Biography, Panel Member

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Dr. Vinodini Reddy is the former Director of the National Institute of Nutrition in Hyderabad, India. She has been engaged in nutrition research for over 30 years and published nearly 200 papers in various scientific journals in India and abroad.

After acquiring her M.D. in Pediatrics from Osmania University, Hyderabad, in 1965, Dr. Reddy went abroad for a year for further studies in Gastroenterology and Nutrition at the Harvard Medical School in Boston. After her return to India, she worked at the National Institute of Nutrition for over three decades and served as its Director from 1988 to 1995. She has contributed significantly to the development of the institution, which is recognized as a leading center of nutrition research and training in the world. She has been serving as Visiting Professor at the Johns Hopkins University, School of Hygiene and Public Health, in Baltimore, Maryland, since 1995.

Dr. Reddy has done extensive research on various nutritional problems in children, particularly protein energy malnutrition and micronutrient deficiencies. Her studies on vitamin A have led to the development of national programs for prevention of nutritional blindness in children. She has received a number of awards and prizes including the Dr. B.C. Roy National Award and the Dr. Kamala Menon Medical Research Award. Her work has also received international recognition, as she was awarded the prestigious Friesland World Prize.

Dr. Reddy is a Fellow of all of the leading academies in India and also a Fellow of the International Union of Nutritional Sciences. She has served on several expert committees of WHO and FAO, and is currently the Vice President of International Union of Nutritional Sciences (IUNS) and a member of the steering committee of International Vitamin A Consultative Group.

PREVENTION OF MICRONUTRIENT DEFICIENCIES — THE NEED FOR A FOOD-BASED APPROACH

By Vinodini Reddy, M.D., DCH, FNA, FIUNS

Micronutrient deficiencies (MND) are among the most prevalent problems of nutrition worldwide. Over 2 billion people, or one-third of the world's population, are at risk of poor health and premature death because of these deficiencies. The three major problems of public health concern are vitamin A, iron and iodine deficiencies, although deficiencies of other micronutrients such as folic acid, riboflavin, zinc and calcium are also prevalent in many developing countries. Women and children are more vulnerable because of their added requirements for reproduction and growth. In recent years, growing awareness of the serious magnitude of the problem and its impact on health and development has accelerated the intervention efforts at the national as well as international levels. This paper presents an overview of the problem, including the causes and consequences of MND and the strategies for their prevention, with the main focus on food-based approaches as a long-term sustainable solution.

A. Major Problems

1. Vitamin A Deficiency (VAD)

Vitamin A deficiency has long been recognized as a significant health problem because of the ocular consequences. Milder forms of xeropthalmia manifest as Bitot's spots and night blindness, while severe deficiency affects the cornea, resulting in permanent blindness. Although the severe forms of blinding malnutrition have shown a significant decline in the past two decades, milder grades of deficiency are still widespread. According to the WHO estimates, a total of 250 million children suffer from VAD and over 3 million have clinical signs with a serious risk of blindness and early death.

Most of the earlier studies focused on ocular changes in VAD since the major concern was the resultant blindness. Recent evidence suggests that even subclinical deficiency is associated with increased risk of morbidity and mortality, adding a new dimension to the problem. A study conducted in Indonesian children showed that vitamin A supplementation could reduce mortality in children by about 30 percent. This has led to a number of intervention trials in Asia and Africa, which confirmed the mortality reduction with vitamin A, although two

studies failed to show any effect. The impact of vitamin A may vary in different regions, depending on the extent and severity of vitamin A deficiency, associated protein energy malnutrition, infection rates and access to health care, all of which are important determinants of child health and survival.

2. Iron Deficiency Anemia (IDA)

Conservative estimates indicate that 1,500 million people are anemic worldwide, and a majority of them are in South Asia and Africa. Iron deficiency is the major cause of anemia, although associated folate deficiency is an important contributory factor in some areas. Anemia is more prevalent among women of reproductive age and young preschool children. Hemoglobin surveys indicate that more than half the pregnant women are anemic in South Asia, over 80 percent in some countries like India.

