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## Micronutrient Malnutrition In SAARC – The Need For A Food-based Approach

C. Gopalan

The countries of South Asia which constitute SAARC (South Asian Association for Regional Cooperation), account for over 22 per cent of the world's population. These countries are India, Pakistan, Bangladesh, Sri Lanka, Maldives and Nepal.

Recent international reports<sup>1,2</sup> have presented a rather depressing picture of the economic, social, and health/nutritional status of several countries in this region. While the deficiencies stated in these reports will not be denied, it is important not to lose sight of the remarkable successes these countries have achieved during the last few decades despite formidable challenges. Practically, all these countries had emerged from long colonial rule barely 50 years ago with a heavy backlog of under development; indeed they are not, as yet, totally free from the legacies of their colonial past and from the effects of the inequitable world economic order of the present. Despite tremendous population growth over the last 50 years, they have been able to stave off the acute large-scale famines that devastated them at frequent intervals in the past. The Green Revolution which they had successfully engineered had, at least, ensured that food-grain availability kept pace with population growth – no mean achievement.

At the time of their political independence 50 years ago, these countries were a veritable museum of the most florid clinical forms of malnutri-

tion. Classical kwashiorkor, keratomalacia, beri beri (cardiac, dry and peripheral neuropathies) and pellagra were widespread as major public health problems. These florid nutritional deficiency diseases have now ceased to be the major public health problems that they were in the past. As one engaged in the study of nutrition problems in the region for over 50 years now, indeed, almost from the days of the Bengal Famine, I have been witness to this remarkable change in the clinical nutrition scene in this region<sup>3</sup>.

The manner in which this remarkable change has been brought about, carries an important message. The control of these diseases was not brought about through narrow vertical programmes consisting of the distribution of synthetic vitamins, drugs, or special formulations, but through improvements in the traditional diets of the people, and through parallel improvements in their socio-economic and health status.

Thus, the once rampant cardiac and dry beri-beri and peripheral neuropathies were not eliminated through the distribution of thiamine pills; pellagra in the Deccan plateau was not brought under control through the distribution of nicotinic acid tablets; kwashiorkor was eliminated as a public health problem not through the distribution of fish protein concentrates, strongly advocated by the Protein Advisory Group and associated Bureaus of Commercial Fisheries of some

important 'developed' countries, but by combating calorie deficiency and improving the diets of pre-school children using their traditional diets.

Most importantly, keratomalacia as a public health problem was substantially overcome not through the use of massive doses of synthetic vitamin A. I was instrumental in introducing the massive vitamin A dose prophylaxis programme approach in nine states of the Indian Union more than 25 years ago, long before IVAAG and the present votaries of this approach ever came into being. I recommended this step in the context of hyperendemicity of keratomalacia in some parts of India then, to be used only for children between one and three years of age, as a purely temporary measure. I did not advocate its use in pregnancy, lactation and infancy. I can now testify to the fact that the implementation of the massive vitamin A dosage prophylaxis programme was extremely poor, and reductions in keratomalacia were achieved in the 1970s and 1980s despite this. The credit for the subsidence of keratomalacia in India does not, therefore, belong to this much-touted approach. The vitamin A deficiency that

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we see today in this region is an extremely mild form of the disease that was encountered 50 years ago, and is seen in a much smaller proportion of the population.

Here, then, is a clear vindication of the food-based approach to the solution of our nutrition problems. This rich historical evidence provided by time-tested experience must be considered far more compelling and convincing than the claims being presented to us annually, favouring a drug-based approach based on synthetic vitamins.

The logical and physiological approach towards combating any nutritional deficiency in a population must lie in bringing about appropriate corrections in the habitual diets of the population.

### MAJOR PROBLEMS

The four major nutritional problems in South Asia that currently demand attention are: (1) Low birth-weights (LBWs) in infants and stunting in under-fives; (2) Anaemia; (3) Iodine deficiency diseases; and (4) Hypovitaminosis A. While the latter three problems are obviously related to micronutrient malnutrition, it is possible that in the genesis of the first, protein energy malnutrition may also play a role. Unfortunately, the role of micronutrient malnutrition in LBWs and stunting has not received adequate attention.

