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Control of Micronutrient Deficiencies in India: Obstacles and Strategies

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Micronutrient deficiencies of vitamin A, iron, and iodine continue to be of public health significance in India. The government of India initiated national programs to prevent, control and combat these deficiencies and their serious consequences. The interventions involved (1) distribution of iodized salt in the endemic areas, (2) administration of semiannual massive dose of vitamin A to young children, and (3) distribution of iron–folic acid tablets to the vulnerable groups. Evaluations revealed that the biologic impact of these interventions was unsatisfactory. Inadequate allocation of funds (10% of the actual needs) necessary to cover the enormous number of beneficiaries was one of the important obstacles. Consequently, the allocation of supplies to different provinces was far short of the requirements (10–30%). As a result of poor orientation, the functionaries were not adhering to the guidelines, leading to woefully inadequate (1–20%) and irregular coverage. There was no proper monitoring or supervision to make midcourse corrections to improve the functioning. The community was not informed of the purpose and details of each intervention. Hence, it did not utilize the resources completely and remained passive recipients. The community was not aware of the dietary approaches to prevent micronutrient disorders owing to absence of nutrition education. With the adoption of National Nutrition Policy by the government of India, a concerted and focused approach should be adopted. The future strategies should include a mix of short-term supplementation and food-based strategy encompassing food fortification and home gardening. Innovative approaches in information, education, and communication (such as social marketing strategy) for making the interventions sustainable should be adopted.

Deficiencies of micronutrients such as vitamin A, iron, and iodine continue to be of public health significance in India.[1] Though over the years the prevalence of corneal xerophthalmia (X2 and X3) declined, the proportion of both milder clinical forms (X1A and X1B) and subclinical forms (low serum vitamin A), especially in preschool children, are still above the WHO criterion[2] calling for public health intervention. The extent of nutritional anemia among pregnant women and adolescent girls in India remains as high as 70–80%. In the case of iodine deficiency disorders (IDD), about 200 million people in India are estimated to be at risk. More importantly, newer IDD endemic areas are being identified, south of the hills of Vindhyas.[3] Although zinc deficiency also has been receiving a lot of attention, there is, as yet, no systematically collected information in different parts of the country. The deficiencies of folic acid and riboflavin are also of significance.

Consequences of Micronutrient Deficiencies

Severe forms of vitamin A deficiency (VAD) lead to nutritional blindness in young children, while even milder forms of the deficiency increase not only the risk of respiratory tract infections and diarrhea in young children, but also mortality.[4,5] The consequences of severe nutritional anemia are increased maternal mortality and adverse pregnancy outcome, reduced resistance to infections, altered mental function in children leading to decreased scholastic performance, and reduced work output. The role of folic acid supplementation in preventing neural tube defects has also been well recognized. IDD causes a wide spectrum of disorders such as abortions, still births, low birth weight, cretinism, neonatal chemical hypothyroidism, psychomotor defects, poor scholastic performance, and low IQ in school children. Unlike either VAD or iron deficiency anemia (IDA), IDD is due to environmental deficiency of iodine in the

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soil, particularly in the hilly and mountainous regions in the country.

Micronutrient Control Programs in India

Several programs have been in vogue in India for more than 30 years for prevention and control of micronutrient malnutrition. India was, perhaps, the first country to initiate, in 1970, a national program of administration of a semiannual massive dose of vitamin A (200,000 IU) to prevent nutritional deficiency blindness in children between 1 and 5 years of age.[6] The program is sponsored by the government of India and implemented by the health functionaries of the subcenters and primary health centers of the respective state governments. The National Nutritional Anemia Control Program, consisting of distribution of 100 tablets of iron and folic acid to pregnant and lactating women (iron: 60 mg + folic acid: 500 μg) and children (iron: 20 mg + folic acid: 100 μg) has been in operation for about 30 years.[7] Distribution of iodized salt (iodine: 15 ppm) as a part of national IDD control program has been in operation in India since 1961. In this communication, an attempt has been made to review these programs with particular respect to the constraints and obstacles and indicate the possible strategies to control micronutrient malnutrition.

Enormity of Numbers

India is the second largest country in the world, with a total population of about one billion. Consequently, the number of beneficiaries in any nutrition program would be enormous. The number of children under the age of 5 years would be about 90–100 million, all of them requiring administration of a semiannual dose of vitamin A. Similarly, the number of pregnant and lactating women, the beneficiaries of the national nutritional anemia control program, would be about 65 million. Thus, it would be a stupendous task to reach this segment regularly all over the country, particularly in some inaccessible regions of the country.

Inadequate Allocation of Funds

India, being a large country, requires huge investments for any direct nutrition intervention. At present, the investments are about 10% of the actual requirements[8] (Table 1).

Table 1. Investments in Nutrition Interventions in India (in millions of Rs*)

Vitamin A deficiency (preschool)	2100
Iron and folate supplementation (pregnant women)	1700
Universal iodization of salt	3300
Total cost projections for 2000	7100
Total current allocations	700–800
Deficit	6300–6400

* US$ = Rs 44.50.

