NFI BULLETIN
Bulletin of the Nutrition Foundation of India
January 1991 Volume 12 Number 1

The Changing Profile Of Undernutrition In India

C. Gopalan

During the past four decades, there have been significant, though not perhaps spectacular, changes in the pattern of undernutrition in India, which have an important bearing on national nutritional policies and programmes. In the following pages, these changes, and the factors that could have contributed to them are briefly considered.

Food Adequacy

The state of adequacy of food (quantitative and qualitative) at the national and family levels, is obviously a major determinant of national nutrition status.

India's overall food grain production which stood at 62.7 million tonnes in 1956, has now risen to 138.41 million tonnes[3], thanks to the "Green Revolution" of the 1960s – a performance that is gratifying, though not as impressive as it could have been. This achievement had, at least, enabled the country to do away with food imports on any significant scale – an outstanding contribution to overall national economy; the per-caput availability of food grains despite the massive growth of population in the intervening years had not declined; and the gloomy prophecies of doom of the early 1950s (before the ushering in of the Green Revolution) were fortunately belied.

Distortions in the pattern of food production: While the Green Revolution had thus ensured a reasonable degree of near-adequacy with respect to calorie requirements at the overall national level, the augmentation of food grain production that it has brought about has not been a *balanced* one from the nutritional and physiological viewpoint. Among food grains, the major "beneficiaries" of the Green Revolution have been wheat and rice. Pulses have suffered a near total neglect. Pulse crops are grown, almost entirely, on rainfed areas where both acreage and productivity have either declined or stagnated. The states of Madhya Pradesh, Rajasthan and Gujarat, between themselves, account for over 70 percent of the decline in national pulse production.

As a result, the per caput availability of pulses has steadily declined over the years – from 61 gs/day in 1951 to 33 gs/day in 1988[3] (Figure 1 and Table 1); and the market prices of pulses had escalated to levels well beyond the reach of the poor. It would be reasonable to expect that the resultant glaring distortion in the ratio of per caput availability of cereals to pulses would be reflected in significantly lower intakes of pulses, and consequent deterioration of the protein quality of dietaries in poor households in the country. A comparison of the NNMB (National Nutrition Monitoring Bureau) data of 1975 and of 1989[11], with respect to average intakes of cereals and pulses, however, does not provide any significant evidence to this effect.

A scrutiny of the disagregated data according to different income groups may possibly provide a clearer and more reliable picture. Since the major part of the decline in pulse production occurred in the late '60s and early '70s, comparison of diet survey data of 1975 and 1989 may have failed to reveal any significant reduction in pulse intake. It is also possible that the great majority of households generally captured in diet surveys are poor and their pulse intake has always been low. In any case, the belated recognition of the need to augment pulse production in the country must be welcomed.

Another distressing feature in the pattern of food production in recent times has been the declining trend in the production of coarse grains (millets – jowar, bajra, maize and barley) – the poor man's staple. As against a record level of production of 33.9 million tonnes achieved in 1983-84, the production has now slumped to 26 million tonnes[3] — a reduction largely attributable to diversion of acreage to other food and cash crops. No significant gains have been made with respect to augmentation of production of vegetables and fruits and of their intakes in the dietaries of poor households.

Failure to achieve equitable food distribution: Perhaps the major failure on the food front during the last few decades has been that the fairly impressive

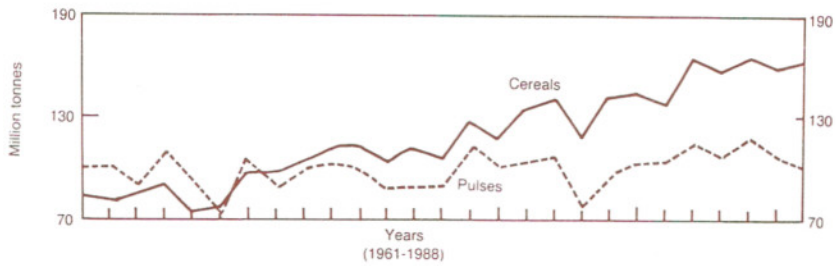
CONTENTS

Table 1. Foodgrain Production Trends (Million Tonnes)

	1965	1988
Cereals		
Rice	30.59	56.43
Wheat	10.40	45.10
Coarse grains	21.42	25.84
Pulses	9.94	11.04
Per caput availability of cereals g/day	346.47	424.52
	1956	**1987**
Per caput availability of pulses g/day	61.00	33.00

Source: Economic Survey 1988-89, Govt. of India.

