FORTIFICATION OF MID-DAY-MEAL IN DHENKANAL

TRAINING MODULE FOR TEACHERS

(An intervention to reduce micronutrient deficiency disorders in school going children)

World Food Programme
wfp.org

Our Special Thanks

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MESSAGE

Anemia and micronutrient deficiency disorders are a major public health problem. India and Odisha specifically, suffer from a huge burden of anemia across the spectrum of age, sex and socio-economic background.

In the district of Dhenkanal, anemia prevalence among school children aged 5-9 years is 76.2 %, and 64.6% among children aged 10-17 years (CAB,2014). For school children, anemia translates in to ill health, school absenteeism, sub-optimal performance and concentration at school thereby reducing total number of years of schooling and earning potential in later life. Though there are many reasons for anemia and micronutrient deficiencies, one of the immediate cause is a gap in the intake of micronutrients on account of poor diets.

To address the need of micronutrients in this age-group, the Dept. of School and Mass Education, Govt. of Odisha and World Food Programme(WFP)'s initiative to pilot and implement a project on fortification of Mid-Day-Meal is a welcome step. This will ensure that children receive a substantial amount of their micronutrient requirements for growth and development from the fortified Mid-Day-Meal. As we progress towards our goal of quality education for all children, we have an added responsibility of facilitating good nutrition and healthy practices to foster overall development.

The present training module has been developed by SOVA/AIRA as part of this collaborative project with the purpose of orientating school teachers on various nutrition, health aspects and as well as the role expected to be played by them towards making this project a success. I urge all officials to actively engage in ensuring quality implementation of this project which is expected to inform national policy. I am certain that this well conceived training module shall go a long way in changing situation at the ground level and will serve as a handy resource for project implementation.

RR Sahoo

Smt. Roopa Roshan Sahoo, IAS.
Collector and District Magistrate,
Dhenkanal.

MESSAGE

I am pleased to know that World Food Programme (WFP) in collaboration with Department of School and Mass Education (DS&ME) has initiated a pilot project towards fortification of Mid-Day-meal in Dhenkanal district. Fortification is a cost effective and efficient strategy to address the issue of malnutrition and anaemia among the population specifically children and vulnerable group.

To build the capacity of the field officials involved in this pilot project, a well-designed and effective capacity building programme needs to be conducted for the better implementation of the project at different levels. This training module developed by AIRA/SOVA would definitely serve the purpose in this regard.

I heartly thank all persons and experts who have given their best effort to bring out this simple, concise training module for all the relevant officials involved directly in the project. I wish them good luck in their endeavor.

Dr.Bidyutlata Mishra.
Chief District Medical Officer
Dhenkanal

About the Training Module

This training module is a collaborative effort between the Department of School and Mass Education, Government of Odisha, the World Food Programme and Social Organisation for Voluntary Action, (SOVA). It has been developed as part of the project activities of the mid-day meal fortification project in Dhenkanal and is expected to facilitate regular nutrition health education sessions by the teachers in the schools as well as ensure that school children regularly consume fortified mid-day meals. The training module designed for school teachers is intended to enhance the knowledge of school teachers in the area of nutrition in general, micronutrient deficiencies in particular along with their role in the mid-day meal fortification project.

CONTENT

CHAPTER - 1

FORTIFICATION OF MID DAY MEAL IN DHENKANAL DISTRICT

Learning Objective :

- To make the trainees understand the goal and objectives of fortification of MDM project
- To get familiarize with the process of project implementation
- To be aware of the expected outcomes of the project

1.1. Introduction :

To boost enrolment in schools, and simultaneously address the problem of malnutrition among school children, the Government of India launched the National Programme of Nutritional Support to Primary Education, popularly known as Mid-Day Meal Programme (MDM). Currently, the program provides for a cooked meal with a minimum of 450 and 700 calories, to be given to all primary and upper primary stage children respectively in government, local body and government aided schools, and alternative education centers.

Odisha is a nutritionally vulnerable State with high levels of micronutrient malnutrition. Government is therefore strengthening implementation of its Mid day Meal (MDM) Programme, to address the nutrition and health problems of school children aged 6-14 years.

United Nations World Food Programme (WFP), as part of its effort for eradicating hunger worldwide, has been supporting the Department of School & Mass Education, Government of Odisha (GoO) to address specific gaps in the nutritional status of school going children through enhancement of nutritional value of the food served in MDM. GoO and WFP has entered into a partnership for implementation of a pilot project for fortification of MDM in Dhenkanal district by using multi-micronutrient fortificant. Fortification of school meals is the most efficient and effective route in alleviating micronutrient deficiencies in school children. Two major alternatives adopted are fortification of rice and introduction of Micro-Nutrient Powder in the Mid-Day-Meal Programme.

MDM Menu in Odisha:

Sl.	Days	Menu	Primary		Upper Primary	
			Energy (K.Cal)	Protein (in gms)	Energy (K.Cal)	Protein (in gms)
1.	Monday & Thursday	Rice & Dalma	503.8	13.9	745.5	18.2
2.	Tuesday & Friday	Rice & Soya Curry	470.8	14.09	719.5	25.12
3.	Wednesday & Saturday	Rice & Egg Curry	506.3	14.29	721.0	18.3

Goal :

To improve the micronutrient status and anaemia in the school going children between the age group of 6-14 years covered under the MDM programme in the district of Dhenkanal.

Project objectives :

- A replicable model developed for the state government for the fortification of Mid-Day Meals.
- All intended MDM beneficiaries in the age group 6 – 14 years have access to fortified meals in all schools of the district.
- Capacity of the concerned officials associated with MDM at the state and district levels built for procurement of appropriately fortified rice and MNP powders, fortification of mid day meals and its quality assurance.
- Capacity of school teachers built on fortification of cooked midday meals.
- Annualy 1840 MTs of fortified rice will be used for onsite cooking under the MDM Program in Dhenkanal district.

Modalities of fortification:

SOVA has been selected as the implementing agency responsible for four blocks i.e. Dhenkanal (Sadar), Kamakhyanagar, Bhuban and Parjang of Dhenkanal where fortified rice will be provided. The other four blocks i.e. Gondia, Odapada, Hindol and Kankadahad will receive micro nutrient powder (MNP) which will be added in measured amount to the cooked and cooled curry dishes served in the schools.

1.2. Why fortification of MDM :

Prevalence of micronutrients deficiency among school children is 76.2% of 5 to 9 years children and 64.4% of 10 to 17 years children. (CAB 2014 survey). As per the National Nutrition Monitoring Bureau (NNMB) Survey, in 2011-12, the average daily intake of micronutrients as against the recommended dietary allowance (RDA) for school children in Odisha reflects a gap between 50 -70% across the school age for both sexes for most micronutrients.

Fortification is a cost effective and sustainable means of achieving prevention of anaemia and other micronutrient deficiency disorders. Food fortification can lead to relatively rapid improvements in the micronutrient status of a population at a very reasonable cost, especially if advantage can be taken of existing technology and local distribution networks. Further it does not require any behavior change on the part of the consumer. MDM's potential in this regard remains largely untapped. The school meal is meant to supplement children's diet and make up the deficiency in calories and proteins. Due to wide outreach of MDM in addressing the malnutrition in the children, policy planners adopted approach of fortification of Mid-Day-Meal through various alternatives. Two major alternatives adopted are fortification of rice and introduction of Micro-Nutrient Powder in the Mid-Day-Meal Programme.

Advantages of fortifying MDM :

- It helps to improve the health and productivity of beneficiaries.
- It provides the Multi micronutrients such as Iron, Vitamin-A, Zinc, vitamin-B1, B12, Folic Acid without changing their dietary habits or behaviour.

· It ill be provided to all the MDM beneficiaries receiving hot cooked meals in the district of Dhenkanal.

Rice fortification is simpler and easier process where fortified rice kernel (FRK) can be blended with regular rice centrally and served to the school going children to prevent themselves from anemia and malnutrition. In current project the fortified rice FRK (fortified rice kernel) will be blended with normal rice with a proportion of 1: 100 respectively. Ms Laxminarayana Agro Foods Pvt. Ltd (LNAF), Panchupati, Dhenkanal is assigned to perform the task of blending. The nominated teachers and CCH from each school will be properly trained on the modalities of fortification.

