UNIT 12 STRATEGIES TO COMBAT PUBLIC NUTRITION PROBLEMS-I

Structure

12.1 INTRODUCTION

In Units 3 and 4, we learnt about the various public nutrition problems, their causes and consequences. In Unit 10 we have discussed the on going nutrition programmes of the country. In this and in the next unit we will learn about various strategies to combat these public nutrition problems. We already know that there are multiple causes of public nutrition problems. Therefore, we require multiple strategies to combat these problems. In most instances, for maximal effectiveness, desirable control programmes will include a variety of intervention strategies/approaches operating concurrently and attacking various facets of the causative factors at the same time so that the basic problems are being modified. What are these possible strategies? What is the basis of these strategies? These are a few aspects covered in Unit 12 and 13. Unit 12 will focus on the diet or the food based and nutrient based strategies. The relationship between immunization and malnutrition, genetics and biotechnology as one of the strategies to combat malnutrition, role of clean water and sanitation to combat malnutrition is the focus of Unit 13.

Objectives

After going through this unit you will be able to:

- highlight the various strategies to prevent malnutrition,
- differentiate between food based and nutrient based strategies,
- describe the various food based strategies namely, diet diversification, food fortification, horticulture intervention, nutrition and health education, and
- discuss supplementation as a nutrient based strategy.

12.2 STRATEGIES TO COMBAT PUBLIC NUTRITION PROBLEMS

PEM and micronutrient malnutrition is a problem of global proportion. Micronutrient malnutrition, as we have already studied earlier in Unit 3, is a term commonly used to

refer to vitamin and mineral nutritional deficiency diseases. Diets which lack adequate amounts of essential vitamins and minerals lead to such diseases. ***Vitamin*** A *deficiency, iron deficiency anaemia and iodine deficiency disorders* are among the most common forms of rnicronutrient malnutrition. Other rnicronutrients found in food, including vitamins such as thiamine, niacin, riboflavin, folate, vitamin C and D, and minerals such as calcium, selenium and zinc can also significantly affect health when dietary deficiencies exist. Micronutrient deficiency is "hidden hunger" in the sense that most people who suffer from these deficiencies are not aware that they are suffering from anything. It has not been until quite recently that the scientific and public health community has begun to understand the extent and impact of these public nutrition problems and develop programmes to combat them.

The primary causes of most micronutrient malnutrition are inadequate intakes of micronutrient-rich foods and impaired absorption or utilization of nutrients in these foods due partly to infection and parasitic infestation, which also increase metabolic needs for many micronutrients. Poverty is often at the root of malnutrition and is also linked to inadequate access to food, sanitation and safe water and to lack of knowledge about safe food handling and feeding practices.

Recognizing this aspect, the Government of India's Policy for control of public nutrition problems currently combines both short, as well as, long term measures and recommends a comprehensive strategy, addressing the following issues to achieve the goal of improving the nutritional status of the population:

a) Diet/Food based strategies viz. dietary diversification/modification, food fortification, horticulture intervention, nutrition/health education,

b) Nutrient based strategy i.e. distribution of vitamin and mineral supplements.

c) Immunization programme in the context of public nutrition programmes.

d) Supplementary feeding programmes.

e) Improving the quality of food produced by genetic approaches.

f) Clean water and sanitation as a strategy to combat public nutrition problems.

g) Improving food and nutrition security.

The strategies are not exclusive of the each other, rather they are complementary and may be of greater or lesser value according to present and changing circumstances. In fact, we need to understand that the public nutrition problems usually do not exist in isolation, thus, a stralegy for a given problem, area or a specific population would likely incorporate many interventions - supplementation, fortification, dietary diversification, as well as, public health measures. The appropriate mix of interventions depends on the specific context. Remember, there is NO 'ONE-SIZE-FITS-ALL' STRATEGY.

A review of these strategies is presented in this and the following unit. Here, in this unit the focus is on the food based and nutrient based strategies. So let's get started.

12.3 DIET OR FOOD BASED STRATEGIES

Malnutrition, particularly micronutrient deficiency, usually occurs when diets lack variety. Since the problem is mainly of dietary origin, it would perhaps be logical ta presume that policies/strategies need to be developed and implemented which ensure year round access and consumption of an adequate vasiety and quantity of good quality, safe food. Foods provide several essential micronutrients, simultaneously addressing a combination of deficiency problems. Furthermore, physiological interaction, between vitamin and minerals can enhance the body's ability to absorb essential micronutrients. It is in this context that diet or food-based approaches as preventive strategies to combat malnutrition are gaining momentum.

Food based strategies are defined as a preventive and comprehensive strategy that use food (i.e. whole, refined form, processed, fortified or a combination) as a tool to overcome micronutrient deficiency.

Diet and food-based approaches play an essential role in preventing micronutrient malnutrition by increasing the availability and consumption of micronutrient-rich foods. In the long-term, such approaches are more likely to be sustainable. However, you would realize that the benefit of such approaches is not immediate. If overt micronutrient malnutrition (such as xerophthalrnia, goitre or cretinism, or severe iron deficiency anaemia) is present, short-term supplementation programmes would need to be implemented in addition to starting food-based activities. We will look at the supplementation as a strategy to combat malnutrition later in this unit. Now let us look at the benefits of food based strategies. The benefits of food-based strategies go beyond the prevention and control of micronutrient deficiencies. These are highlighted in Box 1.

Box 1	**Benefits** of **Food-Based** Strategies

The benefits of food based strategies include:

- They are preventive, cost-effective and sustainable.
- They can be adapted to different cultural and dietary traditions and locally feasible strategies.
- Being broad-based (aiming to improve the overall quality of the diet of a population) they can address multiple nutrient deficiencies simultaneously.
- Because the amounts of nutrients consumed are within normal physiological levels, the risk of toxicity gets minimized.
- Food-based strategies support the crucial role of breastfeeding and the special diet and care needs of infants and young children.
- Food-based approaches foster the development of sustainable, environmentally sound food production systems. Agricultural planners are alerted to the need to protect the micronutrient content of soils and crops.
- Food-based strategies build partnerships among governments, consumer groups, the food industry and other organizations to achieve the shared goal of overcoming micronutrient malnutrition.