Severe anemia in pregnancy is associated with increased maternal mortality and fetal wastage. In addition, low birth weight and high perinatal mortality have been attributed to maternal anemia. There is evidence that even moderate anemia can lead to functional changes. These include lower resistance to infection, reduced work capacity and impaired mental function Anemic children have lower attention span and poor scholastic performance. Studies in plantation workers in Indonesia showed that anemia was associated with low work output, and iron supplementation resulted in a significant improvement. Thus IDA can have a profound impact on national health and productivity.

3. Iodine Deficiency Disorders (IDD)

Goiter is the most visible sign of iodine deficiency and is commonly used for assessment of the problem in a population. In 1991, the WHO estimated that about a billion people are at risk of iodine deficiency and 250 million are affected by goiter or cretinism. Recently the cut-off level of goiter prevalence has been reduced from 10 percent to 5 percent for assessing the public health significance. Reassessment of the problem in 1993 showed that iodine deficiency is a significant public health problem in 118 countries and over 1,500 million people are at risk.

Apart from goiter, iodine deficiency leads to a wide range of health consequences which are collectively described as iodine deficiency disorders. Severe deficiency during pregnancy leads to fetal wastage and cretinism with irreversible brain damage in infants. Milder forms of deficiency affecting child growth and mental development are relatively more common. Studies in endemic areas have shown that school children have low IQ levels and poor scholastic performance. Iodine deficiency is recognized as the most common cause of preventable intellectual impairment in the world today. In adults, goiter can be easily detected, but the impact of subclinical deficiency often remains unrecognized. Most people in endemic areas are lethargic and difficult to educate or motivate to work. Follow-up studies have shown a significant improvement in productivity following iodine supplementation. Thus, iodine deficiency can have a profound impact on community development.

B. Causes of MND

Except for iodine, which is largely an environmental problem resulting from iodine-deficient soil/water, inadequate diet is the primary cause of MND in developing countries. This has two components — low intake of nutrient-rich foods and poor bioavailability of specific nutrients from the habitual diets. Animal foods are, in general, good sources of micronutrients, but their consumption is low in developing countries because of the high cost and limited availability. Meat is the best source of absorbable iron, but most of the dietary iron is derived from cereals and vegetables, from which the absorption is less than 5 percent. Milk and eggs are good sources of preformed vitamin A, but a majority of the population rely on plant sources of its precursor. Green leafy vegetables, yellow/orange vegetables and fruits are rich in B-carotene. However, consumption of these foods is low due to lack of knowledge and seasonal availability. Bioavailability of dietary carotenoids is influenced by a number factors including the choice of vegetables and method of preparation, as well as other dietary components. Dietary fat is important for carotene absorption, but the fat intake is low in poor communities. High prevalence of infections and intestinal parasites further aggravate VAD, while hook worm and malaria are important causes of IDA in some areas.

C. Intervention Strategies

Although micronutrient programs have been in operation for the past several years, they gained momentum following the International Conference on Nutrition (1992), where representatives of 159 countries agreed to eliminate VAD and DD by the end of this century and to substantially reduce the prevalence of IDA. The four key strategies are supplementation, food fortification, nutrition education and dietary diversification.

1. Supplementation

Periodic high-dose vitamin A supplementation has been suggested as a short-term measure to reduce VAD in preschool children, until such time that dietary improvement could be achieved. However, the program has continued for more than two decades in some countries like India and Bangladesh, and no serious efforts have been made to improve the diets until recently. National coverage of all preschool children with vitamin A has been

hard to sustain over time and often does not reach the children who are at risk. Currently, vitamin A supplementation is linked with immunization to improve the coverage.

Iron supplementation has been the traditional approach to prevent anemia, particularly in pregnant women. In India and other countries where associated folate deficiency is common, a combination of iron and folate supplements is being given. But the evaluation studies show little impact on the prevalence of anemia due to inadequate coverage and poor compliance. Poor impact is also attributed to inadequate supplies, irregular distribution and other logistic problems. Recently, alternate strategies of intermittent dosage schedule (one or two doses per week) have been suggested to encourage compliance. However, even in controlled supplementation trials where consumption of daily or weekly supplements was ensured, a significant proportion of women remained anemic. The possible role of other micronutrients such as zinc, riboflavin, and other B vitamins needs to be considered.