Evaluation of National Programs

An evaluation of the national prophylaxis program against blindness due to vitamin A deficiency in different states indicated that there was evidence of reduction in VAD only in a third of the areas surveyed.[9] Similarly evaluation of National Nutrition Anemia Control Program[10] and IDD control program indicated that the implementation of the program was unsatisfactory resulting in poor or no biologic impact.[11] The absence of biologic impact was mainly due to a large number of logistic problems rather than technical failure of the interventions.

Constraints and Obstacles

Inadequate Supplies

In general, inadequate quantities of micronutrient supplements are allocated for each program. In the case of vitamin A, though the requirements to cover all the eligible children in the country would be about 80–90 million, the allocation is adequate to cover only about 30–35 million, which would cover less than 50% of the eligible children. In other words, even if these were distributed effectively, the impact would have been very poor. In the case of the anemia control program, while the requirements of IFA tablets are about 5.5 billion per year to cover all the eligible groups, only 10% of the actual need is provided.

Poor Outreach

Surveys carried out in different states of the country reveal that only about 25% of preschool children received at least two doses of vitamin A during the previous year. In the case of distribution of iron and folic acid tablets, the coverage of eligible beneficiaries was woefully inadequate (pregnant women: <20% and children: <1%). It was therefore natural that there was no biologic impact of these programs even after about 10 years.

Irregular Distribution

Interestingly, coverage of beneficiary children reduced with every subsequent dose of vitamin A. Consequently, the proportion of children who had received more than three doses was 6%, though the coverage for two doses was about 25%. In the case of iron and folic acid tablets, the proportion of pregnant women who had received >90 tablets was <5%. The beneficiaries reported that they did not receive the next supply of IFA tablets after the first round of distribution of 30 tablets to each pregnant woman.

Table 2. Micronutrient Control Programs: Obstacles and Constraints

Supplies	Infrastructure	Community
Inadequate allocation of funds	Personnel not properly oriented	Unprepared
Inadequate supplies	Functionaries ignored guidelines	No active involvement, passive receivers
Irregular supplies	No monitoring and supervision	Poor use of resources
Difficulties in transportation	No nutrition education	Not aware of dietary approaches of prevention

Lack of Orientation for the Functionaries

No specific orientation sessions were held for the functionaries before initiating any intervention program. The health functionaries involved in the program did not follow the guidelines provided by the department. They were not even aware of all the beneficiaries in each program. For example, many of the workers did not know that children were also beneficiaries under the iron–folic acid distribution program. In the case of vitamin A mega-dosing, two specific months are fixed in a year for semiannual distribution of vitamin A, to avoid interference with other health activities. However, the distribution was being done all through the year.

Absence of Community Participation

The community was not prepared or informed before launching any program. As a result, the community was not aware of the purpose and the benefits of the interventions. The communities were not involved in any aspect of implementation and remained passive recipients. Consequently there was certain indifference by the community for any intervention, though acceptance of these programs was satisfactory.

Absence of Nutrition Education

One of the weakest links of nutrition intervention programs is absence of nutrition education. The community was neither aware of the purpose of the intervention nor were they educated about the dietary approaches to control micronutrient malnutrition. The functionaries routinely distributed the micronutrients without explaining to the community the "what and why" of the program or the dietary means to deficiencies.

Nonutilization of Resources

Because of the high rate of illiteracy, the community, particularly females (61%), did not make proper use of the resources. As a result of ignorance about the relationship between diet and disease, the community adopted several deleterious dietary practices. For example about 51% of the mothers discarded the nutritionally rich colostrum and were not feeding green leafy vegetables, an inexpensive and rich source of beta-carotene, to young children, because of the fear that it would lead to diarrhea.

Absence of Monitoring and Supervision

Unfortunately, there is no effective monitoring system for any of the intervention programs that would allow timely actions to make midcourse corrections. The Medical Officers of the Primary Health Centers do not seem to attach much importance to these interventions and consequently, there is no follow up either during the field visits or during the regular monthly meetings.

Thus, the obstacles in the interventions could be summarized as indicated in Table 2.

Future Strategies

The government of India has formulated a National Nutrition Policy (NNP),[12] and a National Plan of Action on Nutrition[13] was also finalized. These provide for multisectorial coordinated direct and indirect interventions to achieve nutrition goals set under the NNP. However, this calls for a concerted approach by different sectors involved. The future strategies are summarized in Table 3.