**Low birth-weight:** Approximately, a third of infants born in South Asian countries today, are of low birth-weight (<2.5 kg). The majority of these LBW babies are small for date. The prevalence of LBW is highest in South Asia. The striking difference in LBW incidence between South Asia and South East Asia is indicated in Table. The incidence of LBW in industrialised countries of the West is much lower.

International reports<sup>1,4</sup> also point to the fact that the incidence of stunting in under-fives in the world is about the highest in South Asian countries. It is not the 'smallness' but the impairment of the physical and mental functions implied by stunting, that should cause concern. In stunted children the innate genetic potential for functional performance – physical and mental – may not find full expression. Where a considerable proportion of children – the future citizens of

a country – are stunted, the 'quality' of the human resources of that country stand severely eroded.

The problem of LBW and of stunting are to some extent inter-related. LBW in infants of small gestational age signifies intra-uterine growth retardation (IUGR). Shanti Ghose's pioneering studies<sup>5</sup>, wherein she followed infants of LBW for 18 years and compared their growth performance with other infants and children of the same socio-economic group born with normal birth-weights, shows that infants born with LBWs continued to grow in a substandard growth trajectory. These observations are in line with those of studies on adopted Indian orphans in Sweden<sup>6</sup>. Apparently, infants suffering from IUGR are 'programmed' to grow and develop in a substandard growth trajectory, thus swelling the numbers of stunted under-fives in the community. While the role of post-natal environmental factors leading to stunting cannot be denied, it appears that a considerable part of the stunting in under-fives is the aftermath of the IUGR they had suffered.

Earlier, many infants with LBW succumbed to diarrhoeal and respiratory infections because of immunodeficiency. However, due to improved management and control of such infections in recent years, there has been a steep fall in child mortality in poor communities. Child survival, however, is not synonymous with child-nutrition; the inputs needed for the latter are far greater and need to be more sustained than those for the former. Decline in child mortality without a corresponding improvement in child nutrition, has resulted in an expanding pool of survivors and this is being reflected in a high prevalence of stunting in under-fives in the poor communities of developing countries.

The precise nutritional deficiency/deficiencies leading to IUGR and consequently to LBW is still debatable. Populations in which LBW incidence is high suffer from a multiplicity of

**TABLE (Ref 2)**  
**Percentage of Infants with Low Birth-weights**

South Asia		South East Asia	
Bangladesh	50	Indonesia	14
India	33	Laos	18
Nepal	26	Malaysia	10
Pakistan	25	Philippines	15
Sri Lanka	25	Thailand	13
		Fiji	18
		Vietnam	17

nutrient deficiencies. Studies on the effect of energy and protein supplementation to mothers during pregnancy<sup>7,8,9</sup>, have yielded contradictory results which are none too impressive. Madhavan Nair *et al*<sup>10</sup> at the National Institute of Nutrition, Hyderabad, found a definite trend towards adverse pregnancy outcome at extremes of Hb levels in women of the poor socio-economic group on cereal-based diets in a study involving nearly 1,000 pregnant women and their offspring. This observation raises the possibility that in poor populations on cereal-based diets with marginal zinc intake, intensive iron administration may be counterproductive and could aggravate zinc deficiency.

**The role of folic acid:** Leela Iyengar<sup>9</sup> pointed out the possible role of maternal folic acid deficiency in the causation of LBW as early as in 1975. Unfortunately, this important observation was not followed up. It is time to return to it and examine the role of folic acid deficiency in IUGR. Plasma levels of homocystiene in maternal and cord blood may be expected to rise, but precise information on this important aspect has to be gathered. It is possible that elucidating the role of folic acid deficiency in IUGR may help provide an alternative explanation to Barker *et al*'s interpretation, based on epidemiological studies, that infants suffering from IUGR and LBWs are more susceptible to chronic degenerative diseases in their adulthood<sup>11</sup>.

The recommended dietary allowance of folic acid for pregnant women is 400 µg daily. While animal foods are rich in free folate, plant foods on which poor populations generally subsist are deficient in folic

acid content but for some green leafy vegetables (GLVs) and pulses. The GLV content in the diets of poor communities are low. Pulses, thanks to the Green Revolution which concentrated on cereals such as wheat and rice, by-passing pulses and legumes, are today in short supply in developing countries and beyond the reach of the poor. Apart from being a good source of the amino acid lysine, pulses are also a good source of folic acid and riboflavin. The solution for correcting pulse shortage with lysine supplementation of wheat, as proposed by some technologists, seems to totally ignore the fact that pulses are a good source of important micronutrients such as riboflavin and folic acid.