Micronutrient being added :

The National Institute of Nutrition (NIN) is a part of Technical Advisory Group (TAG) for the project. The NIN approved micronutrient composition for the project is as follow.

Nutrient	Fortified rice served to children between 11-14 years of age (Upper primary school children)	Fortified rice served to children between 06-10 years of age (Primary school children)
Iron	18 mg	12 mg
Zinc	8 mg	5.33 mg
Vitamin A	300 µg	200 µg
Vitamin B1	0.7 mg	0.46 mg
Vitamin B9	75 µg	50 µg
Vitamin B12	0.5 µg	0.33 µg

Recap :

- To improve the micronutrient status and anaemia in the school going children between the age group of 6-14 years.
- Fortification of MDM is an innovative effort to reduce malnutrition and anemia. It provides the Multi micronutrients such as Iron, Vitamin-A, Zinc, vitamin-B1, B9, B12 without changing their dietary habits or behaviour.
- Precaution during cooking : Wash fortified rice properly, maintain personal hygiene, wear aprons & cap and always wash hands before cooking, no chemicals should be kept nearby, vegetable should be thoroughly washed before cutting and cooking, always cook rice and curry with lid to preserve the nutrients.

CHAPTER - 2

ROLE OF SCHOOL TEACHER AND SCHOOL MANAGEMENT COMMITTEE MEMBERS IN MDM

Learning Objective :

- **To re-orient the school teachers and school management committee members on their roles and responsibilities in MDM**
- **To discuss about the roles and responsibilities of the Teachers and SMC Members in the successful implementation of the fortification of MDM through using fortified rice kernels (FRK)**

2.1 Role of officials and school management committee members in the project

a. School Teacher:

The primary function of the school teachers in the schools is teaching. However, they also have an important role to monitor the MDM; each school is expected to designate a teacher in-charge for MDM who along with the school head master.

General Instructions:

i. **Receive Delivery of Rice**: The transport agent to make delivery of rice to the Head Master after proper weighing in the presence of the Head master, school teachers and SMC members. **In case there is deviation from fair average quality standards of the rice, the Head master can refuse to receive the rice under intimation to higher officials**

ii. **Receive funds for cooking ingredients** : Receive allotment of of e-transfer and withdrawal for expenditure on cooking ingredients

iii. **Checking the ration:** Every day the ration is to be checked by the Head master before being cooked by the cook cum helpers

iv. **Supervise the process of cooking:** Supervise the hygiene process of cooking and taste the MDM before it is served to the children

v. **Data handover to CRCCs:** Handover monthly data to CRCC for further compilation

vi. **Ensuring quality of food:** Ensure proper quality and quantity of food is being served to children as per the attendance on each day

vii. **Display of entitlements:** Entitlements of children are displayed at a prominent wall in the school.

viii. **Ensure hand washing:** Supervise hand-washing of children wash hands before and after eating

ix. **Others:** In addition, the school teacher must ensure that, no stray animals etc. are allowed in the school premises at any time, periodic health check-up of the cook-cum-helper is done regularly and the quality of food is tested before it is served. The taste checking teachers and cook cum helper shall sign the tasting register

Record Maintenance:

i. Receive the fortified rice from the transport agent after due weighing.
ii. Maintain appropriate receipt and usage records of the same.
iii. Records to contain information on date of receipt, received by, date of manufacture, date of expiry, No. of bags received, production batch no

Storage and Management of Fortified rice:

i. The fortified rice bags should be stacked such that they are clear of all walls and roof supports in order to allow access all round for inspection, pest control and physical audit, and to permit free circulation of air
ii. The fortified rice bags should not be stacked directly on the floor because there is risk of moisture from the ground rising into the bags. It should be stacked on a moisture-proof floor cover, such as polythene/ tarpaulin sheeting, or on wooden pallets as appropriate. Care needs to be taken to tie/close the bag after use.

Correct practice- Bags stored on elevated surface

Incorrect practice- Storage of bags directly on the floor

i. The fortified rice bags once opened should not be placed directly in contact with metal storage bins. The rice bags should be placed as it is within the bin or the empty rice bags should be used to line the inner surface of the storage bin prior to decanting the rice.
ii. The rice should not be measured/ decanted using rusted and/or dirty containers. A dedicated and clean, dry stainless steel or plastic container should be used. After use, this container should be placed at a clean and dry place and not left inside the rice bag

Correct practice - Insertion of the empty bags to line the walls of the metal bin

Incorrect practice - Storage of rice directly in metal bins

v. Rice bags received first are to be used first for preparation of MDM (FIFO Principle). All the rice bags appropriately mentioned the date of processing and packaging which should be followed during its use.

vi. The empty rice bags needs to be used as IEC materials. The bags have messages on health, nutrition and feeding habits printed on it. The bags need to be displayed in eachclassroom and can be used as flower vase, sitting mat for the children or any other purpose as deemed useful by the school

Planting purpose

Seating mats for students

Education material for students

Nutrition and Health Education:

i. Conduct regular monthly nutrition health education sessions with school children between classes I-VIII using the flip books provided to the school teachers.

Cooking of Fortified Rice

i. Although, each school has cooks cum helpers appointed for cooking of fortified rice I MDM, the role of school teachers is to oversee activities of the cooks cum helpers:

ii. Clean Fortified rice by removing husk, foreign matter thoroughly.

iii. Transfer the cleaned rice in a clean container/vessel and wash with potable water 1-2 times.

iv. Boil potable water in cooking container. Water shall be just enough to get absorbed in the rice while cooking and no water (Paija) is drained out.

v. Add washed rice in the boiling water, cover the container with the lid and cook to get appropriately softened rice.

vi. NOTE: In case rice is pre- soaked before cooking, please ensure that the rice is cooked in the same water in which it has been pre-soaked.

vii. Do not throw away water left after boiling rice as it is rich source of many vitamins and minerals.

viii. Cooking shall be done ONLY by Water Tight method so that all vitamins and minerals are absorbed and NEVER use Water Drain Method.

b. School Management Committee (SMC) Members

i. **Create Awareness:** To create awareness about the micronutrient malnutrition at community level

ii. **Provide active support and cooperation:** To be involved in the project implementation process with active support and cooperation

iii. **Regularize consumption of MDM:** To regularize the consumption of MDM and ensure each child eat fortified rice.

iv. **Check proper storage of fortified rice:** To check for proper storage of fortified rice in schools (food materials used in preparation of MDM)

v. **Adherence of cooking practices:** To check for adherence of appropriate cooking practice for fortified rice

vi. **Promote social and gender equity**: To promote social and gender equity at school.In addition, the school management committee (SMC) members must ensure that, ingredients are timely procured, funds are made available, etc. for uninterrupted supplyof MDM at school point. Also, to engage and disengage of CCH at school, Proper management of the joint account under MDM for funds flow at the school, adherence to prescribed menu in MDM at the school, to ensure cleanliness during preparation, cooking and serving of Mid-Day-Meal, to ensure attendance vs actual feeding of MDM under the MDM programme.

c. Cluster Resource Centre Coordinators:

The role of CRCC is mainly to monitor the key project activities and ensure consumption of fortified meals on regular basic. The following are their specific role in the project.

- Ensure availability of cooking cost and fortified rice in 3 months advance.
- Ensure hygienic cooking practices
- Ensure appropriate storage of all raw materials including fortified rice.
- Ensure watertight method of cooking at each school
- Ensure regular consumption of fortified meal daily by all school children in their clusters
- Provide handholding support to cooks and teachers
- Collection of reports in timely from schools on fortified rice and submit same to BEO

d. Block Education Officers (BEOs) / Assistant Block Education Officers (ABEOs)

The role of BEO/ABEOs is to monitor the project activities in line with the activities identified for the schools teachers/ SMC and CRCC while ensuring regular consumption of fortified meals. The following as enlisted below are the specific roles of BEO/ABEOs in the project.