Alternative strategies of delivery systems, like linking vitamin A distribution with universal immunization and the integrated child development scheme (ICDS)[14] that has been recently introduced, should be pursued. While studies in Indonesia showed that such a linking had interfered with measles seroconversion,[15] the studies at Hyderabad actually revealed the beneficial effects of such an approach.[16] The role of national and provincial governments, nongovernmental organizations, and the international agencies is crucial in this endeavor. The studies in India indicated that social marketing approach was not only feasible, but actually increased awareness and practice among the community.[17] The National Institute of Nutrition successfully demonstrated the feasibility and effectiveness of home gardening programs[18] in encouraging production and consumption of vitamin A foods to make the program sustainable. Recent experiments to adopt weekly supplementation of iron have not provided any conclusive evidence that this approach will be effective and superior to the existing program. The feasibility and the impact of fortification of edible salt with iron have been demonstrated in a multicentric study in India.[19] In addition, an effective nutrition education program can only increase the regular consumption of foods rich in iron and folic acid by all the members of the

Table 3. Future Strategies to Combat Micronutrient Malnutrition

Aspects	Approaches
Advocacy	Sensitization of politicians and policy makers
Mission approach	Government-directed multisectorial integrated crash programs
Mix of strategies	Implementation of supplementation programs and food- and health-based programs
Household nutrition security	Horticulture and home gardening
Creation of awareness and behavioral changes	Adopting innovative social marketing strategies for IEC
Fortification	Fortification of edible salt with iron and iodine; research on identification of newer foods for fortification
Uncommon foods	Use of red palm oil and spirulina
Primary health care	Immunization, treatment of acute respiratory infections, measles, and diarrhea and deworming

family, particularly the high-risk adolescent girls. Since IDA is also widely prevalent in all the IDD endemic areas, fortification of edible salt with both iodine and iron (double-fortified salt or DFS) could be a simple solution. Community trials and studies in Hyderabad indicated the feasibility of such a program and the acceptance of it by the community.[20] The role of DFS with reference to IDA appears to be more to prevent anemia than to increase the levels of hemoglobin. There is a need to make the program a national strategy because of the public health significance of anemia and IDD in the country. A comprehensive, holistic, and multisectoral approach could only counter the challenge posed by micronutrient malnutrition.

1. Vijayaraghavan K. Strategies for control of micronutrient malnutrition. Indian J Med Res 1995;102:216–22
2. World Health Organization Expert Group. Control of vitamin A deficiency and xerophthalmia. Tech. Rep. Series No.672. Geneva: WHO, 1982
3. Hetzel BS. The story of iodine deficiency—an international challenge in nutrition, 2nd ed. New York: Oxford University Press, 1991
4. Sommer A, Tarwotjo I, Hassain G, Susanto D. Increased mortality in children with mild vitamin A deficiency. Lancet 1983;2:585–8
5. Sommer A, Katz J, Tarwotjo I. Increased risk of respiratory disease and diarrhoea in children with prevailing mild vitamin A deficiency. Am J Clin Nutr 1984;40:1090–5
6. Ministry of Health and Family Welfare, Government of India. Prevention and treatment of vitamin A deficiency. New Delhi: Ministry of Health and Family Welfare, Government of India, 1991
7. Ministry of Health and Family Welfare, Government of India. Policy on control of nutritional anemia. New Delhi: Ministry of Health and Family Welfare, Government of India, 1991
8. Administrative Staff College of India. National strategy to reduce childhood malnutrition. Hyderabad: Administrative Staff College of India, 1997
9. Vijayaraghavan K, Rao NP. An evaluation of the National Prophylaxis Programme against Blindness due to Vitamin A Deficiency. Nutr Rep Intl 1982;25: 431–41
10. ICMR Taskforce. Evaluation of the National Nutritional Anaemia Control Programme—a study. New Delhi: Indian Council of Medical Research, 1989
11. Gopalan C. National Goitre Control Programme—a blueprint for its intensification. Nutrition Foundation of India Scientific Report No. 1. New Delhi: Nutrition Foundation of India, 1983
12. Ministry of Human Resource Development, Government of India. National Nutrition Policy. New Delhi: Department of Women and Child Development, 1993
13. Ministry of Human Resource Development, Government of India. National plan of action on nutrition. New Delhi: Food and Nutrition Board, Government of India, 1995
14. Vijayaraghavan K, Brahmam GNV, Gal Reddy CH, Reddy V. Linking periodic dosing of vitamin 'A' with universal immunization programme—an evaluation. Technical Report. Hyderabad: National Institute of Nutrition, 1996
15. Semba RD, Musasir Z, Bealer J, et al. Reduced seroconversion to measles in infants given vitamin A with measles vaccination. Lancet 1995;345:1330–2
16. Bhaskaram P, Rao KV. Enhancement in sero-conversion to measles vaccine with simultaneous administration of vitamin A in 9 months old Indian infants. Indian J Pediatr 1997;64:503–9
17. Uma Nayak M, Vazir S, Vijayaraghavan K. Prevention of vitamin A deficiency—social marketing approach. Nutrition News 1999;20:1–4
18. Vijayaraghavan K, Uma Nayak M, Ramana GNV, et al. Home gardening for combating vitamin A deficiency in rural India. Food and Nutrition Bulletin 1997;18:337–43
19. Use of common salt fortified with iron in the control and prevention of anaemia. Report of the Working Group on Fortification of Salt with Iron. Am J Clin Nutr 1982;35:1442–51
20. Brahmam GNV, Nair KM, Laxmaiah A, et al. Community trials with iron and iodine fortified salt (double fortified salt). Proceedings of 8th World Salt Symposium. 2000;1:955–60