Figure 1: Trends in Cereal and Pulse Production



Source: Economic Survey, 1988-89, Government of India

record with respect to augmentation of food grain production has not been matched by similar success with respect to achieving equitable distribution of available food resources among the people. As a result, we have the curious spectacle of impressive buffer stocks of food grains on one side, and sizeable population pockets of poverty and hunger on the other. It is generally agreed that the income levels of a substantial section of the population are too low to permit them access to food of adequate quantity and quality. The 'average' food consumption in the households covered in NNMB reports apparently do not indicate major deficiencies (except for vitamin A); but the 'average' values may not tell us the whole story. The NNMB-NSSO (National Sample Survey Organisation) linked surveys of 1983-84[10] showed that the average food expenditure of the families surveyed ranged from Rs.73 to Rs.80 per mensem, representing 60 to 70 percent of their total household expenditure. As against this, the NNMB data of 1988-89 show that in 34 percent of the households surveyed, the monthly per caput income was less than Rs.60 (Table 2).

Thus it may be concluded that at least one-third of the households, even if they had expended their *entire* income on food alone, could not have reached the 'average' level of food expenditure. It will be reasonable to conclude that in a substantial proportion of households surveyed, food consumption levels must have been lower than what the average figures indicate; sizeable sections of populations represented by such households must be suffering from different degrees of deprivation and undernutrition ranging from marginal inadequacy to severe deficiency – depending on regions and seasons.

In whatever way we choose to interpret currently available data, we cannot escape the conclusion that while India has largely succeeded in eradicating her problem of acute hunger and famine, the problem of "chronic" (silent) hunger that does not hit the headlines is still pervasive; and will continue to be so despite further augmentation of overall food grain production until family incomes in poor households rise to levels which will permit adequate access to food.

There have been several sharp debates not only on the extent of poverty and hunger in the country but on the very definitions of hunger and undernutrition themselves. These sterile debates as to whether, for example, the extent of chronic hunger in the country is 25 percent, 30 percent or 40 percent have proved to be wholly counterproductive, diversionary and perhaps even unnecessary in our present state of underdevelopment and scarcity of resources. Even if for argument's sake, we accept that only 25 percent of the population of our country is suffering from chronic hunger – perhaps the lowest possible estimate with any type of statistical exercise, we end up with a staggering estimate of over 215 million hungry people!

The time has come when nutrition scientists of India must turn their attention away from "curiosity-oriented" intellectual exercises that merely seek to assess the precise magnitude of hunger in the country — let us leave these to foreign economists, and instead concentrate on a consideration of what is doable and feasible with current resources to mitigate the problem.

Population Growth, Female Literacy And Health Care

Apart from food availability, trends with respect to population growth, female literacy and outreach and quality of basic health care to poor communities have important bearing on nutritional status. Unlike the performance with respect to food grain production, the achievements during the last four decades with regard to these determinants

Table 2. NNMB – NSSO Survey Data

NNMB-NSSO Survey Report*	
'Average' per caput food expenditure/mensem	Rs. 73-80 (60%-70% of total expenditure)
NNMB Survey (1988)**	
Households per caput/mensem	< Rs.60 (in 34% of households)

*Source: * NNMB (1983-84) – p.6*
*** NNMB Interim Report of Repeat Survey (1988-89) - Table 2.*

have been disappointing (Table 3).

Population growth: India's population had soared from 360 million in 1951 to 822 million in 1990[2], thus nearly nullifying the fairly impressive performance with respect to food production.

"Per caput food availability" is the result of two dynamic forces – rate of augmentation of food production on the one side and the rate of population growth on the other. So far, the 'race' between the two, as far as India is concerned, has not been convincingly and decisively won, though food production has had an edge over population growth. We cannot be content with a situation where per caput food availability has just either "not declined" or "marginally improved". Per caput food availability has to *increase* very substantially for our national nutritional status to show significant improvement.

The impact of population growth is not limited to its effect on per caput food availability alone. The deleterious effects of unregulated population growth have been felt on a whole range of public services – health, education, housing, transport; and on urban migration – all of which have an important bearing on the national nutritional scene.