Food based approaches, therefore, are preventive, cost-effective and sustainable long-term strategies to combat malnutrition, particularly the micronutrient deficiency. A comparison of the cost-effectivenessof food based programmes versus supplementation has demonstrated that food based approaches arc preferable because they are generally less costly, more sustainable, better able to target vulnerable groups and have multiple nutritional benefits. Food based strategies also promote sustainable improvement by encouraging long-term behaviour changes. The modification of behaviour leading to better selection or preparation of food so as to enhance intake or bioavailability of nutrients is the primary goal of the approach. Few important food based approaches which can bring a qualitative improvement in the nutritional status include:

- Dietary diversification/modification to promote year round availability, access to and utilization of foods which promote the increased intake and abso ption of nutrients.
- Horticulture intervention including home gardening addressing issues of food production, preservation, processing, marketing and preparation.
- Food fortification to improve dietary intake of nutrients and their bioavailability.
- Nutrition and Health Education to promote food based approaches.

You may recall studying briefly about these food based strategies earlier in Unit 3 under section 3.3 while studying about the nutritional deficiencies. A detailed discussion on these approaches is presented here in this unit.

12.3.1 Dietary Diversification/Modification

Dietary change or modification, as a food based approach, to improve nutritional status is important. With respect to improving vitamin A stalus or iron status, evidence suggests that dietary modification is the most cost-effective measure. Let us see how?

Green leafy vegetables, we know, are the predominant sources of ~nicronutrientsfor all, particularly for the poor people. In India, for example, the prevailing vitamin A malnutrition reflects the inadequate intake of these beta-carotene rich foods. Efforts in combating vitamin A deficiency must therefore, be logically directed towards augmenting the availability and intake of these relatively inexpensive foods. Abundant sources of vitamin A exist. However, the contribution of such plants to alleviate micronutsient deficiencies is greatly underappreciated. Among the wide range of green leafy vegetables, drumstick leaves (*Moringa oleifera*) in particular provide a very rich and inexpensive source of pre-formed vitamin A, in addition to other important micronutrients. Native to India, the tree grows abundantly in all tropical countries where vitamin A deficiency is a problem. A glassful of fresh drumstick leaves contains the daily requirement of vitamin A for up to ten people, or small amounts of less than 10 gm of fresh leaves can meet the day's requirement of vitamin A of preschool children. Hence, advocating and implementing such dietary modifications can go a long way in improving the vitamin A status of population groups.

Similarly, examples of relatively small modifications/changes in behaviour/skills, related to food, which can have a significant impact on iron status are highlighted in Box 2.

Box 2 Examples of Relatively Small Changes in Food Behaviour/ Skills which can have a Significant Impact on Iron Status

CHILD FEEDING (New Behaviuur)

- Feeding colostrum instead of discarding it
- Breastfeeding as long as possible, but not beyond the 2nd year
- Introducing complementary foods rich in iron at about six months
- Providing small but frequent meals to the child
- Adopting a 5-6 meal pattern for infants/children
- Starting family food by one year of age
- Cooking food in iron utensils
- Introducing variety of foods in the diet of infants
- Feeding items which inhibit or compete with iron absorption in-between meals rather than with meals. Milk with high calcium content may be given in between meals or/and at bed time

GENERAL EATING HABITS

- Consuming iron-rich food more frequently. In fact, including atleast one source/serving of iron-rich food in each meal, if possible.
- Eating new food combinations to enhance iron absorption. Including fruits (specially rich in vitamin C) with or directly after meals rather than only between meals.

- Consuming leaves or other part of the food that are not traditionally consumed
- Avoiding or reducing the consumption of tea and coffee with meals
- Adopting practices such as fermentation/germination, where not practised, to increase the bioavailability of foods.

NEW SKILLS'

- Preparation of recipes using higher proportion of iron-rich foods
- Appropriate household-level preservation methods for fruits, vegetables, fish and meat
- Food preparation methods that preserve micronutrients i.e. short cooking time, steaming, adding food to boiling water rather than cold water, adding just enough water to aid cooking rather than cooking in large amounts of water and draining excess water after cooking.
- Mashing and, if necessary, straining fruits and vegetables so they can be eaten by infants.

Source : Adapted from FAO/IISI 1997

The objective of dietary diversification is to ensure tlzat individuals get. essential nutrients in sufficient amounts through their daily diet. The modification of the behaviour leading to better selection or preparation of food so as to enhance intake or bioavailability of these nutrients is the primary goal of this approach.

Dietary diversification to include more micronutrient rich food is an ideal and sustainable long term solution. Improvements can be made, as you may have noticed in the examples above, through the introduction of new crops, better cooking or food preparations in the home, better storage or preservation methods, improving food safety or the promotion of more varied diets through nutrition education.

In adopting dietary diversification, as a food-based strategy, to prevent micronutrient deficiency, certain steps have been suggested which are listed in Box **3.**

Box 3 Steps in Adopting Dietary Diversification/Modification as a Food Based Approach

The steps suggested in adopting diet diversification as a food based approach include:

- *Assess what people are already eating,* describing the daily meal pattern - the foods/meals consumed and the items/dishes included therein - and describing how dietary patterns are changing. Remember, food preparation methods are culturally and economically determined and should be approached with care and respect.
- Determine/analyse the bioavailability of the nutrient say availability of iron, calcium etc. in the diet.
- Assess what can be modified with respect to:
  - composition of meals (given the local food availability, cost and cultural factors)
  - food preparation
- *Implement such modifications.* For example frying and fermentation decrease

levels of beta-carotene in foods by about 25%, vitamin C is destroyed by cooking. Losses of both beta-carotene and ascorbic acid can be greatly reduced when vegetables are placed in boiling water and cooked for the minimum time necessary. Steaming in a covered pan preserves nutrients even more effectively.

- Assess the impact of approach i.e. in case of iron deficiency anaemia reassess Hb levels (i.e. before and after improved practices)

Source: Adapted from WHO (1994)

Geared with the knowledge about how to adopt dietary diversification as a food based strategy, we must further understand that dietary change programmes may be more sustainable at the family and community level when food sources are locally available and have the advantage of providing other nutrients and dietary factors to improve absorption and utilization of micronutrients. Dietary diversification, it must be noted, is cheaper than any form of supplementation or fortification. First and foremost, it requires a minimal amount of money, it promotes intakes of a whole range of micronutrients rather than singling out and tackling just one, it is sustainable, it fosters community and individual involvement, and can help stimulate local food economy. Furthermore, this approach does not "medicalise" food and nutrition, rather it enables individuals, families and communities to maintain their own health and nutrition. The key to this solution lies in bringing about a shift away from the growing of just staple crops, to a diversity of crops in the fields.