There are no detailed studies on the bio-availability of total folate in the diet. On an average, only about 50 per cent of free folate in foods is bio-available, and allowing for a loss of 50 per cent in cooking, the current folic acid intake in diets of poor communities may be expected to be well below the recommended levels. The prevailing diets in pregnant women of poor communities can provide only a fraction of the required amount. The poor intake of folates in diets is reflected in subnormal red cell folate levels (<125 ng/ml) in about 50 per cent of pregnant subjects<sup>12</sup>. The reported high incidence of neural tube defects in some populations of India<sup>13</sup> is also in line with this observation.

Unfortunately, in national programmes for the control of anaemia in pregnancy, folic acid and iron are administered in the last trimester of pregnancy (100 mg of iron and 500 µg of folate). The importance of folic acid in the early stage of pregnancy, and indeed even at the time of conception, has now been established<sup>14</sup>. Since animal foods are beyond the reach of the poor, a diet based on wheat, Bengal gram, amaranth, cluster beans and colocasia could provide enough folate to meet daily requirements. Unfortunately, the consumption of even these plant foods is hard to come by among the poor.

Apart from folic acid, the role of other micronutrients, especially zinc, as a cause of LBW and stunting in under-fives also merits consideration. Data gathered by the Nutrition Foundation of India on a large number of

pregnant women indicates no relationship between serum retinol levels and LBWs among poor communities.

**Stunting:** Normal growth is dependent on the regular supply of a multiplicity of macro and micro nutrients. In earlier years, stunting was usually attributed to protein energy malnutrition, but the possible role of micronutrients such as zinc, iron, folic acid, calcium, vitamins A, B and D, is now being better appreciated. While many of these deficiencies co-exist in poor countries, there could also be instances wherein a micronutrient deficiency could be the first limiting factor. Indeed, with the gradual correction of erstwhile gross energy deficits in the diets, micronutrient deficiencies may emerge as the major factors responsible for growth retardation in poor communities around the world.

The degree of growth retardation in children of a poor community may be dependent on the nature of prevailing nutrient deficiencies. Some nutrient deficiencies may depress growth more than others. Thus, as pointed out by Golden<sup>15</sup>, while selenium deficiency could result in low tissue concentration of selenium without much impairment of growth, zinc deficiency could result in stunting with maintenance of normal tissue zinc concentration. Zinc depletion in the soil results in low yield; it is only in the advanced stages of zinc deficiency that its depletion is seen in plant tissues. The mix of nutrient deficiencies in a given diet is thus the determinant of the degree of growth retardation. Not all nutritional deficiencies may be expected to depress growth to the same extent.

Stunting is also associated with the impairment of mental and physical functions, but the nature and extent of such impairments may again depend on the precise mix of nutrient deficiencies in a given population. Like stunting, the associated impairment of mental functions is also a sum effect of multiple deficiencies of nutrients which have a role in brain function. The effects of nutrient deficiencies on growth and mental function need not necessarily run parallel, since impairment of growth and mental function are not mediated by the same mechanisms. No linear relationship between the degree of stunting on the one hand and the degree of impairment of physical and mental

function on the other may be expected in situations wherein, prevailing patterns of nutritional deficiency are widely different. The mix of nutrient deficiencies in poor diets can vary from country to country depending on the dietary pattern.

In view of these considerations, it may be wrong to attempt comparisons between countries with respect to their nutritional status on the basis of the extent of stunting in their under-fives. International Reports have seriously erred in making such a simplistic assumption and in arriving at the unwarranted conclusion that South-Asian children are more malnourished than those of the Sub-Saharan Africa or Sudan<sup>1,2,4</sup>. Golden's wheat plant grown in soil low in selenium may have better growth than the one grown in soil low in zinc, but the former could be more diseased and unhealthy.

All this is not to deny that growth performance is a useful yardstick of nutritional status and that stunting, however brought about, is undesirable. 'Small' is certainly not 'healthy'<sup>16</sup>. While the degree of stunting cannot be used for inter-country comparisons of the nutritional status of populations for reasons stated above, stunting and its functional implications need to be combated by an all-round improvement of the diet and the correction of the deficiencies that may be responsible, rather than arbitrary concoctions of synthetic nutrients.