Female literacy: Female literacy apparently holds the key to the success of health, nutrition, family planning and education programmes in all developing societies. The level of average female literacy in the country which stood at 7.9 percent in 1951 has now risen to 24.8 percent[2]. Even this 'average' figure, depressing as it is, does not indicate the enormity of the problem. In the poorest groups where poverty, hunger, and undernutrition are the major problems, female literacy is actually much lower than this national average. The nation has been, thus far, largely denied the major contribution that increased female literacy could have made to its human resource development.

Outreach of basic health care: The severity of undernutrition in a community can be significantly reduced if the superadded factor of infection is held in check. Moreover many nutrition programmes, for example iron-folate supplementation, have to be implemented by the health system. The outreach and quality of health services will therefore play an important role in conditioning the national nutrition scene. Unfortunately, however, despite a whole chain of health care centres, the rural population of the country does not still enjoy adequate access to basic health care.

Table 3. Population Trends in India

	1951	1990*
Population (millions)	360.95	821.99
Birth rate	40.80	28.20
Death rate	24.60	10.00
Female literacy %	7.90	24.80

** Report on the population projections, No. 4, 1988, Govt. of India.*

Declines in "severe malnutrition" in children (Gomez scale) reported by the NNMB in recent years are probably attributable to better health care achieved despite the current inadequacies in the health system. Even so, we have a long way to go in this regard; the substantial contribution that a competent health 'service' of adequate outreach and good quality could make to overall health/nutrition improvement continues to elude us.

Changes In Undernutrition Profile

The major shifts in the profile of undernutrition in the country during the last four decades may now be briefly discussed.

Eradication of famines: The augmentation of food grain production, the gearing-up of the food distribution administrative machinery, and the introduction of a reasonably efficient early-warning system had contributed to what perhaps has been the most outstanding achievement on the national nutrition front during the last four decades – namely, the virtual "banishment" of acute large-scale famines, of the type that used to decimate sizeable sections of the country's population with distressing regularity (once in seven years) for centuries. The Bengal famine of the early 1940s (before the attainment of political independence), in which the casualties India suffered exceeded the total casualties that the Allies had suffered in World War II, was the last great tragedy of its kind in this country. (The much publicised Bihar famine of later years was really a famine that never was.) This is not to deny that pockets of acute hunger still exist in some parts of the country in some seasons, and in times of disasters like droughts and floods; however these are at present being dealt with more efficiently and expeditiously.

Decline or virtual disappearance of some major nutritional deficiency disorders: A notable development during the last few decades has been the virtual elimination of some major nutritional deficiency diseases which at one time ranked as important public health problems.

Beri beri (cardiac, dry, and infantile) which used to be widespread in coastal Andhra Pradesh (part of the old Madras Presidency) has now been practically eliminated as a public health problem. Considering that prior to the 1950s, several hundreds of cases of beri beri used to be seen in the hospitals of Guntur and Vishakapatnam in Andhra Pradesh, this is no small achievement.

Fulminant forms of vitamin B complex deficiency – such as "orogenital syndrome"[9] and "burning-feet syndrome"[4] described several decades ago, and which used to be seen in large members of subjects in institutions (like the penitentiaries), and the outpatient departments of hospitals of South India, have now ceased to be important. This is not to deny that clinical cases of vitamin B deficiency are still being seen, but fortunately not on any large public health scale. We are, however, in no position to pinpoint the actual factors that had led to these beneficial results.

There are also strong indications that Osteomalacia, once fairly widespread in North India[12,15], and pellagra in the Deccan have also significantly declined.

Nutrition scientists of India had devoted considerable time and attention towards the elucidation of the nature and solution of the above problems. But no special programmes had been instituted and vigorously pursued to bring about their elimination. It must be presumed that the increased awareness of these problems, generated by scientists, among the public, policy-makers and public health services had contributed to

the decline in their incidence.

Subsidence of 'severe' PEM, nutritional blindness (?) and anaemia: The reports of the NNMB point to a definite decline in the prevalence of 'severe' forms of PEM (in the Gomez scale). This would imply that classical forms of kwashiorkor and extreme forms of marasmus which were widespread two decades ago, are now no longer so. This must be because, thanks to intensive nutrition research, impending cases of kwashiorkor and severe marasmus are now being better managed and treated by health personnel; and superadded infections which usually aggravate PEM are now being more promptly and efficiently handled. This has also contributed to better child survival; fewer children are now dying of PEM.