The "World Declaration and the Plan of Action on Nutrition", adopted by 159 countries at the International Conference on Nutrition jointly organized by FAO and WHO in 1992 states that strategies to combat micronutrient malnutrition should:

"Ensure that sustainable food-based strategies are given first priority particularly for populations deficient in vitamin A and iron, favouring locally available foods and taking into account local food habits."

Furthermore, it pleads forcefully in its Plan of Action for a policy of:

"...promoting the dissemination of nutrition information and giving priority to breast-feeding and other sustainable food-based approaches that encourage dietary diversification through the production and consumption of micronutrient-rich foods, including appropriate traditional foods. Processing and preservation techniques allowing the conservation of micronutrients should be promoted at the community and other levels, particularly when micronutrient-rich foods are available only on a seasonal basis."

These statements are a clear call for the action that is urgently needed to promote dietary diversification for the prevention and control of micronutrient deficiencies.

With a clear idea about the role of dietary diversification in combating public nutrition problem, we move on to the next food based strategy i.e. horticulture interventions.

12.3.2 Horticulture Interventions

Let us begin our study on horticulture intervention as a strategy to combat malnutrition by considering the following case studies:

Case Study 1: Papaya saplings, drumstick trees and amaranth seeds were distributed to mothers of preschool children, up to 30% of whom were landless, living in South India. Local agricultural officers demonstrated how to plant and care for the trees and beds of amaranth. The gardening demonstration project raised the awareness of women pertaining significance of vitamin A-rich foods in their child's diets.

Case Study 2: Vegetable gardens (10 m plots) planted for a harvest sequence of spinach-fenugreek-safflower-dock-amaranth-dill-amaranth-spinach provided well over 100% of the recommended daily allowance for a family of five. Harvesting the leaves early in the day and eating the leaves within 3 hours after harvest provided the highest beta-carotene intake.

Having gone through these case studies, what do you conclude? Yes, any programme/ intervention that increases the production of micronutrient-rich foods is likely to have a beneficial effect on the awareness and the micronutrient status of a population.

Horticulture inputs including home gardening addressing issues of food production, preservation, processing, marketing and preparation are innovative measures targeted to meet the goal of reducing the incidence of malnutrition and deficiency disorders. Home gardening as a traditional family food production system is widely practised in many homes and socities. *FAO* states that "the home garden is an important land unit for households as it is often the center of family life; a well developed home garden is a complete farming system; the home garden is the most direct means of supplying families with most of the non-staple foods they need year-round. *'Hoogerbrugge and* Fresco define the home garden as a small-scale, supplementary food production system by and for household members that mimics the natural, multi-layered ecosystem. Indigenous gardens have been a part of household production systems since the beginning of agriculture and remain important for food supply, nutrition and income in both industrialized and developing countries (*Soleri et al*).

Studies indicate that initiation of home gardens is possible and, if implemented effectively, could have a comprehensive impact on community development, health, nutrition and household food security in target populations. But, the use/effectiveness of home gardening as a strategy to combat micronutrient deficiency in India is limited to vitamin **A** deficiency control programmes. The Department(s) of Agriculture and Social Forestry are making efforts in this direction. The Indian Council of Agricultural Research (ICAR) has established so far101 *Krishi Vigyan Kendras* or **Farm** Science Centres in various parts of the country to impart training in agriculture technologies to farmers. In the past, the major thrust was on cereal and millet production. It is only in the recent years that horticulture production is receiving emphasis. Women Extension Workers are trained not only in agriculture technologies, but also in home gardening and preparation of recipes based on locally available nutritious foods.

In our discussion above so far we have focussed on home gardens. Besides home gardening, community and family vegetable and fruit gardens play a significant role in increasing small-scale production of micronutrienl-rich foods. School-based gardening programmes can be an excellent means of introducing new ideas about gardening and a useful channel for reaching others in the community, as children tend to be more open than adults to the adoption of new ideas. School-based programmes can reduce micronutrient malnutrition by:

- promoting consumption of fruits and green leafy vegetables,
- teaching students how to establish and maintain home gardens,
- introducing students to food preparation and storage techniques,
- providing nutrition information and encouraging adolescent girls to adopt more healthful dietary habits before their first pregnancy, and
- enhancing the status of and student's interest in agriculture and nutrition as future occupations.

A successful example of school gardening project is illustrated in Box 4.

Box 4	Successful Gardening Promoted Through Schools - the Asian Vegetable Research and Development Centre Case Study

A model school garden project in Taiwan developed a 10 x 18 m school garden that provided half a cup of vegetables per day for each of 142 children throughout the school year, using indigenous plants. Each garden consisted of 12 raised beds that over the course of the year contained four or five vegetables. Garden produce provided an estimated 58% of the daily vitamin A requirement and 285% of the daily vitamin C requirement for a 10-year-old child.

Having gone through the discussion above it must be evident that if planned and designed with a good understanding of local circumstances, gardening is an effective food-based approach to improving micronutrient status. A variety of micronutrient-rich crops can be grown by making use of available space, soil, water and microclimates. Gardening can be promoted at the household or community level or at schools.

Programmes that promote small-scale production of micronutrient-rich foods can mobilize communities by appealing to community member's perceived needs (e.g., to increase food supply or generate income) in addition to offering to improve nutritional quality of the local food supply. Women are often more interested than men in working in such community projects, and their involvement can improve their income and social status. Even more important, children's nutrition benefits the most when women retain control of income gcncrated by community projects.

With this we end our study of horticulture intervention, and move to the next important food basd strategy i.e. fortification. But first let us recall what we have learnt so far.

Check Your Progress Exercise 1

1. Enumerate the strategies, which can be adopted to achieve the goal of improving tho nutritional status of the population.

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2. What are rood-based strategies'? What are their benefits?

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3. Discuss the role of dietary diversification in combating public nutrition problem.

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4. 'I-Iome gardening is an effective food-based approach for improving micronutrient status'. Comment on the statement giving appropriate examples.

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Continuing with our study on food-based approaches, we now move on to fortification as a strategy to combat malnutrition.

12.3.3 Food Fortification

The addition of nutrients to foods in order to maintain or improve the nutritional quality of individual foods or the total diet of a group, a communuity or a population is referred to *as food fortification.* Fortification as defined by the Codex Alimentarius as *"the*

addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups".