- Ensure timely transmission of quarterly requirement of cooking cost and fortified rice in all schools under their respective blocks to District Office.
- Ensure hygienic cooking practices in all schools as stated in the national MDM guidelines Ensure proper storage of all raw materials including fortified rice in schools.
- Through regular monitoring visit, ensure watertight method of cooking at each school in the block.
- Ensure regular consumption of fortified meal daily by all school children in their blocks
- Provide handholding support to cooks and teachers
- Collection of reports from CRCCs on fortified rice and submit same to District Office in timely manner.

d. District Education Officer (DEO)

DEO is one of the key person responsible for implementation of both modalities of the project. Primarily the role of DEO is to oversee all activities and manage key issues during implementation of the project, also the DEO shall conduct regular visits to schools to monitor daily consumption of fortified meals.

Broadly the DEO shall ensure:

- Timely allotment of quarterly budget requirement of cooking cost and fortified rice in all schools of the district.
- Hygienic cooking practices in all schools are adhered as per the National MDM guidelines
- Proper storage of all raw materials including fortified rice in schools. Water-tight method of cooking at each school in the district.
- Timely reporting on consumption of fortified meals to state office and WFP

Recap :

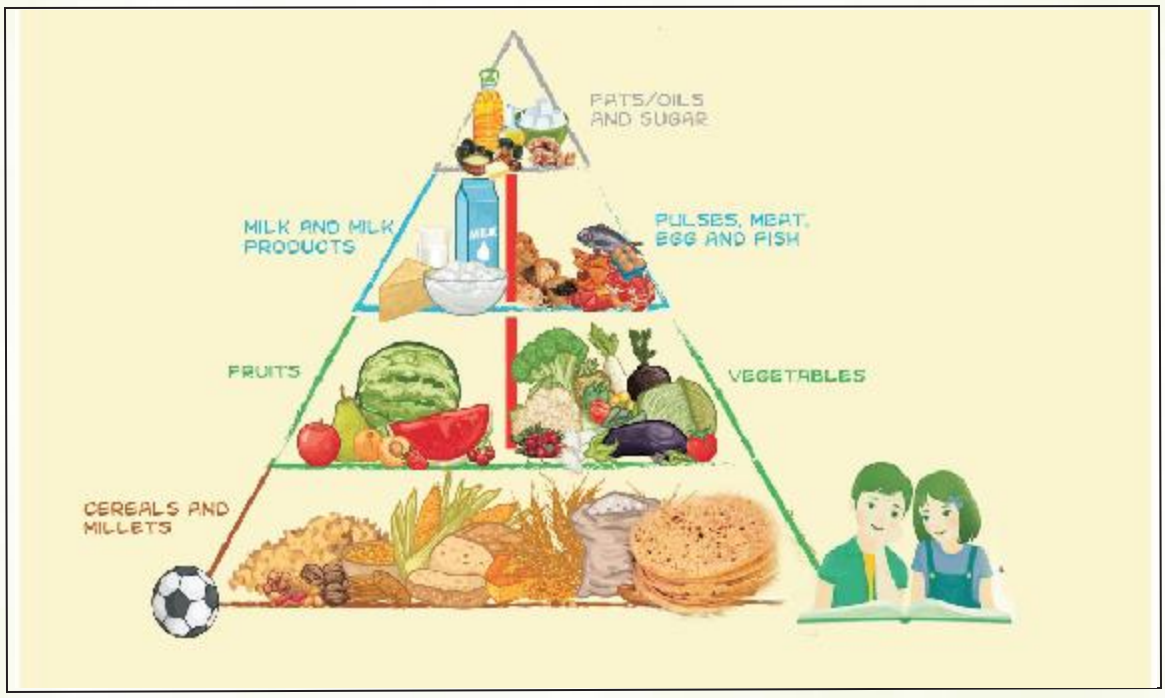
- Coordinated effort at all levels is of vital importance for the successful implementation of this project.
- The teachers and SMC members must play a proactive role to achieve the goal of the project

CHAPTER-3

NUTRITION & NUTRIENTS

Learning Objective :

- **To educate the trainees on the concept of Nutrition**
- **To make them understand the importance of Nutrition**
- **To educate them about Micronutrients & Macronutrients and its role and sources**



Nutrition is the intake of food, considered in relation to the body's dietary needs (WHO). The essential nutrients for life include carbohydrates, proteins, fats, as well as fibre, vitamins, minerals, and water.

Good nutrition, an adequate, well balanced diet combined with regular physical activity, is a corner-stone of good health.

- Having proper nutrition knowledge can help us achieve optimum health. Nutrition is key to developing and maintaining good health.
- The school going children as they go through rapid growth process need adequate amount of nutrients in right combinations.

Poor nutrition - can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity.

These nutrient classes can be categorized as under :

(i) Macronutrients (needed in relatively large amounts): These are proteins, fats and carbohydrates which are often called "proximate principles" because they form the main bulk of food.

(ii) Micronutrients (needed in smaller quantities): These are vitamins and minerals. They are called micronutrients because they are required in small quantity which may vary from a fraction of a milligram to several grams but they are equally most important for the body growth and development.

3.2 Macronutrients, its source and role

Types	Source	Role
Carbohydrates	Rice, Chapatti, Potato, Sugar, etc.	The role of carbohydrates is to provide energy, as they are the body's main source of fuel, needed for physical activity, brain function and operation of the organs. All the cells and tissues in your body need carbohydrates, and they are also important for intestinal health and waste elimination
Proteins	Dal, Fish, Meat, Egg, milk, etc.	Proteins are used for growth and repair of tissues. They are needed for formation of Enzymes which act as catalyst for many processes in the body. Proteins also form hormones, which transport chemical messages between tissues and organs. Proteins are also important building blocks of bone, cartilage, muscle, skin, and blood
Fat	Nuts and seeds, plant oils like Coconut, Mustard, butter, ghee, Til, Groundnut, etc.	Fats act as a backup source of energy when carbohydrates are not available. Fat is an essential part of the diet. It provides energy, absorbs certain nutrients and maintains core body temperature

3.3 Micronutrients, their sources and roles

These are different vitamins and minerals which are required by the human body in very minute quantities hence known as 'micronutrients'

Sl. No	Name of the Micronutrient	Natural Source	Deficiency Disease caused by their absence
1	Calcium	Milk, Yogurt and cheese	Osteoporosis, Weak Bones
2.	Iron	Heme Sources- meat, fish and poultry Non-heme sources- Green leafy vegetables, beans peas and lentils	Iron deficiency Anemia
3.	Zinc	Oysters, red meat and poultry, beans, nuts	Growth retardation, loss of appetite and impaired immune function, delayed sexual maturation, impotence
4.	Vitamin A	Pumpkin, Carrots, Papaya	Night blindness, Xerophthalmia.
5.	Thiamine	Whole grains, nuts, meat fruit and vegetable	Beri-Beri, weight loss and anorexia, confusion, short term memory loss.
6.	Riboflavin	Milk, egg, rice, fortified breakfast cereals, liver, legumes, mushrooms and green vegetable.	Aribofavinosis, cracks or sores on the outsides of the lips (cheilosis) and at the corners of the mouth (angular stomatities), inflammation and redness of the tongue (magenta tongue)
7.	Niacin	Yeast, meat, poultry, red fish (e.g. tuna, salmon), Legumes and seeds, milk, green leafy vegetable, coffee	Deficiency Disease – Pelagra, Three D's : dermatitis, diarrhea and cementia
8.	Vitamin B6	Fish, liver, fruit (other than citrus)	Dermatitis- like eruption, atrophic glossitis with ulceration, angular cheilitis conjunctivitis intertrigo and neurologic symptoms of somnolence, confusion and neuropathy.
9.	Vitamin C	Amla, Citrus fruits, Lemon	Scurvy : gingivitis, petechiae, rash, internal bleeding, impaired wound healing
10	Folic Acid	Dark green vegetables such as broccoli, spinach, okra, citrus and juice	Spira Bifida, Neural tube Defects, Mecaloblastic Aremia, insomnia, depression and forgetfulness.
11.	Vitamin B12	Non-Vegetarian food like meat, fish, dairy and eggs, vegans are more susceptible to B12 deficiency	Pernicious anemia : nerve and brain damage, which may evertualy become irreversible.
12.	Vitamin D	Sunlight, Mushrooms, Cheese, Fish, EGG, Soya Milk	Vitamin D is required to mairtain normal blood levels of calcium and phosphate, that are in turn needed for the normal mineralization of bone, muscle contraction, nerve conduction. Deficiency Disease' Rickets
13.	Vitamin E	nuts such as almonds, peanuts and hazelnuts, and vegetable oils such as sunflower, wheat germ, safflower, corn and soybean oils	Vitamin E deficiency causes nerve problems due to poor conduction of electrical impulses along nerves due to changes in nerve membrane structure and function
14.	Vitamin K	Green leaves, and dark green leafy vegetables such as romaine lettuce, kale and spinach	Vitamin K1 deficiency can result in coagulopathy, a bleeding disorder. Symptoms of K1 deficiency include anemia, bruising, and bleeding of the gums or nose in both sexes, and heavy menstrual bleeding in women

Table 3.1.: Recommended dietary allowances for school age children.