**Iron deficiency anaemia:** In many developing countries where moderate and severe anaemia in pregnancy is widespread, current control programmes undertaken by public health agencies have consisted largely in the administration of iron/folate tablets (60 to 120 mg iron, 500 mcg folate) in the last 100 days of pregnancy as part of antenatal care. This is generally not accompanied by serious efforts towards improving diets in poor households and, more importantly, towards improving the diets of women during pregnancy.

That this strategy has been inadequate has been shown by the Indian experience as reported by the Indian Council of Medical Research (ICMR)<sup>17</sup>.

The practice of routine iron supplementation of all pregnant women has been recently challenged<sup>18</sup>. The studies of Madhavan Nair *et al*<sup>10</sup> referred to

above, also point to the need for caution with respect to excessive iron medication as the sole answer to the problem of anaemia, especially in poor cereal-eating populations suffering from multiple micronutrient deficiencies. The possible role of deficiencies of zinc and other micronutrients in such poor diets needs to be elucidated.

The message that stands out from this finding is that in cereal-eating populations, the control of anaemia will call for the effective convergence of three major approaches:

- Dietary improvement, especially by the inclusion of vitamin C-rich food items which could increase the bio-availability of food iron
- Iron/folate tablet administration
- Fortification of appropriate food items with iron

**Iodine deficiency:** The inexpensive technology, a time honoured and time tested one, for the control of goitre is the iodation of common salt. Programmes for goitre control must rest squarely and socially on this technology.

Periodic parenteral administration of iodated oil (not presently manufactured in any SAARC country) has been suggested as an alternative approach especially in areas 'inaccessible' to common salt.

It is difficult to imagine any areas in South Asia which are now 'inaccessible' to common salt but readily 'accessible' to disposable syringes and to an army of 'injectors'. There has been a steep rise in the HIV seropositivity rate among drug addicts in our countries during the last few years. Those familiar with real life situations in the field will realise that 'disposable' syringes will not be dutifully 'disposed off'. Under the circumstances, the consequences of resorting to a technology which is dependent on repeated injections (using 'disposable' syringes) could be disastrous.

**Vitamin A deficiency:** The countries of South Asia are blessed with a wide array of inexpensive foods rich in pro-vitamin A carotenoids. A whole range of inexpensive local foods for combating vitamin A deficiency in poor populations is available in this region.

There is also the possibility of

augmenting the cultivation of red palm in India, Indonesia and Bangladesh. Now that techniques by which the pro-vitamin A fraction of red palm oil can be retained in an acceptable and palatable form have been identified, red palm oil could become a powerful tool for combating vitamin A deficiency. The above foods can easily meet the vitamin A requirement.

Spirulina, a source of pro-vitamin A carotenoids, has been developed from the blue-green algae, *Spirulina fusiformis*<sup>19</sup>. With further research and improved technology, it should be possible to identify ways by which spirulina, which can be widely harvested, can be incorporated in a potent, inexpensive and acceptable form in the dietaries of developing countries.

It will thus be clear that SAARC has a vast potential for further augmenting the production of carotene-rich foods. It would be extremely short-sighted and imprudent not to put these valuable, indigenous and inexpensive resources to proper use.

The general message that stands out from these considerations is that policies for combating micronutrient malnutrition (indeed malnutrition itself) must be firmly rooted in a food-based rather than a 'drug-based' approach. We should look to our farms and not to our pharmacies for the solution of our nutrition problems.

*Based on the keynote address by the author at the FAO-sponsored SAARC conference held in Dhaka, Bangladesh, in November 1997 on 'Prevention and Control of Micronutrient Malnutrition Through Food-based Approaches in SAARC Countries'.*

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## NUTRITION NEWS

### ● 'Dietary Guidelines for Indians'

This Publication prepared by NIN, was released by Prof N.K. Ganguly, Director General, ICMR, on June 1, 1998, at NIN, Hyderabad.

● 'Diet, Nutrition and Chronic Disease - An Asian Perspective', published by Smith Gordon, UK, and jointly edited by Dr P.S. Shetty and Dr C. Gopalan, has been released. This contains the proceedings of a symposium organised by NFI in February 1997.