While studying about fortification, you may also come across other terminology, which are used for the addition of nutrients to foods, namely *restoration* or *enrichment* or *nutrification*. What arc these terms? Can we use them interchangeably with fortification? Let's find out.

Fortification, we learnt above, is the addition of nutrients at levels higher than those found in the original or cotnparable food. Food technologists frequently refer to fortification as nutrification. The food that carries the nutrient is the vehicle; the nutrient added is the fortificant. Multiple fortification is the addition of more than one nutrient to a single food vehicle.

Restoration, on the other hand, means the addition to a food of essential nutrients which are lost during the course of Good Manufacturing Practices (GMP), or during normal storage and handling procedures, in amounts which will result in the presence in the food of the levels of the nutrients present in the edible portion of the food before processing, storage or handling. *Enrichment*, however, has been used interchangeably with fortification, but it has also been defined as the restoration of vitamins and minerals lost during processing.

Having looked at the definition of food fortification, can you now illustrate one example of food fortification in our country. Yes, the iodization of salt is a classical example of food fortification. Extensive tests, using iodine fortified salt in the community, have demonstrated the effectiveness of the fortified salt in improving the iodine status and reducing the prevalence of iodine deficiency disorders.

Fortification is an important food based strategy that may offer considerable nutritional benefits under certain circumstances. Advantages of food fortification relative to other modes of intervention have been widely noted and a result of these is that fortification programmes can be implemented and yield results within a short period. Food fortification as a strategy is likely to prove most beneficial when one or more nutrients are in short supply in the community, particularly in the wide segment of the population, but when the total amount of food available is not seriously inadequate. In simple terms, fortification improves the quality of the food without affecting the quantity.

Specific benefits of food fortification include the following:

- It can provide wide population coverage. Combined nutrient fortification can address multiple deficiencies.
- It encourages industries to be socially concerned and to add nutritional value to their products. It provides opportunities for consumers to become involved in food quality issues and creates demand for safe, wholesome rood.

In developing countries, fortification is increasingly recognized as an effective medium- and long-term approach to improving the micronutrient status of large populations. Fortification does not require changes in the dietary habits of the population, can often be implemented relatively quickly and can be sustainable over a long period of time. It is considered, by World Bank, as one of the most cost-eff'ectivc means of overcoming micronutrient malnutrition.

So then what is the philosophy behind the addition of nutrients to food? Is it purely nutritional considerations or are other factors involved? *Harris* has described six distinct philosophies of food fortification which are reviewed herewith:

I. *Fortification for restoration to normal level:* We have read above that nutrients can be removed or destroyed in food processing or storage. Under such

circumstances, fortification may be undertaken for addition of nutrients to replace those removed or destroyed.

2. *Fortification above normal level:* Addition of nutrients to certain foods for special dietary uses is allowed. In special purpose foods i.e. foods for infants or geriatric food or foods for use in weight reducing diets, nutrients may be added in quantities well above the natural level with the intention of supplying the total nutrient requirements in the minimum amount of food consumed, perhaps in a normal daily portion of the particular food.

3. *Enrichment with public heulth objective:* Fortification of salt with iodine is in fact, a classical example of enrichment with public health objective. Food or series of foods as a vehicle is used for distributing nutrient supplement linked to a demonstrable need for these nutrients in the population or in a particular segment of the population.

4. *Enrichment of 'substitute' foods to equivalent nutrient level:* With advancements in food science and technology, new products are being developed as alternates to natural products. A need has risen to ensure that these foods supply equivalent amount of important nutrients. This is where fortification assumes importance. The fortification of margarine with vitamin A is an example of this kind of fortification.

5. *Fortification to make a food complete in itself:* Under this philosophy. each food might contain adequate amount of the nutrient required for its metabolism. For example, suitable quantities of group B vitamins might be added to sugar or other heavily sweetend foods to provide for the demand of carbohydrate metabolism.

6. *Addition of nutrients for non-nutritional purposes:* You may recall studying about the use of carotene, riboflavin etc, as natural colouring matter in foods. Similarly, the addition of ascorbic acid, vitamin E etc. as antioxidants is prevalent. Addition of nutrients for technological reasons as mentioned above is the philosophy here.

With these philosophies in mind we can now appreciate the importance and scope of food fortification. However, for maximum effectiveness of this strategy, certain basic criteria should be satisfied. These include:

- There should be a demonstrated need for a nutrient in one or more population groups
- Food selected as a vehicle for the nutrient(s) must: reach the population at risk
- The amount of nutrient added to foocl will supply adequate intake when the food is consumed in normal amounts by the population at risk
- The amount of nutrient added will not be toxic or harmful to individuals with a high intake of the fortified food
- The nutrient is biologically available in the form in which it is added and is stable in the food selected as a vehicle
- The food selected does not seriously interfere with the utilization of the nutrient
- Addition of the nutrient has no detrimental effect on flavour, shell-life, colour, texture or cooking properties of the food
- Fortification is technically feasible for the particular food
- The cost of fortification does not result in a significant change in the cost of food
- A method of controlling and/or enforcing the level of fortification is available

Selection of the carrier for fortification is a critical step and several required characteristics of the carrier have been noted. The identified vehicle must be consumed in roughly constant quantities throughout the year by majority of the population. The food must pass through a centralized point to facilitate a rigidly controlled fortification process. The addition of fortificants at the required levels must not affect the organoleptic qualities of the food. Thus, if a fortifiable food exists that is consumed by many people at risk of developing a deficiency/ malnutrition, fortification is likely to be the most cost-effective component of any control programme.

Considering these aspects various carriers for fortification have been identified and adopted. One approach is to fortify a staple *food* that is consumed in significant quantities by most of the population. *Fortification of wheat flour with iron* has been successfully implemented in several countries in the Caribbean, South America, North America and Great Britain. The fortification of ready to eat breakfast cereals is another wide-spread practice.