Age group		Calcium (mg)	Iron (mg)	Vit A (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit C (mg)	Dietary Folate (µg)
6 yr	RDA	600	13	400	0.7	0.8	11	40	100
7-9 yr	RDA	600	16	600	0.8	1	13	40	120
10-12 yr (boy)	RDA	800	21	600	1.1	1.3	15	40	140
10-12 yr (girl)	RDA	800	27	600	1.0	1.2	13	40	140
13-15 yr (boy)	RDA	800	32	600	1.4	1.6	16	40	150
13-15 yr (girl)	RDA	800	27	600	1.2	1.4	14	40	150

NNMB Technical Report No. 24, 2012

RECAP

- Basic nutritional food in required amount will keep us healthy as well as help us to remain fit and productive.
- It is very much essential to know about the nutritional value of our everyday diet so that we can lead a long and disease free life.
- Regular intake of above food items makes us healthy and strong, increase our immune power and build muscles well.
- Besides, we remain in good mood and we perform our day to day tasks with a great deal of interest, enthusiasm and spirit.

CHAPTER - 4

MALNUTRITION AND ITS CAUSES

Learning Objective :

- To make the trainees understand about Malnutrition
- To educate and inform them about the causes of Malnutrition
- To understand about the conceptual framework on Malnutrition
- To orient them as to the symptoms of Malnutrition so that they can easily recognize the children suffering from malnutrition

4.1 . Introduction

The term malnutrition refers to both under-nutrition and over-nutrition. Malnutrition literally means 'bad nutrition' and is an defined as the immediate outcome of insufficient food intake (hunger) and repeated infectious diseases' (UNICEF). Malnutrition is an indication of poor nutritional status. It can take a variety of forms and badly tell upon our overall health.

Healthy Child

Malnutrition is of the following types :

- Under nutrition- this can be either underweight, stunting or wasting.
- Over nutrition- obesity/overweight
- Micronutrient deficiency disorders

Malnourished Child

The following groups are at high risk than others

- Children aged 0–24 months
- Elderly, disabled and people with chronic diseases
- Pregnant and lactating women
- People living with HIV and AIDS

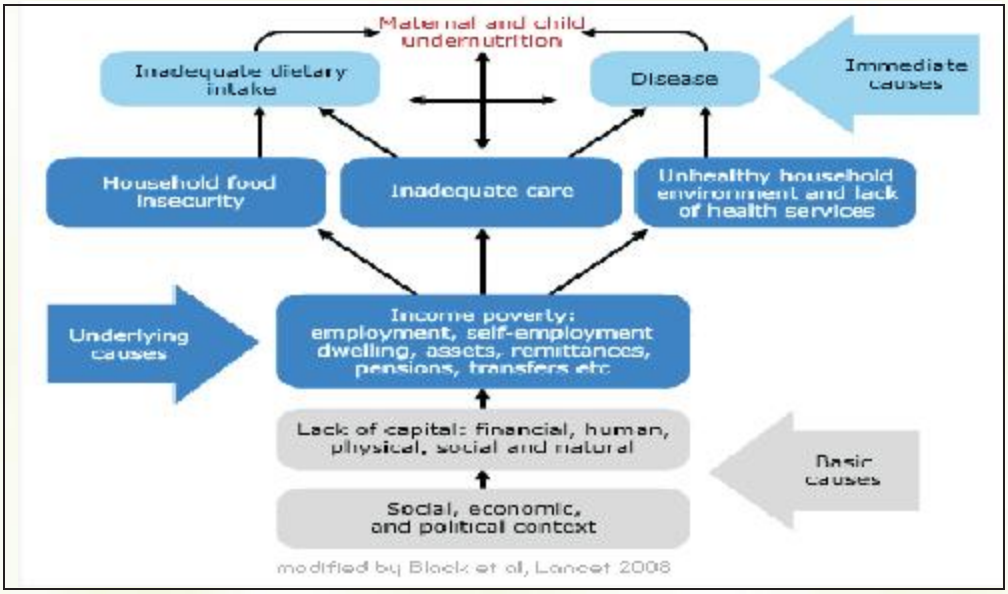
The above category of people is at high risk because of their increased nutritional requirements.

Underweight - Moderate and severe - below minus two standard deviations from median weight for age of reference population; severe - below minus three standard deviations from median weight for age of reference population

Wasting - Moderate and severe - below minus two standard deviations from median weight for height of reference population

Stunting - Moderate and severe - below minus two standard deviations from median height for age of reference population (Source: UNICEF)

4.2. Causes of Malnutrition and Conceptual Framework :



Under nutrition is the result of many causes, not solely related to food. The conceptual framework, identifies three levels of causes of under nutrition.

1. Immediate cause :

The immediate cause of under nutrition is a result of a lack of dietary intake, or disease. This can be caused by consuming too few nutrients or an infection which can increase requirements and prevent the body from absorbing those consumed.

2. Intermediate Cause :

Whether or not an individual gets enough food to eat or whether s/he is at risk of infection is mainly the result of factors operating at the household and community level. They can be grouped into three broad categories:

- Household food insecurity, E.g. Females more affected with malnutrition than boys, favoritism towards boys for food.
- Inadequate care.
- Unhealthy household environment and lack of health services (poor public health). These are often referred to as 'food', 'care' and 'health' factors.
- Unavailability and lack of education on proper menstrual health and hygiene practices - ultimately leading to urinary infections in girls more than boys.

3. Basic Causes :

The third level of factors contributing to under nutrition identified by the conceptual framework are considered basic causes. These refer to what resources are available (human, structural, financial) and how they are used (the political, legal and cultural factors). These can be thought of as the real reasons behind the underlying causes.

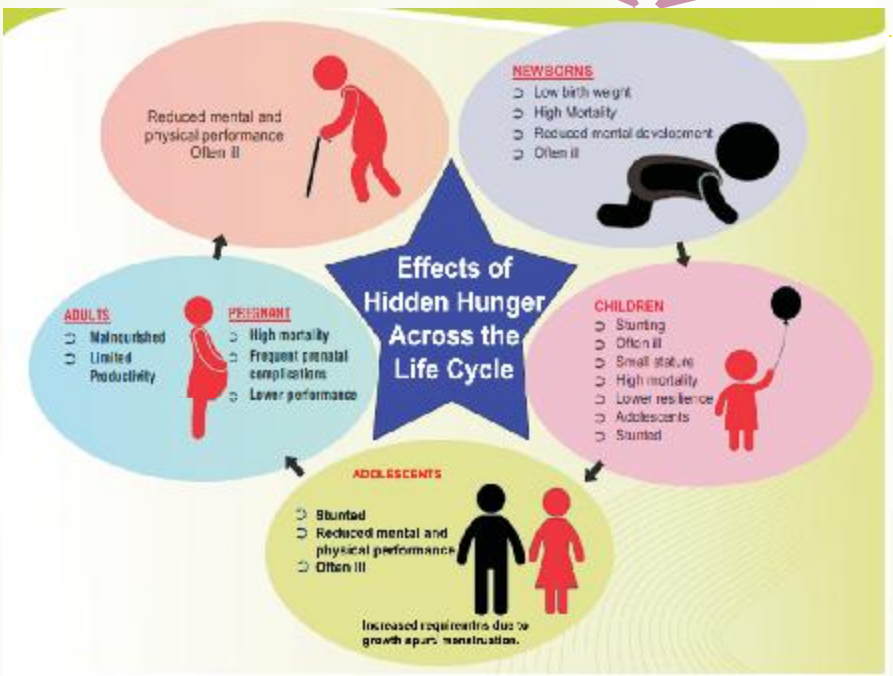
4.3. Impact of Malnutrition :

Impact on Brain:

- Attention deficit disorder
- Impaired school performance
- Decreased IQ scores
- Memory deficiency
- Learning disabilities
- Reduced social skills
- Reduced language development
- Reduced problem-solving abilities.