Though precise data with respect to the current prevalence of nutritional blindness in our country are hard to come by, as was pointed out earlier[5], there is suggestive evidence pointing to substantial decline of the disease. It is not clear as to what extent the programme for the prevention of the diseases through massive synthetic vitamin A dose prophylaxis, developed by the National Institute of Nutrition, had contributed to this development.

Iron-deficiency anaemia, largely attributable to the poor bio-availability of iron in the habitual cereal-based Indian dietaries, continues to be widespread, especially among women and children. The national programme of iron-folate supplementation as part of antenatal care, is being tardily and inefficiently implemented. The proposed programme of fortification of common salt with iron is still in the "pilot trial" stage.

Despite all these limitations, the two major factors which had contributed to marked aggravation of anaemia in earlier years, namely chronic malaria and hookworm infestation, do not currently exhibit the same menacing dimensions as in the past. The depressing picture of vast areas of the country ravaged by chronic malaria and severe anaemia, with hundreds of stunted pot-bellied children suffering from varying degrees of splenomegaly, is now no more than a distant painful memory. Malaria, which had almost been vanquished, has returned but, fortunately, is now being better contained and controlled. Hookworm infestation is still very much a problem, especially in the delta areas and plantations, but cases of advanced oedematous ankylostomiasis with extreme degrees of anaemia that used to be seen in the past are relatively rare.

Table 4. Average Weights and Heights for Age of Children in Tamil Nadu Comparison of Data of 1936 and of 1984

Age	Weight (Kg)			Height (Cms)		
	1936*		1984**	1936*		1984**
	C	M		C	M	
6+	16.0	17.0	15.4	106.7	111.8	106.3
7+	17.7	17.1	17.1	113.0	114.3	112.0
8+	19.0	18.7	18.8	116.8	119.3	117.9
9+	21.5	19.2	19.4	120.7	119.3	119.7
10+	23.0	21.5	21.9	126.0	129.5	126.5
11+	24.5	21.8	22.9	130.6	132.0	130.2
12+	25.7	24.5	25.0	133.1	137.1	134.0
13+	31.0	27.5	27.9	141.7	144.7	136.8
14+	31.0	31.6	30.1	141.7	147.3	143.1
15+	34.4	33.0	34.6	146.8	149.8	149.8

*Source: * Data of 1936 from C – Coonoor; M – Mettupalayam. Aykroyd & Krishnan: Ind. Jour. Med. Res., 1936.*
*** NNMB Report 83-84 (Data for Tamil Nadu).*

The Changing Course Of Some Diet-related Diseases

While the 'classical' nutritional deficiency diseases, in general, are thus on the retreat, some other diet-related diseases have significantly changed course in recent years.

Goitre: Goitre, arising from iodine deficiency which had traditionally had a sub-Himalayan geographic distribution, has, in recent decades, "invaded" the cultivated and irrigated plains. Goitre of the plains is generally of the milder variety. It is not clear as to what extent modern intensive agricultural technology and the resultant depletion (poor availability) of iodine from the soil, or the intensive use of pesticides, contributed to this development. The extension of goitre to newer areas, at a time when we have failed to effectively control the problem in the traditional endemic areas of the disease, has greatly added to the magnitude of the problem. The discovery that nearly 13 percent of neonates in goitre endemic areas show evidence of poor thyroid function[6,7] with possible implications of retarded mental development, lends added urgency to the solution of this problem.

Lathyrism: 'Lathyrism' in Madhya Pradesh, the spastic paralysis of the lower limbs caused by excessive consumption of the pulse lathyrus sativus, had been the subject of intensive investigation by nutrition scientists of India for several decades. The nature of the toxic factor in lathyrus, and the manner by which it could be removed, had been elucidated through painstaking research by Indian nutrition scientists[1,14]. It must, however, be confessed, that if today lathyrism is not the problem that it was in Madhya Pradesh some decades ago, the credit must go, not to the scientists, but to the play of the "market forces".

In view of the relative scarcity of pulses and their escalating market prices, lathyrus, which was once used by the rich landlords for partial payment of wages to their poor serfs (who fell victims to the disease), has now become too "precious" a commodity to be palmed off to the poor. There is now a brisk and flourishing trade of "export" of lathyrus from Madhya Pradesh to other states for purposes of adulteration with other more expensive pulses like Bengal gram. Outbreaks of lathyrism in Madhya Pradesh have now become very infrequent; and the problem, at least as far as Madhya Pradesh is concerned, has been "solved" – with what cost to the rest of the country, we do not know!