Although staple foods are generally used as vehicles in food fortification programmes, at times when none can be identified which has all the required characteristics, it is necessary to find other options. One such option is to fortify a widely consumed condiment. Salt, sugar, curry powder, fish sauces have all been successfully fortificd. Salt has been favoured as a carrier for iodine due to its wide spread coverage, effectiveness, simple technology involved and low cost. Under the National Iodine Deficiency Disorder (IDD) Control programme, in India, we know, that the common salt is fortified with potassium iodate. The suggested minimum level of fortification of common salt with potassium iodate is 25 parts per million. This provides about 150 microgram of iodine in 10 g of iodized salt. Based on the suitability of salt as a widely used and low cost vehicle, fortification of salt with other nutrients has also been attempted. The National Institute of Nutrition (NIN), I-Iyderabad has developed a technology for the fortification of common salt with iron. Extensive tests, using iron fostified salt in the community, have demonstrated the effectiveness of the fortified salt in improving iron status and reducing the prevalence of anaemia. Rut, this measure has not been introduced on a large scale. Recenily, a new technology for the double fortification of salt with iron and iodine has been developed, which is currently being field tested. Besides salt, field studies on mono sodium glutamate (MSG) fortification with vitamin A have been conducted in the Philippines and Indonesia. Sugar, too, has been found to be a suitable vehicle for nutrients in fortification programmes in Latin America and the Caribbean.

Besides staple foods and condiments, *fortification of oil, butter, margarine, dried and liquid milk* (with iron, vitamin A) is already being implemented in some countries. In India, it is mandatory for the hydrogenated cooking fat product called 'Vanaspati' to be fortified with vitamin A. Trials conducted in India and Pakistan established the technical feasibility of fortifying tea with vitamin A. Table 12.1 lists the foods that have been fortified with Vitamin A, iron and iodine in developing countries.

With respect to infants and young children, who are undoubtedly vulnerable, for a number of reasons, fortification of complementary foods is positively one important preventive strategy for iron deficiency. More recently, multiple fortifications - fortifying wheat flour and other selected food items with nutrients like iron and B-Complex vitamins has also been suggested for our country. Fortification with two micronutrients (e.g. iron and vitamin A or iron and vitamin C) would enhance the effect of fortification on micronutrient status. This is particularly important with respect to infants/young children, in whom the prevalence of multiple nutrient deficiencies is high.

Table 12.1: Foods fortified in developing countries

	Vitamin A	Iron	Iodine	Multi-mix
ONGOING	Sugar	Wheat flour	Salt	Tea
	Margarine	Infant formulae	Corn flour	
		Rice	Water	
		Biscuits	Bread	
			Milk	
			Salt	
EXPERIMENTAL	Whole wheat	Sugar	*Sugar	Wheat flour
	Rice	Salt		Corn meal
	Tea	Milk		Wheat flour noodles
	*Oil	Water		
	*Salt	Fish sauce		
		Curry powder		
		Maize meal		
		*Salt		

*Laboratory stage only.
Source: Adapted from Nestel (1993).

Evidence of fortification as a major approach to prevent micronutrient deficiency in the industrialized, as well as, less industrialized world exists. The role of food fortification in virtually eliminating micronutrient deficiencies in developed countries is widely acknowledged and recognized. WHO identifies fortification (micronutrient intervention) as among the most cost-effective of all health interventions. Although fortification may be effective without consumer education, it is generally considered wise to include a consumer education component, only to avoid incorrect information. Education may also be required when the fortified product requires different handling during household storage and when certain cooking or product use practices result in loss of the fortificant.

Thus, having gone through the discussion above; it must be evident that in spite of its good track record, fortification too has drawbacks. In most instances, food fortification is only feasible in countries that possess well-developed, efficiently monitored and properly regulated pharmaceutical and food processing sectors. Like supplementation, as you would learn later in this section, fortification too, does not lead to awareness building and changes in wider dietary habits and its impact is limited to those who can access these fortified products. Further, educational programmes may be required along with food fortification, as mentioned earlier, particularly if (i) the fortification causes any change in the flavour, appearance, cooking properties, or cost of the food, (ii) there is a danger that the home treatment of the food may remove or destroy the added nutrient. For example, some people may be accustomed to washing impure salt before using it. If salt of this kind is iodized, consumers must be educated not to wash it because washing will remove all the iodine, or (iii) the programme depend on the addition of a locally centrally prepared premix. It is important to note that food fortification can never become a substitute for a planned nutrition programme designed to improve the food supply or food usage. It is only one part of the overall programme.

With this we end our study on fortification. You would realize that the success of food-based strategies lies in effective nutrition communication. How nutrition communication can promote food-based strategies, is the focus of the next section.

12.3.4 Nutrition and Health Education

In our discussion above we have highlighted that diet diversification, agricultural production of micronutrient-rich foods and production of micronutrient-fortified processed foods enhance micronutrient availability. However, achieving increased consumption of these foods may require a change in food habits. This is not easy. Such a change requires a vigorous and concerted effort through a variety of communication channels, e.g., radio/television, print media and interpersonal communications. Nutrition communication, can be a powerful force in helping individuals make sound decisions about what they purchase, grow and eat. There is conclusive evidence that nutrition communication can convey information, help people develop necessary skills and motivate people to make lifestyle changes. Evidence from India indicate that nutrition communication alone without any other input can be a promising approach for bringing about improvement in dietaiy behaviour. Nutrition education can convey information, persuade individuals to consume food rich in micronutrients, choose fortified Foods, and prepare food in new ways to protect their nutrient content and change patterns of feeding children.

So, what is nutrition communication or nutrition cducation'? *Nutrition Education is that group of communication activities* **aimed** *at achieving a voluntary change in nutrition-related behaviour to improve the nutritional status of the population (FAO).*

The Government of Inciia's policy for control of nutritional anaemia, for example, includes Nutrition /Health Education as one of the major long-term measures to prevent iron deficiency. The National Consultation on Control of Nutritional Anaemia (GOI 1998) recommended that the existing Nutritional Anaemia Control Programme should be comprehensive and incorporate nutrition education through school health and ICDS infrastructure to promote:

- regular intake of iron/folic acid-rich foods by all age groups,
- consumption of foods that increase absorption of iron and vitamin C and avoid foods which inhibit iron absorption (tea/coffee), and
- adequate availability of iron-rich foods by:
  - increasing their production through development of' kitchen gardens in homes, schools and the villages
  - development of iron fortified foods and promoting their consumption.

Based on these guidelines the key messages to promote good iron status among children through diet diversification/modification have been identified and highlighted in Box 5.