Impact on Body:

- Anaemia-Pallor, Lethargi
- Repeated infections and illness
- Poor Growth and Development- Weight-loss, stunting etc
- Weak immune system



Prevalence in Odisha and Dhenkanal:

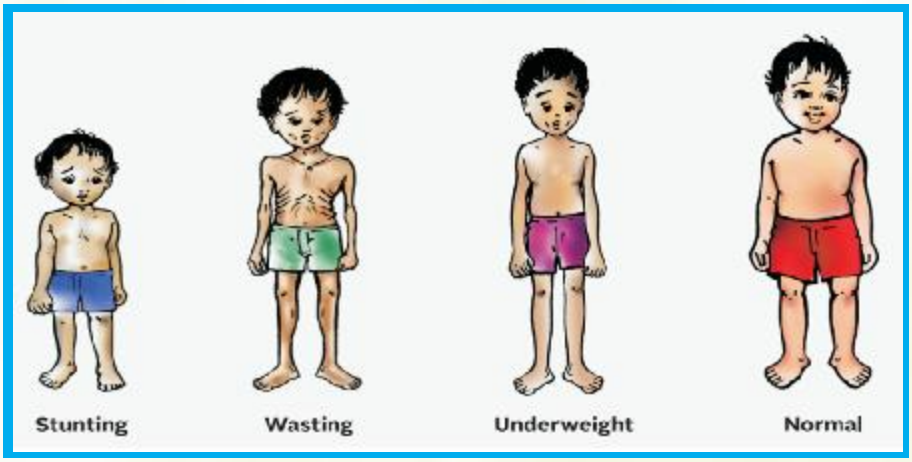
The average daily intake of micronutrients as against the recommended dietary allowance (RDA) for school children in Odisha reflects a gap between 50 -70% across the school age for both sexes for most micronutrients. (National Nutrition Monitoring Bureau (NNMB) Survey, in 2011-12).

Prevalence of micronutrients deficiency among school children in Odisha is 81.2% of 5 to 9 years age group of children and 74.5% of 10 to 17 years age group of children. (CAB 2014 survey).

Prevalence of micronutrients deficiency among school children in Dhenkanal is 76.2% of 5 to 9 years age group of children and 64.4% of 10 to 17 years age group of children. (CAB 2014 survey).

RECAP

- Four types of Malnutrition: Underweight, Wasting, Stunting, Micronutrient Deficiency.
- High risk groups: Children aged 0–24 months, Elderly, disabled and people with chronic diseases, Pregnant and lactating women, People living with HIV and AIDS.
- Importance of good nutrition on school children.
- Conceptual framework of Malnutrition.
- Impact of malnutrition.



CHAPTER - 5

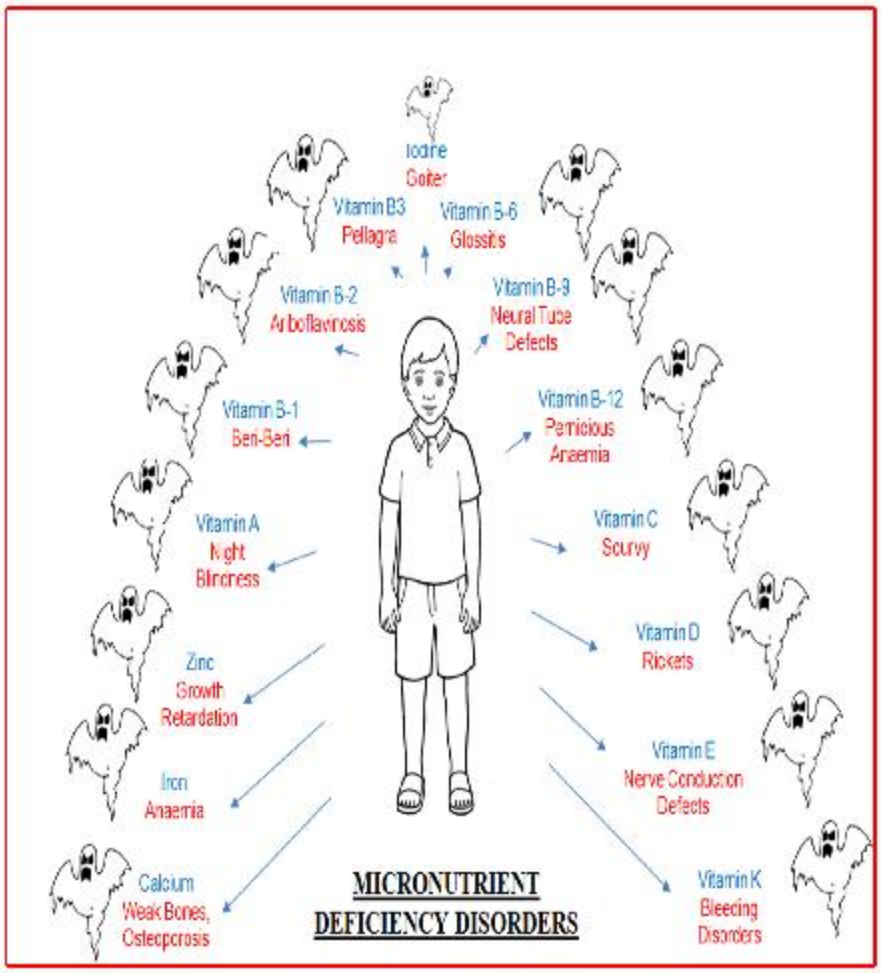
MICRONUTRIENT DEFICIENCY DISORDERS

Learning Objective :

- To make the trainees understand about Micronutrient deficiency disorder.
- To make understand about on impact of Micronutrient deficiencies.
- To make understand about deficiency disorder of various micronutrients.

5.1. Introduction

Micronutrients are vitamins and minerals or chemical elements such as zinc, iron etc. These are also called micro-elements or trace elements. Dietary deficiencies of these micro nutrients is known as "Hidden Hunger." In general vitamins are needed to regulate the maintenance and growth of the body, and to control metabolic reactions in cells. Most vitamins are provided to the body through the diet, however, the body can make vitamin D, vitamin K and niacin.



5.2. Impact of Micronutrient Deficiencies

Micronutrients are absolutely essential to good health. Billions of people around the world suffer from micronutrient malnutrition. People living in rural areas do not get enough micronutrients required to lead a healthy and productive lives from the foods that they eat.

Micronutrient malnutrition is a serious public health concern. The micronutrient deficiencies which are of greatest public health significance include iron deficiency, vitamin A deficiency and iodine deficiency disorder. Micronutrient mal-nutrition has many adverse effects on human health. It can affect all age groups, but young children and women of reproductive age are more likely to suffer from micronutrient deficiencies. Among women of -reproductive age group, it weakens women's ability to survive childbirth, makes them more susceptible to infections, and leaves them with fewer reserves to recover from illness. It affect a variety of health and disease outcomes: Child growth and development, maternal health, malnutrition and vulnerability to infectious diseases.