2. Food-based approaches

It is now recognized that increasing the production and consumption of nutrient-rich foods is the only long-term sustainable strategy to eliminate MND. There are many reasons for a food-based strategy in preference to nutrient supplementation. VAD or IDA rarely occur in isolation. Populations suffering from these deficiencies also have other MND and varying degrees of PEM. Natural foods provide several nutrients that can overcome multiple deficiencies. For example, GLV supply not only B-carotene but also folate and vitamin C, which can improve the absorption of dietary iron. A wide range of natural foods are fortunately available in many areas where MND are prevalent. Low bioavailability does not detract from the value of natural foods as a source of nutrients.

Food fortification: Fortification is considered to be the most cost-effective approach to combat MND. Fortification of foods has been practiced in industrialized countries for many years with considerable success. Iodization of salt has proved to be successful in controlling IDD in both developed and developing countries. Indian experience shows that iron-fortified salt is effective in reducing anemia. Since IDA and IDD often co-exist, simultaneous fortification of salt with iron and iodine is the most cost-effective way to combat the twin problems of public health concern. The technology for double fortification of salt is also available now. Vitamin A fortification of sugar has been successful in improving the vitamin A status of the population in Guatemala and other Latin American Countries. Other examples are vitamin A fortification of margarine in the Philippines and monosodium glutamate, a flavoring agent, in Indonesia. In some countries like Venezuela, staple foods are fortified with multiple micronutrients. The level of fortification depends on the amount of food consumed and the extent of deficiency in the diet. But in many developing countries where such foods are grown and processed locally, fortification becomes difficult. Quality control and safety are other issues that need to be considered in developing a fortification program.

Dietary diversification: Eating a variety of nutritious foods is the most natural way of obtaining the nutrients required for health. Although micronutrients are found abundantly in many plant foods and animal products, poor people may not have access to them. So the first step is to increase the availability of micronutrient-rich foods through horticultural approaches. Recent experience in Bangladesh has demonstrated that promotion of home gardens increased the availability of vegetables at the household level and this was accompanied by increased intake of micronutrients.

Apart from low intake, low bioavailability of micronutrients from the habitual diets based on cereals and vegetables is an important factor contributing to MND. Nevertheless, dietary diversification, with appropriate combination of foods, can improve the bioavailability. For example, consumption of fruits containing vitamin C can improve the absorption of dietary iron, while increasing the fat intake will improve bioavailability of dietary carotenoids. Intervention programs designed to promote the consumption of vegetables and fruits should also emphasize appropriate methods of cooking and storage to preserve the micronutrient content.

Nutrition education: Although poverty is a major determinant of food selection, micronutrient intake is not always related to the income status. Even better off families sometimes choose foods with little nutritive value due to dietary habit or convenience. Nutrition education is the key to the success of micronutrient programs. Past experience shows that traditional methods of education are not very effective. There is a need for innovative methods of communication to motivate people and change dietary practices. Recently, social marketing strategy has been successfully used in Thailand and Indonesia to promote home production and consumption of micronutrient-rich foods.

Conclusion

Micronutrient deficiencies are widespread in many parts of the world, despite being preventable. Vitamin A, iron and iodine deficiencies are the major public health problems, although deficiencies of other micronutrients such as zinc, calcium, folate and riboflavin co-exist in many populations. Inadequate

diet is the primary cause of these deficiencies. The three main complementary strategies are supplementation, fortification and dietary diversification. Although supplementation is an effective intervention, it is only a short-term measure to reduce the deficiency, while a food-based strategy is the most effective long-term sustainable solution. Micronutrients can be obtained from a whole range of inexpensive local foods. There is a vast potential for further augmentation of their production. It would be extremely short-sighted and imprudent not to put these valuable indigenous resources to proper use.