Box 5 'Key Nutrition Messages to Improve Iron Status

- Breast feed the child exclusively for 4-6 months
- Introduce complementary food at 6 months of age
- Ensure adequate inclusion of iron and vitamin A/C-rich food or foods fortified with iron in the household diet
- Provide lots of green leafy vegetables such as mustard, fenugreek, bathua, spinach and corriander etc.
- Avoid serving tea/coffee along with meals (atleast 2-3 hours before or after a meal)

- Serve a glass of fresh lemon juice along with meals rather than tea/coffee
- Add a few drops of lemon juice in dal/vegetable preparations
- Cook food in iron pots/kadhai. This will provide the much needed iron to keep the body healthy
- Include flesh foods (meat, poultry, liver, fish) in the diet, whenever possible
- Use fermented and sprouted foods such as sprouted pulses
- Wash raw foods thoroughly before eating or serving to children
- Remove milk from the meal and serve it between meals or at bed time.

Source : Adapted from GOI (1996), WHO (1994)

Experiences have shown that the most successful behaviour-change nutrition education projects are based on systematic planning. A theoretical framework for planning nutrition education interventions has been proposed by *Adrien and co-workers.* The framework highlights four phases - conceptualization, formulation, implementation and evaluation - as its components which are described later in Unit 15 in this course booklet. Based on the framework, planning a nutrition education intervention to prevent micronutrient deficiency, would require consideration on the following issues:

- What are the factors contributing to the micronutrient deficiency?
- Which food or food-related behaviour to promote or change?
- Who does the message need to reach?
- How should the message be presented?
- What communication channels should be used for maximum impact?

A detailed discussion on these aspects and other issues related to nutrition and health education is presented later in Units 15-18. Hence, we shall not go into the details here in this unit.

What we must emphasize here is that any nutrition communication programme should aim to reach the wider population. For example, a communication campaign that aims to improve rnicronulrient intake in young children must be directed at the care givers of the children. Besides the mothers, caretakers, or those who prepare food for the family and supervise the feeding of children, it is also important that those who make decisions and shape opinions about food consumption patterns in the household are included in the campaign. In any community religious, traditional and cultural leaders can influence shifts in food behaviour and sanction new customs. In certain regions, fathers do the shopping and control the money used to buy food. In many cultures, the father decides what food is served in the household and how it is apportioned. For these reasons, targeting messages only at mothers, caregivers may be ineffective. It is also important to provide nutrition education for school children, girls out of school and adolescents, as they are future parents and need to be aware of how to maintain or improve their dietary habits.

From our discussion above, you may now be able to appreciate the role of nutrition and health education in improving the nutritional status of community groups. But, it must be emphasized here that for any nutrition communication programme to be effective and to bring about a lasting change it must focus on exposing the target population to the messages and on the retention of the message on the part of the audience. A long term carefully sequenced communication effort is necessary to achieve permanent change in food behaviour. Repeated exposure to the message is

extremely crucial for long lasting effects. Specialists in public health communication have noted the phenomenon of behaviour decay, or reversion to an original behaviour pattern in the absence of periodic reinforcing messages. Experiences from the Expanded Food and Nutrition Education Programme (EFNEP) in USA indicate that it may take years for the desired changes in behaviour to become sustained. Hence, nutrition and health education is a long term strategy, but can be an effective strategy to combat the public health problems.

Check Your Progress Exercise. 2

1. What is food fortification? Explain giving appropriate examples.

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2. Enumerate the philosophy behind using fortification as a strategy to combat public nutrition problems.

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3. List the basic points one should keep in mind for ensuring maximum effectiveness of fortification as a strategy to combat malnutrition.

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4. 'Nutrition communication, can be a powerful force in helping individuals make sound decisions about what they purchase, grow and eat'. Justify the statement using appropriate examples.

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Having studied about the food based strategies, let us move on to the nutrient based strategy, i.e. supplementation as a strategy to prevent malnutrition.

12.4 NUTRIENT BASED APPROACH: THE MEDICINAL APPROACH TO COMBAT PUBLIC NUTRITION PROBLEMS

As compared to the food based approaches, the medicinal approach - is a drug-based approach - to combat public health problems. Nutrient supplements are effective. The medicinal approach, which is cheap in terms of cost of the pills, but expensive in terms of the support: devoted to repetitive use of scarce health-manpower, has been successful in reducing clinical deficiency signs. To illustrate, countries like Indonesia, as well as, Vietnam have declared themselves to be free of clinical vitamin A

deficiency (Xerophthalinia) in part because of the successful broad coverage achieved through periodic delivery of high-dose vitamin A supplements. In unit 3 earlier, we have learnt about supplementation as a strategy to combat public nutrition problems. What is the strategy? What are its potentials and drawbacks? Under what circumstances, the strategy is likely to be beneficial? These are a few issues highlighted in the next section. So let's get started.

12.4.1 Supplementation – A Short Term Preventive Strategy

Supplementation, as a short term strategy, to prevent micronutrient deficiency particularly, iron and vitamin A deficiency, is most common in many countries. The oldest intervention route has been the provision of daily oral supplement. At the time of its introduction, supplementation was thought of as a short term emergency measure. But most of the current strategies worldwide still rely heavily on health interventions - usually the administration, at periodic intervals, of oral dosages of synthetic vitamin/ mineral supplements to children under three years of age. This was pioneered in India in the late 1960's . What was originally envisaged as a temporary and short-term measure, and an adjunct to dietary improvement of communities in India, became the default model for current prograins to eliminate some of the common public health problems like VAD.

Single-nutrient supplementation targeted at specific population groups has become an increasingly popular strategy to combat micronutrient malnutrition. You may recall studying about supplementation as a strategy to combat iron deficiency anaemia, vitamin A deficiency etc. earlier in Units 3 and 10. The Government of India, you learnt, has launched the vitamin A supplementation programme on a National scale and *the* 'National Nutritional Anaemia Control Programme' to prevent and control nutritional anaemia. Under these programme, the schedule of supplementation recommended for preventive/therapeutic supplementation for population groups is highlighted in Table 12.2. This population-based approach is a pragmatic response to limited resources and assumes that, within a targeted group, the diagnosis of the nutrient deficiency is secure, its prevalence is clinically significant, and the benefits of supplementation outweigh the risks.

