

pathology :
BOAA is a neurotoxin.
→ overstimulates nerve cells of UMN, followed by their destruction
- involves pyramidal tract.
- irreversible UMN disease.
- results in paraplegia.
- reversible in only early latent stage.

Clinical stages :
1. Latent stage (1-3 months).
- apparently healthy
- weakness of lower limbs - jerky gait in exertion.

2. No stick stage.
- short jerky steps w/o stick.

3. One stick stage.
- crossed gait with tendency to walk on toes
- muscular stiffness.
requires one stick to walk.

4. Two stick stage
- extensive bending of knee
- crossed legs.
- requires 2 crutches for support.
- tired after walking short distance.

5. Caudes stage
knee jt cannot support at all.
atrophy of muscle of lower limb
gt. reduced to crawling.

Interventions :
(a) Vitamin C prophylaxis.
- daily administration of 500-1000 mg ascorbic acid.

(b) Banning the crop.
- Prevention of Food Adulteration Act.

(c) Removal of toxins
(i) Steeping method.
↳ soak pulse in hot water for 2 hours, drain & dry in sun
- toxin are water soluble.

(ii) Parboiling.
- soaking in lime water + boiling.

(iii) Education - regarding dangers.

(d) Genetic approach.
low-toxin varieties from Agri Research Institute.

(e) Socio economic changes.

Assessment of Nutritional Status

- Nutritional status is a result of many inter-related factors.

Objectives of survey:
- prevalence & geographic distribution of nutritional problems of a given community,
- at risk popln
- to develop healthcare program according to need
- assess effectiveness of program.

- Assessment methods:
1. Clinical Examination
2. Anthropometry
3. Biochemical evaluation
4. Functional Assessment
5. Assessment of dietary intake.
6. Vital and health statistics.
7. Ecological studies.

I Clinical Examination:

- essential factors
- simplest, most practical method.

Signs are classified into:

(a) not related to nutrition
eg: alopecia, pyorrhoea, pterygium.

(b) that need further investigation
eg: malar pigmentation
corneal vascularisation
goitre.

(c) known to be of value.
eg: angular stomatitis, Bitot's spot, calf tenderness, absence of knee or ankle jerk, enlargement of thyroid etc

- Drawbacks:
1. Malnutrition cannot be graded.
2. many def. don't have physical signs.
3. lack of specificity & subjective nature of physical signs

II Anthropometry

height, weight, skinfold thickness, arm circumference

III Lab & biochemical assessment

(a) Lab tests:
- Hb estimation
- stools & urine → alb, sugar
  ↳ parasite, dysentery, diarrhoea

(b) Biochemical tests:
- Nutrient conc. (ser. retinol, iron)
- abnormal metabolite in urine.
- measurement of enzymes.

IV Functional Indicators:

- Skeletal integrity
- Erythrocyte fragility, capillary fragility, tensile strength
- Host defense (neutrophil chemotaxis, phagocytic capacity, bactericidal capacity etc)
- Hemostasis (prothrombin time)
- Reproduction (sperm count)
- Nerve function
- Work capacity (HR, vasomotor system)

V Assessment of Dietary Intake

→ wt. of raw foods.
→ wt of cooked foods.
→ oral questionnaire method
  ↳ 24 hour recall method.

VI. Vital Statistics.
- morbidity, mortality ...

VII Assessment of ecological factors
1. Food balance sheet
2. Socio economic factors
3. Health and educational services.
4. Cultural & religious influences.

Nutritional surveillance
→ growth monitoring.
① maternal nutrition → Birth wt.
② Infant & preschool child → Broad family population.
→ weight for age.
height for age.
weight for height
arm circumference.
clinical signs & symptoms.

School child → ht. for age.
wt for ht.
clinical signs.

FOOD FORTIFICATION.

v the process whereby nutrients are added to foods to maintain or improve quality of the diet of a group, a community or a population.

- prevention & control of some nutritional disorders as a long term measure.

Criteria to qualify as suitable for fortification:

(1) the vehicle fortified must be consumed consistently as part of the regular diet by relevant sections of population

(2) the amt. of nutrient added must provide an effective supplement without contributing to a hazardous excess to high consumers.