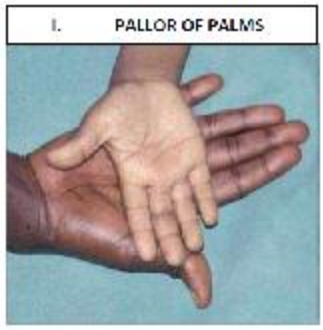
5.3. Micronutrient deficiency disorders

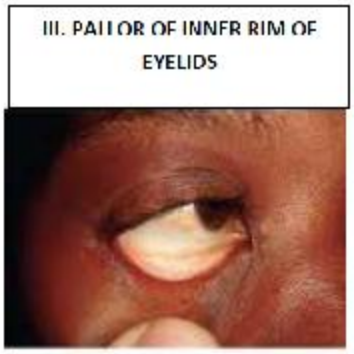
IRON

Deficiency Disease caused :Iron-Deficiency Anaemia

Manifestations of deficiencies

- Weakness and fatigue
- Reduced work performance
- Pale skin, nail beds and conjunctivae
- Brittle nails
- Shortness of breath
- Poor pregnancy outcomes (pre-term, low birth weight,
- increased maternal and peri-nantal mortality
- Impaired cognitive function (in children)
- Impaired immune function
- Heart failure (in severe cases)





IRON Deficiency Pale and Brittle Nails

Vitamin A (Retinol, Carotene)

Deficiency Disease caused : Night Blindness

Manifestations of deficiencies

- Deficiency leads to poor vision in dim light or night blindness. Severe deficiency can lead to total blindness.
- For children, lack of vitamin A causes severe visual impairment and blindness, and significantly increases the risk of severe illness
- For pregnant women in high-risk areas, vitamin A deficiency occurs especially during the last trimester when demand by both the unborn child and the mother is highest.

Bitots Spots, Corneal Inflamation and Corneal Uceration (from Top to Bottom, Left to Right)

Vitamin C (Ascorbic Acid)

Deficiency Disease caused : Scurvy

Manifestations of deficiencies

Scurvy can result from lack of ascorbic acid. It tends to occur in infants and the older adults. Scurvy leads to spots on the skin, bleeding gums and loose or loss of teeth

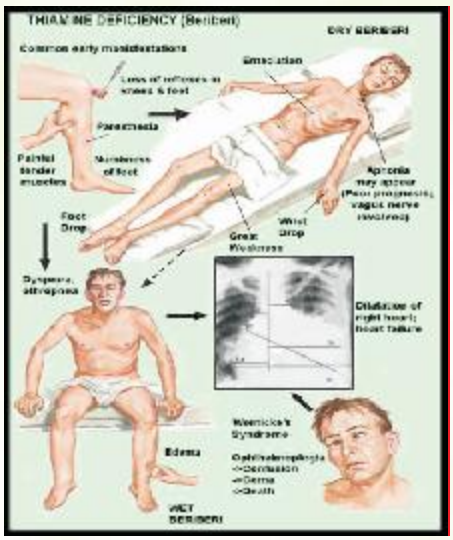
Scurvy: Bleeding of gums

Thiamine (Vitamin B-1)

Deficiency Disease caused :Beri-Beri

Manifestations of deficiencies

- In its early stage, thiamin deficiency can cause weight loss and anorexia, confusion, short-term memory loss, and other mental signs and symptoms; muscle weakness; and cardiovascular symptoms (such as an enlarged heart)



Beri Beri, Either Dry Beri Beri or Wet Beri Beri: leading to either paralysis, Weakness of muscles or Swelling of feet, arms etc (wet beri beri)

Riboflavin (Vitamin B-2)

Deficiency Disease caused : Ariboflavinosis

Manifestations of deficiencies

- Ariboflavinosis is the medical name for clinical riboflavin deficiency. Riboflavin deficiency occurs frequently in combination with deficiencies of other water-soluble vitamins.
- Symptoms of riboflavin deficiency include, sore throat, redness and swelling of the lining of the mouth and throat, cracks or sores on the outsides of the lips (cheliosis) and at the corners of the mouth (angular stomatitis), inflammation and redness of the tongue (magenta tongue), and a moist, scaly skin inflammation(seborrheic dermatitis) symptoms may involve the formation of blood vessels in the clear covering of the eye (vascularization of the cornea) and decreased red blood cell count.
- Other in which the existing red blood cells contain normal levelsof hemoglobin and are of normal size (normochromic normocytic anemia)

Angular Stomatitits - Cracks and Sores on Corners of mouth

Folic Acid (Vitamin B-9)

Deficiency Disease caused :Megaloblastic Anaemia

Manifestations of deficiencies

- Deficiency of folate can lead to megaloblastic anaemia. Symptoms can include insomnia, depression and forgetfulness.
- Folic acid deficiency is most serious in the developmental stages of life (embryo, fetus, infant and child)

Spina Bifida or Neural Tube Defect

Cyanocobalamine (Vitamin-B12)

Deficiency Disease caused: Pernicious Anaemia

Manifestations of deficiencies

- Fatigue
- Depression
- Mood changes
- Numbness in limbs
- Myocardial infarction
- Sore red tongue
- Loss of balance
- Dementia
- Paralysis*
- Stroke

*occurs in 10% of deficiency cases

Sore Red Tongue

Zinc

Deficiency Disease caused : Skin Lesions

Manifestations of deficiencies

- Skin lesions
- Impaired wound healing
- Loss of taste and appetite
- Anaemia

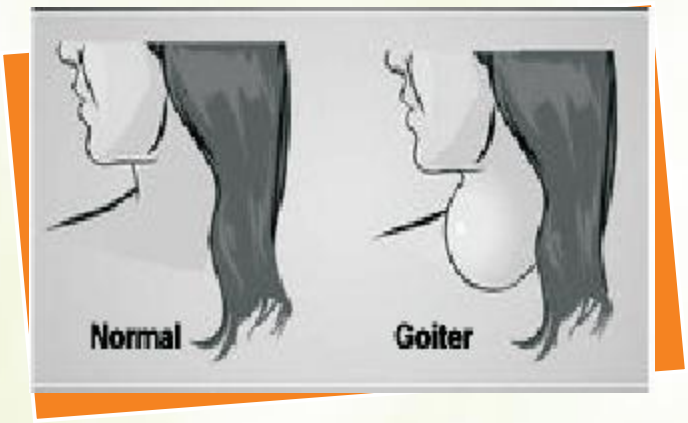
Skin Lesions

Iodine

Deficiency Disease caused :Iodine Deficiency Disorders (Idd)

Manifestations of deficiencies

- Swelling in neck
- Goitre
- Protruding eyes
- Mental Retardation & Deafness
- Dullness/tiredness
- Abortion/Still Births



Goiter

Vitamin B-3 /Niacin

Deficiency Disease caused : Pellagra

Manifestations of deficiencies

- Skin - Erythematous Dermatitis,
- Mind - Insomnia, Apathy
- Diarrhoea

Erythematous Dermatitis

Vitamin B-6/Pyridoxine

Deficiency Disease caused : Dermatitis

Manifestations of deficiencies

- Dermatitis with cheilosis and glossitis
- Anaemia

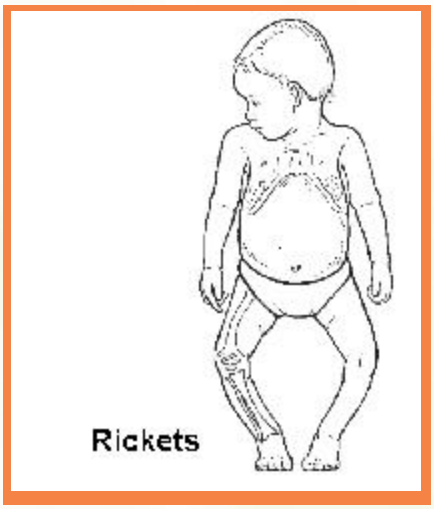
Dermatitis with Glossitis ulceration conjunctivitis

Vitamin D

Deficiency Disease caused: Rickets

Manifestations of deficiencies

Bone tenderness,
Dental problems
Muscle weakness,
Increased tendency for fractures (easily broken bones), especially greenstick fractures,Skeletal deformity.



Vitamin E

Deficiency Disease caused: Nerve Problems

Manifestations of deficiencies

- Nerve problems due to poor conduction of electrical impulses along nerves due to changes in nerve membrane structure and function.