Endemic fluorosis: Endemic fluorosis as a disease entity caused by excessive consumption of fluoride in drinking water was discovered for the first time in India[13]. As important as that original discovery was, the finding in the mid-1970s by the scientists of the National Institute of Nutrition of the new manifestations of the disease, characterised by marked genu valgum in large numbers of adolescents and young adults in the endemic areas, following

on the construction of huge dams[8]. The series of studies which attempted to unravel the sequence of metabolic events leading to this new syndrome constitutes a fascinating chapter in the history of fluorosis. This discovery had lent new impetus and direction of fluorosis control measures being undertaken as part of the Technology Mission for safe drinking water.

Better "Child Survival" Not Matched By Better "Child Health Nutrition"

More and more poor infants and children are now "surviving" despite continuing poverty, undernutrition, and insanitation, because of "death-control" strategies like, say, ORT. "Child survival" rather than "old-fashioned" maternal and child-health/nutrition is being actively promoted as the target, thanks to the false leads of international agencies. The basic problems of poverty, undernutrition and insanitation remain. There is no evidence of substantial improvement in the nutritional status of the "survivors" among the poorest segments of the population. There is no evidence that the severity of growth retardation and underdevelopment among poor children has significantly declined. In short there is a progressive erosion of the quality of our human resources in view of the expanding pool of substandard "survivors".

The secular trend with respect to heights that was evident in all developed countries during their phase of socio-economic development has yet to start in this country, as far as the poor are concerned. A comparison of the anthropometric data from surveys carried out in the early 1930s and the 1980s will bear testimony to this (Table 4).

That the persistent poor growth performance of these children, in comparison to international (NCHS) standards, is not attributable to genetic factors but to environmental constraints is evident from the fact that the children of the affluent minority of the populations in different parts of the country have either already approached, or are in the process of approaching, the NCHS standard with respect to their growth performance.

We have thus reached what may well be the dangerous "twilight" phase of underdevelopment and undernutrition which may breed complacency. National interests demand that we traverse this phase expeditiously. The elimination of florid clinical manifestations of undernutrition and better child survival should not be considered as synonymous with the attainment of optimal health/nutritional status which would permit the expression of the full genetic potential of the younger generation.

The Other End Of The Nutrition Spectrum

While poverty and undernutrition persist among large sections of the people, a notable development on the national nutrition scene during the last few decades has been the emergence (and rapid expansion) of a class of "new-rich", among the urban middle class. The life styles and the "conspicuous consumption" in this group are being reflected in an alarming increase in the incidence of obesity and degenerative heart disease among the urban affluent sections. Flourishing "slimming" industries and sophisticated "heart-care" centres are springing up in all major cities and towns. The emerging nutritional scene bears ample testimony to the inequities of the prevailing socio-economic order. "Malnutrition" would henceforth need to be combated on two fronts.

The challenges and opportunities that await Indian nutrition scientists in the next two decades are truly formidable, and would call for far greater support to nutrition research in the future than in the past.

Excerpted from the special lecture at the Silver Jubilee of the Nutrition Society of India, in Hyderabad on December 1, 1990.