(3) addition of nutrient should not cause it to undergo any noticeable change in taste, smell, appearance or consistency

(4) the cost of fortification must not raise the price of food beyond the reach of the population in greatest need.

Eg.
→ Vit A & D to vanaspati, milk.
→ KI or NaI to salt
→ Iron to salt.
→ Lysine to wheat flour.
→ Fluoridation of water.

Salt.
↳ widely consumed.
↳ proportional to energy requirements
→ technology needed is well established, inexpensive, easy to transfer to other countries.
→ does not affect smell/taste
→ concentration in salt can be adjusted easily.

Mid-day meal Scheme

- known as PM Poshan Scheme, National Program of Nutritional Support to Primary Education.
- launched on 15 Aug 1995 revised in 2004.

Objective:
- universalisation of primary education by ↑ enrolment.
- Impacting on nutrition of students in primary classes.

→ covered children of classes 1 to 5 in govt, local body and govt. aided schools.
children in Education guarantee scheme and alternative and innovative Education centre.

→ central assistance provided to states
↳ free supply of food grains from Food Corporation, foodgrains @ 100g per student per day
+ subsidy for transport.

→ cooked mid-day meal with min 300 calorie and 8-12 gram of protein.

suggestions for prep:
- foodgrains stored in place away from moisture in tight containers.
- use whole / broken wheat.
- unpolished or parboiled rice.
- Single Dish meals.
↳ broken wheat or rice + pulse / soya + vegetable + edible oil.

→ cereal : pulse
3:1 to 5:1.

→ Include sprouted pulse.
→ wash leafy veg.
→ soak of rice / dal / grain + + cooking time.
→ Fermentation improves nutritive value.
→ cooking with lid on.
→ Avoid overcooking.
→ No reheating of oil.
→ use only iodized salt.

pathways
→ It is a supplement, not a substitute for home diet.
→ should provide atleast 1/3rd of daily calorie required & 1/2 of daily protein required.
→ cost of meal should be reasonably low.
→ meal should not involve complicated cooking process.
→ menu changed frequently to avoid monotony.
→ feeding days should be fixed 200 days.

Food toxicants

1. Neurolathyrism
2. Aflatoxin (14 flavi, 1 parasiticus) (in food grains)
3. Ergot (field fungus claviceps purpurea)
   ↳ ergotism → N, V, gibbous deformities
4. Epidemic dropsy
   sanguinarine → basement wall
   b/c swelling of legs + diarrhoea
5. Endemic ascitis
   millet → Panicum miliare
   contaminated with seeds of Crotalaria
   ↳ pyrrolizidine alkaloid
   ↓
   hepatotoxin
6. Fusarium toxins
   sorghum
   fusarium incarnatum

Food guide Pyramid

visual representation of optimal no. of servings of food a person must eat from each food group

→ Veg (400 g) & fruits (100 g)
→ Cereals (250 g)
→ Milk (300 ml) pulses (85 g)
→ Nuts (30 g)
→ fats (27 g)

~~Fat~~ Fluorine
- most abundant element
- bones & teeth

Source → drinking water (0.5 mg/L)

→ food (sea fish, cheese, tea)

• Deficiency → dental caries
  excess → dental & skeletal fluorosis

RDA → 0.5 – 0.8 mg/L

Dental fluorosis
↳ mottling of dental enamel
>1.5 mg/L
chalk white patches

Skeletal fluorosis
↳ 3–6 mg/dl
crippling → permanent disability

Genu valgum

Intervention
→ changing water
→ chemical treatment
→ others (don't consume supplements, × fluoride toothpaste

• Prudent diet
→ health promoting eating pattern characterized by ↑ consumption of veg, fruits, legumes, nuts etc limiting red meat, sweets, high fat dairy
↓
↓ salt intake, avoidance of a high alcohol intake

Antioxidants
Vit E, C, β-carotene
Selenium, SOD, glutathione
→ reduce adverse effect of ROS & nitrogen species