Table 12.2: Supplementary doses of nutrients recommended for preventive/therapeutic supplementation

Nutrient	Target group	Schedule of supplementation
Iron	Pregnant Women	100 mg of elemental iron and 0.5 mg (500 µg) of folic acid daily for 100 days
	Children	20 mg of elemental iron and 0.1 mg (100 µg) of folic acid daily for 100 days
Vitamin A	Infants 6-11 months of age Children between the age 1-5 years (currently only)	100,000 IU of vitamin A 200,000 IU of vitamin A given once every 6 months
Iodine	Women and children in hyper-endemic areas (Children between 1-3 yrs. old)	Iodized oil injection - Single dose of 1 ml

The evidence is indisputable that supplements can substantially reduce the micronutrient deficiency. However, it is to be noted that supplementation, as **a** strategy, cannot correct a basic inadequacy in the quantity of food. The circumstances in which supplements may, therefore, be useful are limited and have been outlined herewith:

- *Supplementation as a therapy of specific deficiency and other diseases:* As discussed above, supplementation may be needed to treat nutritional deficiency diseases prevalent in an area. For example providing folifer tablets to all pregnant women for prevention of anaemia. Further, diseases causing malabsorption or excessive loss of nutrients may lead to secondary malnutrition, the classic example is the role of hookworm infections in causing iron deficiency anaemia. Under such circumstances, the administration of appropriate therapeutic levels of iron would be a necessary part of therapy.
- *Part of a broad preventive programme in the face of demonstrated need:* If it is apparent that a particular deficiency disease is prevalent in a population, provision of suitable supplement is indicated as a measure to effectively promote rapid improvement. Under such circumstances waiting for a broader programme of nutrition/health education and food supply may not be very appropriate. However, it must be realized that supplementation should be used in conjunction with, but not as an replacement for, improvement in food selection.
- *Complement to feeding programmes:* Certain situations indicate a need for nutrient supplement. For example, you may recall studying that under many circumstances, the government resorts to provision of food supplements. However, in areas where it is apparent that a particular deficiency disease is prevalent, it may be strongly recommended that in such areas a food source may be fortified with the particular nutrient. However, if a suitable fortified source is not available, then it is clearly expedient to supply the nutrient supplement along with the food source. This is how supplementation complements the feeding programme.

Supplementation, as a short term strategy, therefore, can be effective. However, long experience with this intervention shows that it docs not always work. The reasons identified, contributing to its ineffectiveness include: lack of compliance, economic constraints, poor efficiency of health services, dose-related undesirable gastrointestinal side effects, poor coverage, lack of awareness by local health workers, poor quality of supplement tablets etc. The 'drug-based approach' such as that of providing synthetic vitamin A has received wide criticism, even from the very individuals who have pioneered the work. Some of the limitations cited based on the 30-year experience of India are: ineffectiveness in correcting VAD (especially in populations where milder signs of deficiency arc widespread), the limited shelf-life of vitamin A and logistical problems in ensuring supply.

Supplementation programmes are often expensive and unsystematic and coverage may be poor. Frequently, the key target groups are different for each micronutrient, and operational constraints are severe. Further, the ease of supplementation has meant neglection of research into and promotion of better use of inexpensive food sources and diet diversification as a lasting long term strategy to prevent public nutrition problems.

With our discussion above we end our study of different strategies. Next, we shall learn how to implement an intervention strategy,

12.5 SELECTING/IMPLEMENTING AN INTERVENTION STRATEGY

Having read about the different food and nutrient based strategies, the crucial question that needs to be addressed next is, which of these strategies, is the most appropriate. Well, this is a difficult question to answer. As mentioned ea lier, there is really NO ONE-SIZE-FITS-ALL STRATEGY. Several *approaches* exist, as we now know, and are also highlighted in Table 12.3, to prevent and treat malnutrition, each with its own strengths and limitations (refer to Table 12.4), but which are highly effective if applied in complementary ways. The appropriate mix of interventions will depend on the specific context.

Table 1123: Approaches to prevent micronutrient deficiencies

	Dietary diversification	Food fortification	Supplementation	Public health measures
Iodine deficiency disorders	Sea foods Reduce goitrogens	Salt Water Baby foods Condiments Flour Milk	Iodized oil Potassium iodide tablets	Legislation Enforcement Salt monitoring Primary health care
Vitamin A deficiency	Green leafy Vegetables Orange Fruits/vegetables Red palm oil Aminal foods Breast milk	Sugar **Salt** Milk powder Baby foods Condiments	Administration of tnassive or small doses	Prevention of infections: – immunization – antiparasitics – environmental health
Anaemia	Green leafy Vegetables Pulses Fruits/vegetables (vitamin C) liver, red meat Avoid tea/coffee with meats	Salt or Cereal Flour Condiments	Iron/folate tablets Parenteral iron	Prevention of infections – Immunization – Antiparasitics – Environmental health

There arc several points which need to be considered in selecting/implementing an intervention strategy. These are illustrated next:

- *Epidemiologic considerations*:
  - prevalence of the specific micronutricnt deficiency
  - severity of the specific micronutrient deficiency
  - geographic extent/clustering of the micronutrient deficiency
  - specific groups or subgroups affected
  - cause of the deficiency (single, multiple)
- *Level of country development*: This aspect for example will influence the selection of strategies like food fortification which entails that food processing facilities, preferably centralized, must exist.
- *Capacity of country to implement and sustain the intervention*
- *Cultural considerations*
  - typical diet
  - symbolic, ceremonial meaning of food/meals

Circumstances in which the various interventions may be appropriate in conjunction with advantages and disadvantages of the main interventions are presented in Table 12.4.

Table 12.4: Interventions - appropriateness, advantages and disadvantages

Intervention	Appropriate for:	Advantages	Disadvantages/ Challanges
Supplementation	Therapeutic treatment Prevention programmes (target groups)	Timely Sustainability	More costly than other measures Narrow scope of coverage
Fortification	Prevention (Universal)	Highly cost-effective Wide coverage Sustainable	Requires participation of food industry Does not lead to awareness building and changes in wider dietary habits
Dietary Diversification	Prevention (Universal)	Highly cost effective Wide Coverage Sustainable	Requires changes in eating behaviour Requires economic development to be feasible Require change in agricultural policies

An important advantage of food-based strategies is that foods provide many micronutrients simultaneously. Food-based approaches (i.e. fortification and dietary diversification) have the additional benefit of integrating micronutrient control programmes, and interactions are avoided between potentially concentrated-dose supplements. *The long-term goal of intervention should he to shift away from supplementation* (which may be appropriate in the short-term for dealing with severe deficiency) toward a *combination of food fortification and dietary diversification.* In other words, as the prevalence and level of severity for a given deficiency decreases, in a population the interventions should favour food-based approaches.