References

1. Adiga, P.R., Rao, S.L.N. and Sharma, R.S. Some Structural Features and Neurotoxic Action of a Compound from L. Sativus Seeds, *Curr. Sci., 32* (1963), 153.
2. Census of India, A Handbook of Population Statistics, 1988.
3. Economic Survey 1984-85 and 1988-89, Ministry of Finance, Government of India.
4. Gopalan, C., The 'Burning-Feet' Syndrome, *Indian Med. Gaz., 81* (1946), 22-26.
5. Gopalan, C., Control of Vitamin-A Deficiency – Priorities for Future Research in India – Reviews & Comments, *NFI Bulletin, 9*, 4 (1988).
6. Kochupillai, N. *et. al*, Endocrinology, 102, 128 (1978).
7. Kochupillai, N.; Neonatal Thyroid Status in Iodine Deficient Environment of Sub-Himalayas region, *Ind. Jour. Med. Res., 80* (1984), 293-299.
8. Krishnamachari, K.A.V.R. and Krishnaswamy, K.; An Epidemiological Study of the Syndrome of Genu-Valgum among Residents of Endemic Areas for Fluorosis in Andhra Pradesh, *Indian. J. Med. Res.*, 62 (1974), 1415.
9. Nair, V.G., Orogenital Syndrome, *Journal I.M.A.*, VIII, 4 (1939), 215-223.
10. National Nutrition Monitoring Bureau, Report of the NNMB-NSSO Linked Survey (1983-84), National Institute of Nutrition.
11. National Nutrition Monitoring Bureau, Interim Report of Repeat Survey (Phase-I), 1988-89, National Institute of Nutrition, 1989.
12. Scott, A.C.; A Contribution to the Study of Osteomalacia in India, *Ind. J. Med. Res.* (1916), 140-168.
13. Shortt, H.E., Pandit, C.G. and Raghavachari, T.N.S., Endemic Fluorosis in the Nellore District of South India, *Indian Med, Gaz., 72* (1937), 396-398.
14. Stott, H.; On the Distribution of Lathyrism in the United Provinces and on its Cause, with a Description of a 4 3/4 Months' Feeding Experiment on Tonga Ponies with Botanically Pure Cultures of Lathyrus sativus and of Vicia sativa, *Ind. J. Med. Res.* (1929), 51-55.
15. Wilson, D.C., Osteomalacia (Late Rickets) Studies, Part V, Osteomalacia in the Kangra District, *Ind. J. Med. Res.* (1930), 951-958.

NUTRITION NEWS

The Silver Jubilee Celebrations of the Nutrition Society of India were held at the National Institute of Nutrition, Hyderabad, on December 1, 2 and 3, 1990. The highlights of the Scientific Programme were the Gopalan Oration by Dr. J.C. Waterlow on "New Challenges in Protein Energy Malnutrition", the Srikantia Memorial Oration by Dr. M. Gabr, on "Better Nutrition for the World Poor: A Challenge for the Future" and special lectures by Drs. C. Gopalan, Dutra d'Oliveira and Chong Yoon Hin. Five Symposia and two "Young Scientists' Award sessions" were organised where several papers on different aspects of 'community' and 'experimental' nutrition were presented.

At its General Body Meeting on December 3, the Nutrition Society of India elected the following office bearers:

President: Dr. K.T. Achaya; Vice Presidents: Dr. (Ms.) M.S. Bamji, and Prof. K.N. Agarwal; Secretary: Dr. (Ms.) Meenakshi Mehta; Joint-Secretary: Dr. Ramesh Bhatt; and Treasurer: Dr. K. Vijayaraghavan. The society placed on record its appreciation of the valuable services of the outgoing officers including the President Dr. (Ms.) Rajammal P. Devadas and Joint-Secretary Dr. (Ms.) Kamala Krishnamurthy, who had played an important role in organising the Silver Jubilee celebrations

JAN 91 VOL. 12 NO. 1.

REVIEWS AND COMMENTS

"Reduced Mortality" With Vitamin A Supplementation

K. Ramachandran

● In a recent paper, Rahmatullah *et al*[1] have claimed that with a weekly dose of 8333 IU of Vitamin A, "mortality was reduced on an average by 54 percent" in children six to 60 months of age, observed over a one-year period. Unfortunately there are a number of aspects of this report which could raise doubts about the validity of this far-reaching conclusion.

● The paper does not provide data on the base-line mortality rates in the Vitamin A and placebo groups of children, though these must have been available to the investigators; nor does it provide separate information, for the two groups on other relevant base-line characteristics beyond stating that the matching of the two groups was "satisfactory". In particular, one would like to know if mortality (even though it was retrospectively obtained at base-line) in the treated group, was lower than that of the placebo group even to start with. Further one would like to have information on the extent of decline in mortality from the base-line levels in both the Vitamin A and placebo groups for a proper appreciation of the results of the trial It may be noted that the mortality rates reported for both groups (including the placebo group) were markedly lower than the national average, indicating that there were substantial reductions in mortality in both groups. We now gather (personal communication), that there were, in fact, very substantial reductions in mortality, even in the placebo group as compared to basal levels. The claim has to be carefully examined in this context.

● In the 'discussion', the authors state that they monitored infant mortality rate for a one-year period in 1988 and 1989 and that the mortality rate in infants of six to 11 months of age was 22 per 1,000. However, in their Table 3 the authors present the mortality data for the entire 0 to 11 months period and not for six to 11 months for the treated and control groups. This raises the question as to whether the six to 11 months mortality did or did not show the same difference as reported for the zero to 11 months age group?