Dry Skin

Vitamin K

Deficiency Disease caused: Coagulopathy (A Bleeding Disoder)

Manifestations of deficiencies

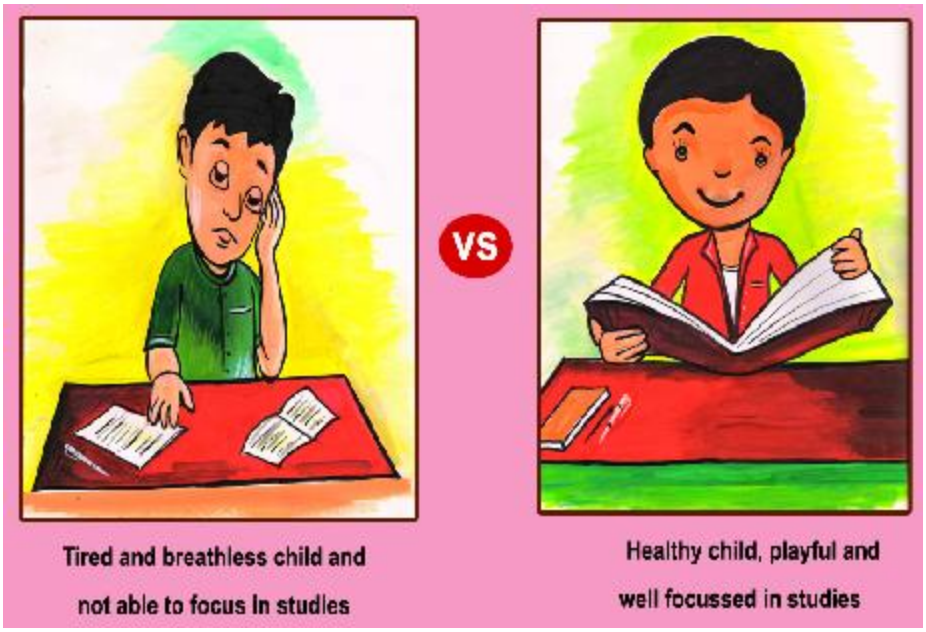
- Anemia,
- Bruising, and bleeding of the gums or nose in both sexes
- Heavy menstrual bleeding in women

Nose Bleeding

5.4 Anaemia

Anaemia is the most common disorder of blood. It is a condition in which, the number of healthy red blood cells (RBCs) in the blood is lower than normal. It commonly affects children and women of all ages - esp. menstruating women. Causation for anaemia can be multi-factorial in origin, lack of iron along with deficiency of other micronutrients (like folate, Vitamin C etc) leads to the disease. Other causes for anaemia include:

- Hookworm infestation
- Low absorption of iron in body
- Loss of blood through menstrual bleeding in adolescent girls and women
- Frequent episodes of malaria.



Cut off level of hemoglobin for diagnosis of Anaemia

Age	Hemoglobin in Blood (g/dl)
Children 6-59 months	<11.0 g/dl
Children 5-11 years	<11.5 g/dl
Children 12-14 years	<12.0 g/dl
Non-Pregnant Women (15 years of age and above) Pregnant Women	<12.0 g/dl < 11.0 g/dl
Men (15 years of age and above)	< 13.0 g/dl

Prevention and Treatment of Anaemia :

- Eat foods that are rich in iron such as green leafy vegetables (spinach, mint, raddish leaves, drumstick leaves), egg yolk, fish, liver and meat.
- Include rich foods in vitamin C such as guava, amla, oranges, lime, green leafy vegetables in the diet.
- Do not drink tea or coffee with meals or for at least one hour after taking iron tablets and meals.
- Maintain personal hygiene and sanitation and safe handling of food.
- Wear footwear to prevent worm infestation, take a course of de-worming if worm infestation is suspected before starting iron supplementation.
- Prevent early marriage and early motherhood.
- Prevent breeding of mosquitoes to protect self & family from malaria.
- Regular consumption of iron and folic acid tablets.

Symptoms of Anaemia:

- Tiredness or loss of stamina
- Shortness of breath
- Palpitations
- Pounding headache
- Difficulty in Concentrating
- Older individuals suffering from cardiovascular diseases can present with worsening angina (chest pain)
- Other non-specific manifestations such as difficulty in swallowing, pica, glossitis, cheliosis etc.

Consequences :

- Decreased work capacity
- Maternal mortality
- Impaired cognitive functioning

Adverse effect of Anaemia:

Anemia can affect people of all age group. Let us study how it affects women, children and elderly people.

Effects of Anaemia in Pregnant Women	Pregnant women with significant anaemia may have an increased risk for poor pregnancy outcomes, particularly if they are anaemic in the first trimester
Complications from Anaemia in Children and Adolescents	Severe anaemia can impair growth and motor and mental development of school going children. Children may exhibit a shortened attention span and decreased alertness.
Effects of Anaemia in the Elderly	Effects of anaemia in the elderly include decreased strength and increased risk for cardiac failures
Iron Deficiency Anaemia	Iron deficiency, and specifically iron deficiency anaemia, remains one of the most severe and important nutritional deficiencies in the world today. Every age group is vulnerable. • Iron deficiency impairs the cognitive development of children from infancy through to adolescence. • It damages immune mechanisms • It increases morbidity rates. • It creates multiple adverse outcomes for both mother and infant during pregnancy • It is responsible for increased risk of child mortality, maternal mortality, and low birth weight. • It is estimated that nearly all women are to some degree iron deficient, and that more than half of the pregnant women in developing countries suffer from anaemia. Finally, it decreases physical work capacity and performance

RECAP

- Different type of micronutrients i.e. iron, Vitamin-A, Vitamin-B1 (Thiamine), Vitamin-B2 (Riboflavin), Vitamin-B9 (Folic Acid), Vitamin- B12 (Cyanocobalamine), Vitamin-C(Ascorbic Acid), Zinc
- Its manifestation of deficiencies
- Anaemia and its symptoms
- Cut off level of hemoglobin for diagnosis of Anaemia

CHAPTER - 6

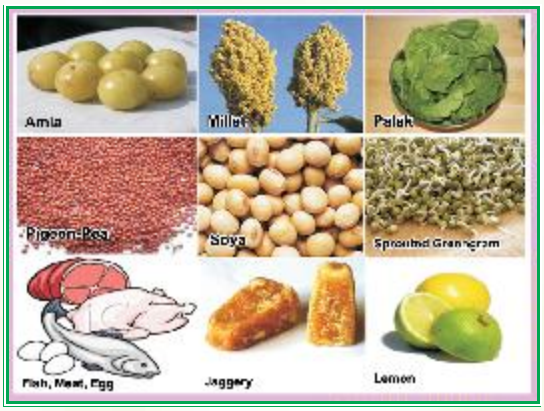
STRATEGIES TO ADDRESS ANAEMIA AND OTHER MICRONUTRIENT DEFICIENCY DISORDERS

Learning Objective :

- To make the trainees understand about Anaemia and strategy to address
- To make understand about the adverse effects of Anaemia
- To make understand about how to control Anaemia

Iron deficiency and Anaemia should be tackled simultaneously using a multi-factorial and multisectoral approach

6.1 Dietary diversification

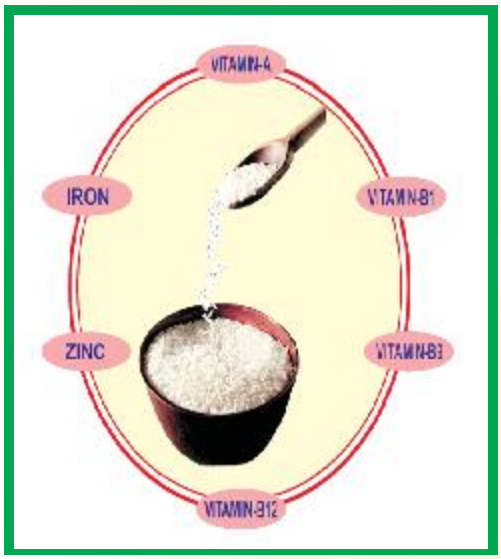


It represent the most desirable and sustainable method of preventing and addressing micronutrient malnutrition. Such approaches are designed to increase micronutrient intake through the diet.