Having gone through the strengths and limitations, you would agree that an appropriate combination of interventions depending on the specific context should be considered. Although, the three major micronutrient deficiencies have many different causes and potential solutions, opportunities exist to coordinate micronutrient deficiency control programmes.

The advantages of programme coordination include:

- reductions in costly duplication,
- avoidance of unconstructive competition for funding (for example, joint grant applications may increase the likelihood of obtaining funding for all programmes),
- opportunity for combined information, education and communication efforts.
- opportunity for holding joint training sessions, and
- an increased likelihood of reaching policy makers with effective messages.

However, to be efficient and effective, strategies must incorporate a means of programme monitoring such that ongoing feedback occurs and programmes are improved in response to feedback.

Check Your Progress Exercise 3

1. "Supplementation as a short term strategy is effective to combat malnutrition". Comment on the statement giving appropriate justifications.

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2. Enumerate the limitations of adopting supplementation as a strategy to combat malnutrition.

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3. What points would you consider in selecting/implementing an intervention strategy?

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1126 LET US SUM UP

Various strategies can be adopted for the prevention of public nutrition problems prevalent in our country. In this unit we studied about the food-based and the nutrient based strategies to prevent malnutrition. Among the food based strategies, diet diversification, fortification, horticulture intervention, as well as, nutrition and health education were covered. We studied that these food based strategies are the most cost effective means to tackle the public health problems and are in fact the long term measures. As compared to the food based strategies, supplementation is the medicinal approach, to combat the public nutrition problems. Supplementation as a short term strategy to prevent micronutrient deficiency particularly, iron and vitamin A deficiency, is most common in many countries. But, it bas various limitations. Therefore when we talk about strategies, an appropriate combination of interventions, namely diet diversification, fortification, horticulture intervention, nutrition and health educatian, supplementation may be considered, depending on the specific context.

12.7 GLOSSARY

Intramuscular Injection : Injection of medicines into muscle for treatment of disease.

Malnutrition : Condition occuring due to deficiency or excessive intake of nutrients.

12.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. The strategies which can be adopted to achieve the goal of improving nutritional status are:

   - Diet/ Food based strategies viz. dietary diversification/ modification, food fortification, horticulture intervention, nutrition, health education.
   - Nutrient: based strategy i.e. distribution of vitamin and mineral supplements.
   - Immunization programme in the context of prevention of public nutrition programmes.
   - Supplementary feeding programmes.
   - Improving the quality of food produced by genetic approaches.
   - Clean water and sanitation as a strategy to combat public nutrition problems.
   - Improving food and nutrition security.

2. Food based strategies are preventive and comprehensive a that etnploy food (i.e. whole, refined form, processed, fortified or a combination) as a tool to overcome micronutrient deficiency,

The benefits of food-based strategies include:

- They are preventive, cost effective and sustainable.,
- They can be adapted to different cultural and dietary traditions and are locally feasible.
- As they are broad based, aiming to improve overall quality of the diet of a population, they can address multiple nutrient deficiencies simultaneously.
- Since the amount of nutrients consumed are within normal physiological levels, the risk of toxicity is minimized.
- Food-based strategies support the crucial role of breast feeding and the special diet and care needs of infants and young children.
- Food based approaches foster the development of sustainable, environmentally sound food production systems. Agricultural planners are alerted to the need to protect the micronutrient content of soils and crops.
- Food-based strategies build partnerships among government, consumer groups, the food industry and other organization to achieve the shared goal of overcoming micronutrient malnutrition.

3. The role of dietary diversification is to ensure that individuals get essential nutrition in sufficient amounts through their daily diet. Better selection or preparation of food so as to enhance intake or broad availability of these nutrients is the primary goal of this approach.

4. Home gardening is an effective food based strategy and if implemented effectively, it can have an impact on community development in health and nutrition. Home gardening as a strategy, is limited to combat vitamin A deficiency as vitamin A/ carotene rich green-leafy vegetables cultivation can be promoted through this method.

Check Your Progress Exercise 2

1. Food fortification is defined as the addition of one or more essential nutrients to a food, (whether or not it is normally contained in the food) for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups e.g. addition of iron to fortify cornflakes.

2. According to Harris, the six distinct philosophies of food fortification are:

   1. Fortification for restorations to normal level.
   2. Fortification above normal level.
   3. Enrichment with public health objective.
   4. Enrichment of 'substitute' foods to equivalent nutrient level.
   5. Fortification to make a food complete in itself,
   6. Addition of nutrient for non-nutritional purposes.

3. The basic points one needs to keep in mind are:

   a) There should be a demonstrated need for a nutrient in one or more population groups.

   b) Food selected as a vehicle for the nutrients must reach the population at risk.

c) The amount of nutrient added to food, will supply adequate intake when the food is consumed in normal amounts by the population at risk.

d) The amount of nutrient added will not be toxic or harmful to individuals with a high intake of the fortified foods.

e) The nutrient is biologically available in the form in which it is added and is stable, in the food selected as vehicle.

f) The food selected does not seriously interfere with the utilization of the nutrient.

g) Addition of the nutrient has no detrimental effect on flavour, shelf life, colour texture or cooking properties of the food.

h) Fortification is technically feasible for the particular food.

i) The cost of fortification does not result in a significant change in the cost of food. A method of controlling and/or enforcing the level of fortification available.

4. Nutrition communication should be able to convey information, persuade individuals to consume food rich in micronutrients, choose fortified foods and prepare food in new ways to protect their nutrient content. Further, nutrition communication can help in developing necessary skills and motivate people to make lifestyle changes.

Check Your Progress Exercise 3

I. Supplementation especially short-term, is beneficial in combating malnutrition. This is aptly justified as short term supplementation show compliance from the community, foregoing economic constraints and the impact is maximum during a short term strategy. E.g. administration of folifer tables during the course of pregnancy has seen a marked improvement in haemoglobin levels. However, long term use has seen lack of compliance, GI disturbances and hence discontinuation of its use.

2. The limitations of adopting supplement as a strategy to combat malnutrition are:

- It is an expensive strategy compared with other interventions
- It has a narrow scope of coverage in a population
- Long term intervention is nut effective and impactful lending to non-compliance.

3. The points one would consider in selecting implementing an intervention strategy are:

- Epidemiological considerations
- Level of country development
- Capacity of country to implement and sustain intervention
- Cultural considerations