● In the absence of information on relevant base-line characteristics of the two groups, it is not clear if the randomisation of the 206 clusters between the treated and control groups achieved similarity in spatial spread of the two groups with reference to location of the physical health facilities in the area like the sub-centres/dispensaries, etc. This has relevance to the utilisation of health services during the study period. Information on access to, and the pattern of utilisation of, health services by the households in the treated and control groups with particular reference to pre-school children would be important for the interpretation of difference. Under Indian conditions there can be wide differences between groups of villages within the same district with respect to access to basic health care.

● In the section on 'Survey Personnel and Procedures', it is stated that children with symptoms of xerophthalmia, including night blindness, were treated with a large-dose combination of Vitamin A and Vitamin E both at base-line and at the six-month examinations. The question would arise whether the numbers treated at these two points were closely similar in the treated and control groups? Though it is stated that the data "were analysed both including and excluding them", the results of such analysis are not presented in the paper.

● It is not clear whether the data on mortality were tabulated clusterwise/villagewise in the control group to examine if the mortality pattern was reasonably uniform within the control group. Under Indian conditions, localised epidemics or fluctuations in the occurrence of infectious diseases can sometimes cause havoc with results of field studies if one or other of the comparison groups get selectively affected by such an occurrence. This would be particularly important if randomisation resulted in dissimilar spatial spread of the treated and control groups with reference to agro-socio-economic variables.

● A very surprising aspect of the cumulative deaths presented in Figure 1 of the paper is the striking difference in the mortality picture seen as early as four and eight weeks after the start of the trial! Seven deaths were reported by four weeks in the control group as compared with only one death in the treated group (7:1)! It would be interesting to know how many of these seven deaths in the first four weeks took place within the first week itself. By eight weeks, the deaths in the control group were 20 as compared with only five in the treated group (4:1). Can this miraculous phenomenon have a rational physiological explanation considering the amount of Vitamin A administered to the children in four or eight weeks? The fact that the maximum impact on mortality was achieved even within the first four weeks of supplementation would strongly suggest the overwhelming determinant role of the contact factor, rather than that of supplementation. A variation in the intensity of the contact factor (despite the "double-blind" approach) as between the two groups, rather than supplementation, would seem to be the logical explanation.

● The authors have not presented evidence on the internal consistency of the conclusion drawn by them. The mortality in the treated group could have been looked at in relation to the number of doses administered to the children. For example, the mortality data in the children who had missed only five or fewer doses could have been compared with that in children who missed six to 20 doses and more than 20 doses respectively to examine the dose response relationship. In any case the fact that the nutritional impact was observed even within the first four weeks would indicate the absence of a dose response relationship. If there was no strong dose response relationship, the explanation for the differences in mortality may have to be looked for in other than Vitamin A supplementation as between experimental and control groups.

● In Table 4, surprisingly, deaths from respiratory diseases account for less than five percent of all deaths in the children! This is completely contrary to all available evidence in India on mortality in rural pre-school children. About a fifth of all deaths in the pre-school age group is generally attributed to respiratory diseases.

● In Table 5, a strong differential is seen in mortality in relation to stunting but the differential is much less pronounced in relation to stunting and wast-

ing. Why? Was an analysis of nutritional status done in the two groups by age, particularly in the six to 11 months and 12 to 35 months age groups, since the mortality differential between the treated and control group is very pronounced in these two age groups?

● The omission of any information on the effect of supplementation on morbidity is surprising. (We now gather [personal communication] that there was in fact no difference in morbidity as between two groups in the study.)

Using the same data of the earlier study of Sommer *et al* (*Lancet* ii 586 2983), wherein mortality reduction with vitamin A supplementation had been claimed, Indonesian scientists (Muttee *et al* GIZI Indonesia 1990, 115 (1): 23-31) now report that "the effect of Vitamin A supplementation in the treatment group versus the control group on prevalence rate of diarrhoea, cough and fever was *not* significant ($p < 0.05$), given the other factors in the model". An explanation is needed as to how Vitamin A supplementation achieved its claimed miraculous antilethal effect in the two studies without leaving any impact on the morbidity profile.