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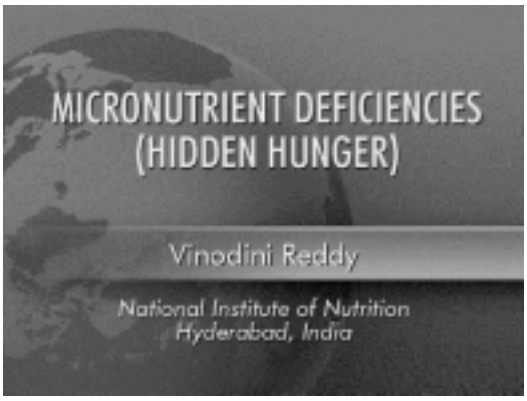

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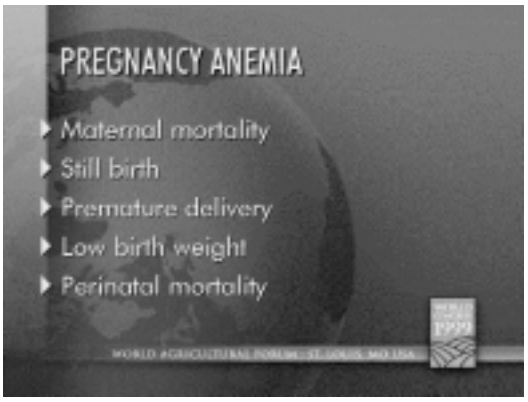

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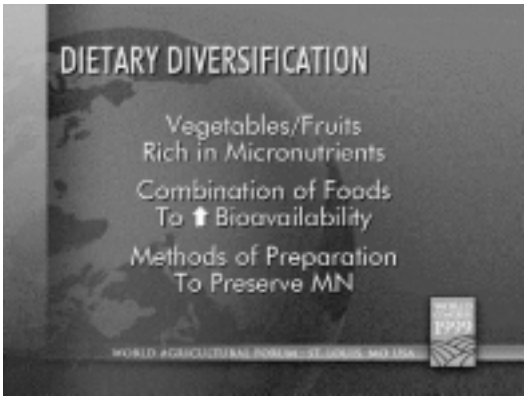

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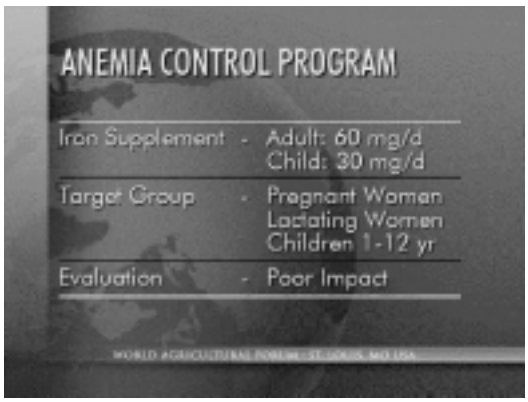

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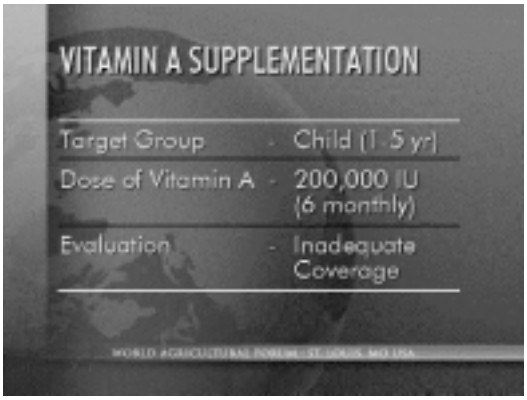

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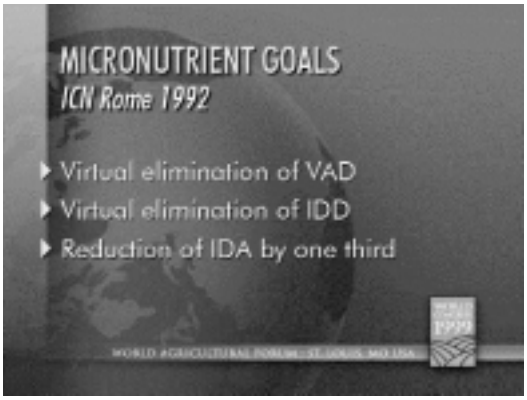

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