Acquiring all micronutrients from one or two food groups is not plausible and requires regular intake of several foods and food groups in sufficient quantity and variety to satisfy the nutritional needs

Dietary diversification strategies help community access a range of nutrient-rich foods. They involve educating caregivers on appropriate infant and young child feeding practices and improving the use of locally available foods.

6.2 Fortification

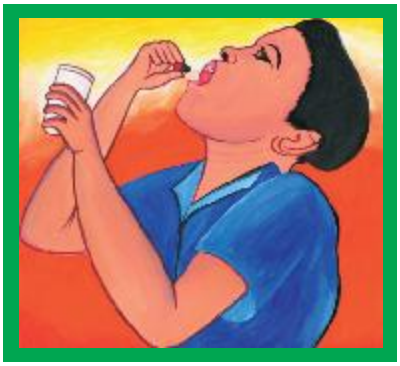


Fortification is a cost effective and sustainable means of achieving prevention of anaemia and other micronutrient deficiency disorders. Food fortification can lead to relatively rapid improvements in the micronutrient status of a population at a very reasonable cost, especially if advantage can be taken of existing technology and local distribution networks. Further it does not require any behavior change on the part of the consumer

Fortification is the practice of deliberately increasing the content of an essential micronutrient, i.e. vitamins and minerals (including trace elements) in a food, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health

64.3. Nutrition and Health Education

Improving health and nutrition practices through education and awareness like washing hand in soap before and after taking food, drinking safe and clean water, using toilet, consuming green and leafy vegetables in daily diet, practicing healthy and hygienic habits at home with a focus on improving menstrual health and hygiene among adolescent girls.



6.4. Supplementation

National Iron plus Initiative (NIPI) is evidence based programmatic response to the prevailing anaemia situation amongst adolescent girls and boys through supervised weekly ingestion of IFA supplementation and biannual helminthic control. The long term goal is to break the intergenerational cycle of anaemia, the short term benefits is of a nutritionally improved human capital. The programme, implemented across the country both in rural and urban areas.

Benefits of Iron supplementation

- Improved concentration in school, and school performance
- Feeling stronger and less tired,
- Increased energy levels and output in day to day work, Increased appetite,
- Improved overall capacity to work and earn
- Better sleep
- Improved skin appearance,
- Regularization of menstruation
- Building prepregnancy health
- Reduction of Anaemia

6.5. Public health measures

- Malaria prophylaxis, hookworm control
- Immunisation
- Counselling on Nutritional and Health Education such as Hand washing before meals, consumption of iron tablets on a weekly basis, use of cleaned boiled water for drinking, use of toilet, habit of wearing of shoes/ chappals regularly

- Environmental health, control of micronutrient malnutrition and community based PHC.
- Hook-worm infections are one of the most common causes anaemia among school children. hence along with hand washing before meals, deworming tablets/syrups must be consumed once in six months.

6.6. Cooking and eating practice

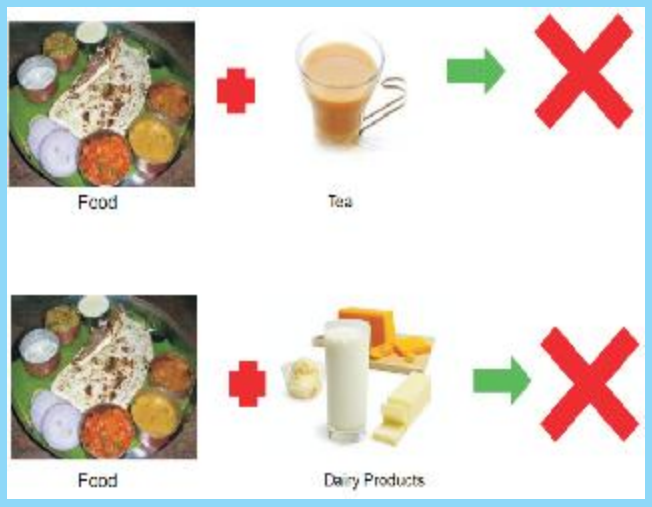
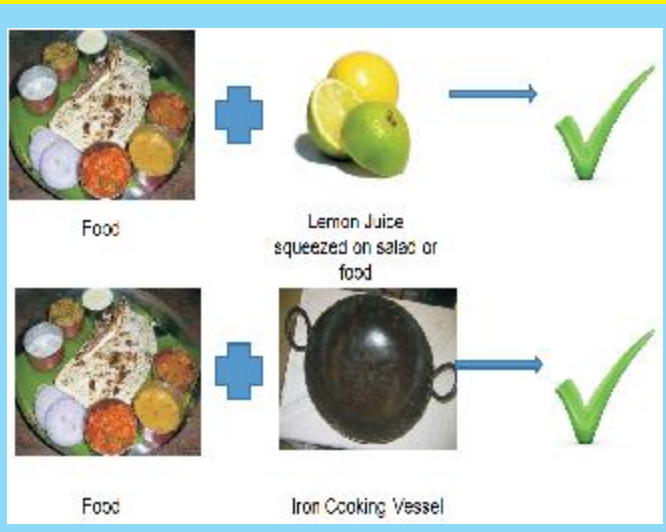
Cooking Practice:

- Cooking in iron vessels, wash the rice properly, maintain personal hygiene, wear aprons and always wash hand before cooking.
- No chemicals should be kept nearby.
- Vegetable should be thoroughly washed before cutting and cooking. For chopping vegetables, a clean chopping board should be used. Wooden chopping board to be avoided.
- Always cook rice and curry with lid to preserve the nutrients. Use water tight method of cooking. Cooking temperature should be above 75°C for cooking food. Service temperature should be maintained at 65°C.
- Water use for cooking should be potable. Utensils must be thoroughly washed, cleaned and dried after use.
- Only double fortified salt shall be used.
- All the ingredients like soya, dal and spices shall be of good brand and quality with FSSAI license no which is mandatory. Preference shall be given to product with AGMARK and BIS standard.

Eating Practice :

- Regular consumption of iron rich foods such as green leafy vegetables, cereals such as wheat, ragi, jowar and bajra; pulses (especially sprouted pulses); legumes, nuts, oilseeds, dried fruits and jaggery.
- In addition, wherever culturally and economically feasible, consumption of iron flesh foods such as meat, liver, poultry, fish etc must be encouraged.
- Including vitamin C rich foods in the meal for e.g. cauliflower, cabbage, carrot, guava

- Consuming milk, cheese, and other dairy products as a between-meal snack, rather than at mealtime
- Avoiding consumption of tea/coffee along with meals.
- Consuming fermented and germinated foods for e.g., sprouted pulses

Food based approach – Incorrect Practices	Food Based Approach – Correct Practices
	

Recap :

Iron deficiency and Anaemia should be tackled simultaneously using a multi-factorial multi sectoral approach i.e. dietary diversification fortification, nutrition and health education, supplementation, cooking and eating practices, public health measures.

ABBREVIATIONS

AIDS	Acquired Immuno Deficiency Syndrome
AIIMS	All India Institute of Medical Sciences
BDO	Block Development Officer
BRCC	Block Resource Centre Coordinator
CCH	Cook-cum-Helper
CRCC	Cluster Resource Centre Coordinator
DSME	Department of School & Mass Education
FCI	Food Corporation of India
FEFO	First-Expiry-First-Out
FIFO	First-In-First-Out
FRK	Fortified Rice Kernel
FSSAI	Food Security and Standard Authority of India
HIV	Human Immuno Deficiency Virus
IEC	Information Education & Communication
IFA	Iron Folic Acid
IIPH	Indian Institute of Public Health
MDM	Mid-Day-Meal
MNDs	Micro Nutrient Deficiencies
MNP	Micro Nutrient Powder
NABL	National Accreditation Board Laboratory
NIPI	National Iron Plus Initiative
NNMB	National Nutrition Monitoring Bureau
PHC	Primary Health Centre
PRI	Panchayati Raj Institutions
RBC	Red Blood Cell
SHG	Self Help Group
SMC	School Management Committee
TAG	Technical Advisory Group
UNICEF	United Nations Children's Fund
UNSCN	United Nations Standing Committee on Nutrition
WFP	World Food Programme
WHO	World Health Organisation

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