While the "contact factor" could help to bring down mortality through promoting prompt and efficient treatment of acute infections before they reach the terminal stage, it may not be effective in preventing infections and reducing morbidity, in view of the prevailing environment.

The absence of significant impact on morbidity even in situations where mortality reduction has been claimed would strongly indicated that differences in the intensity of the contact (for one reason or another despite the double blind approach) rather than Vitamin A supplementation contributed to the differential mortality as between the supplemented and placebo groups.

The author, Professor and Head of the Department of Biostatistics at the All India Institute of Medical Sciences, New Delhi, is India's leading biostatistician.

Reference

1. Rahmathullah, L., Underwood, B.A., Thulasiraj, R.D., Milton, R.C., Ramaswamy K., Rahmathullah, R. and Babu, G.; Reduced Mortality among Children in Southern India Receiving a Small Weekly Dose of Vitamin A, *N. Engl. J. Med.*, 323 (1990), 929-935.

We are grateful to UNICEF for a matching grant towards the cost of this publication.

The NFI International Symposium on 'Recent Trends in Nutrition'

Shushma Sharma

The first ever symposium organised under the auspices of the Nutrition Foundation of India at India International Centre, New Delhi on December 5 and 6 drew enthusiastic response from the Nutrition Science community. Over 350 delegates from all parts of India participated, and the auditorium was packed from start to finish. In all seven sessions were held in the course of the two days, and 16 outstanding scientists (six from foreign countries) participated. The business-like and orderly way in which the symposium was conducted, the strict adherence to the time schedule, and the avoidance of "ceremonies" at the inauguration and closure ensured maximal use of the available time for presentation of papers and discussions. This was a truly "scientific" meet!

The two papers at the first session which started after the brief opening remarks of Dr. C. Gopalan, President of NFI were: one by Prof. John Waterlow on "Stunting" and the other by Prof. P.S. Shetty, on "Thermogenesis in undernutrition". The etiopathogenesis of 'stunting' and its practical significance and implications from the public health point of view, on the one hand, and the subject of "costless adaptation" to undernutrition on the other, being themes of great interest and concern to nutrition scientists of all developing countries, these papers attracted considerable interest.

The second session was devoted to work performance in undernutrition. While Dr. Klein discussed the technique of estimation of energy expenditure using double-labelled water, Prof. Spurr presented his data on $V0_2$ max and work performance of undernourished school children, using established conventional methods which better lend themselves for such studies.

At the third session, Prof. Dutra d' Oliveira reviewed his studies on dietary protein, with special reference to soya protein while Dr. K.S. Nair presented his studies on regulation of protein turnover in humans using labelled leucine.

The important area of nutrition and infection was discussed in the two presentations in the fourth session at which Dr. Vinodini Reddy reviewed the data from the studies at NIN, Hyderabad on nutrition immunity infection interactions; and Dr. P. Bhaskaram presented fascinating evidence pointing to the effect of impaired immuno-competence induced by undernutrition on tuberculous infection.

The fifth session included three papers on disorders related to food contamination. Dr. Ganguli's paper dealt with the possible role of copper toxicity in Indian childhood cirrhosis; Dr. Kamala Krishnaswami's paper discussed the anticarcinogenic properties of traditional food items, including turmeric and spices, in Indian dietaries. Dr. Susheela's presentation on fluorosis included not only observations on the histochemistry of bone in the disease but also on its public health implications.

In session six, Dr. Ghafoorunissa considered the practical approach towards augmenting n-3 fatty acid intake in Indian dietaries, based on scientific and practical considerations. Dr. Bamji's presentation dealt with the impact of upper respiratory infections – a major factor in child mortality/morbidity in developing countries, on riboflavin metabolism.

Session seven was taken by two fascinating papers on nutrition endocrinology, one by Dr. Kochupillai on the aetiology of the disturbing problem of neonatal hypothyroidism in goitre-endemic areas, and the other by Dr. Copeland on the usefulness of IGF-1 measurements in nutritional assessment.

At the final session Dr. Aggarwal reviewed his studies on learning disabilities in undernourished children.

All papers evoked lively discussion. The participants were happy to learn that the proceedings were to be published and would be available for wider distribution.

There were ample opportunities for scientific interactions and useful exchanges outside the conference hall. The symposium was a pleasant and memorable learning experience to all participants.

The author is Professor of Nutrition at the Lady Irwin College, New Delhi.