





NUTRITION FOUNDATION OF INDIA









Rashtrapati Bhavan, New Delhi, India

The formation of the Nutrition Foundation of India on the initiative of enlightened citizens and distinguished scientists is indeed a welcome development. Children are the most valuable resource that the human race has. A well conceived and forward looking nutritional programme implemented with imagination and determination will ultimately determine the quality of our youth and endow the future with promise. Nutrition, in all its aspects and dimensions, must therefore receive the highest priority among national objectives. Such a programme will call for closely coordinated action on the part of the government agencies as well as the active involvement of voluntary agencies and non-governmental organisations including international agencies.

I wish the Foundation success in the great task which lies before it – a task which is at once a challenge and an opportunity for public service.

- waiters

N. Sanjiva Reddy

November 27, 1979





Prime Minister

I have always regarded nutrition as one of the key points for the launching of the attack on poverty. However, we do not need to reach the level of incomes of affluent countries (who seem to be only squandering their resources) in order to ensure that all our people have adequate, healthy diet. This involves a good deal of public education and research, including the rediscovery and popularisation of traditional foods which have gone out of vogue.

My good wishes for the work of the Nutrition Foundation of India.

New Delhi November 1979

India Jonath.

Indira Gandhi



DEDICATION OF THE FOUNDATION TO THE NATION

The Foundation was dedicated to the Nation by the then Vice President of India, Shri K. R. Narayanan on May 6, 1995 in the presence of a large, distinguished gathering of scientists, policy-makers and representatives of the enlightened lay public and of international agencies. The then Hon'ble Minister for Human Resources, Mr Madhavrao Scindia, presided. The then Hon'able Lt Governor of Delhi, Mr P. K. Dave, was also present on the occasion.



Excerpts from the speech delivered by Shri K. R. Narayanan as well as some messages received on the occasion are presented in the following pages.



DEDICATION ADDRESS BY SHRI K.R. NARAYANAN Vice President of India

I feel greatly honoured to be here with you today for the Dedication of the Nutrition Foundation of India to the Nation. The dedication is in recognition and appreciation of the important role that this Nutrition Foundation of our country has played and is playing for the welfare of our people.

Dr Gopalan has been a pioneer in this field and is one of our most distinguished scientists. His valuable contributions have been widely recognised, nationally and internationally. He has not only significantly contributed to the advancement of science but has also distinguished himself as a great institution-builder, as his dedicated work at the National Institute of Nutrition, Hyderabad, at the Indian Council of Medical Research, Delhi, and now at the Nutrition Foundation of India for the last 15 years will show.

May I, first of all, congratulate Dr Gopalan and his colleagues for the contribution they have made to the health of our Nation. When we look back at our history we will realise how enormous an achievement this has been.

While we have achieved self-sufficiency with respect to food grains, the nutritional standards of our people still stand in need of improvement. What we now need after the successful Green Revolution is a 'Nutrition Revolution' to make our people healthy and happy. It is towards this revolution that Dr Gopalan and his colleagues, with other scientists in the field of health care, have been striving with dedication.

When we talk about nutrition, we tend to forget that nutrition is not merely a matter of food, nor even just a matter of nutrients. In fact, nutrition is the key to national development. Good nutrition is a reflection of good socio-economic development. It is on the basis of this broad concept that scientists, particularly nutrition scientists, have been working in our country.

The task of achieving nutritional adequacy is particularly important with respect to our women and children. We now know that malnutrition in expectant mothers has an important influence on the health of the infant. It has been established on the basis of scientific advances that malnutrition in expectant mothers could result in far-reaching



effects including degenerative diseases in later adult life. Ensuring the health of mothers and children is of the utmost importance. It is sad that as per some reports two-thirds of our women are undernourished and one out of every three preschool children suffers from severe malnutrition. The nutritional status of our women is very low and this is an unacceptable situation. Traditionally, women in our country have been less well fed than our men folk. It is high time that we gave special attention to these disturbing factors.

We often refer to the 'public sector' and the 'private sector'. There is also a third sector, which is emerging in importance in the world of today namely, the 'social sector'. Nutrition, health, education and programmes related to human development, all belong to this 'social sector'. Education and health of women are the key to social development in any country. In Kerala, it has been found that given the same levels of family income, children of families wherein the mothers are educated are better off from the point of view of their health and nutrition than those of families wherein mothers are uneducated. Apparently, educated mothers, with the same level of income. Infant mortality rates in families with educated mothers are low. Education of mothers has, thus, a far-reaching effect on the family and society.

Women's education, health and nutrition are interrelated and must receive top priority. In every country, in every war, those who suffer most are women and children. It is this group that stands in need of special protection.

I am sure that the Nutrition Foundation of India will continue its good work, and indeed will further intensify its efforts towards the improvement of the health of our people and towards overcoming the problems of malnutrition in our country. We look to this Foundation for important scientific and practical leads to combat the problems of undernutrition and ill health that presently attack our people, and to act as the spearhead of a national Nutrition Movement. I am confident that the Foundation's contributions will prove most valuable to our Nation.

In Dedicating this Institution to the Nation, today, I wish the Foundation every success in the great tasks that lie ahead.

New Delhi May 6, 1995





Prime Minister

I am happy to learn that a new building at the Nutrition Foundation of India is being dedicated to the Nation. The Foundation has made a significant contribution through its several studies, publications and activities to our nutrition programmes and policy. It has provided invaluable assistance to the Government and its agencies in improving the health and nutritional status of our people. I am confident the Foundation will redouble its efforts in this direction in its new premises.

I convey my best wishes to all members of the Nutrition Foundation of India on this happy occasion.

P.V. Manalen

P.V. Narasimha Rao

New Delhi April 28, 1995



DR M.S. SWAMINATHAN President, National Academy of Agricultural Sciences

The Dedication of the Nutrition Foundation of India (NFI) to the Nation by the Hon'ble Vice President of India marks a crowning moment in the history of NFI. Fighting against great odds, Dr Gopalan helped our country to achieve one of its most meaningful transitions – from a nation regarded in textbooks as a museum of nutritional deficiency diseases to a nation committed to achieving nutrition security at the level of individuals in each household. He built the capacity of our country to bring about this transition first by building the National Institute of Nutrition from the earlier Nutrition Research Laboratories, and later, by establishing and nurturing the Nutrition Foundation of India. He has developed NFI, within a period of 15 years, into the centre of origin of the National Health Scout Movement. He has now provided NFI with a sustainable future through an elegant and functional home.

I recall my first meeting with Dr Gopalan about 35 years ago, when he advocated a foodbased rather than a drug-based strategy for combatting nutritional deficiencies and disorders. His advocacy brought about an alliance between professionals engaged in agricultural and nutrition research and education and to the introduction of nutrition in the curriculla of agricultural universities. A joint ICMR-ICAR Panel on Nutrition was also established during his tenure as Director General of ICMR. I hope, through the efforts of NFI, we will give increasing emphasis to promoting agricultural and horticultural remedies to nutritional maladies. This will help to foster a Green Health Movement in our country, designed to provide solutions to the findings of the National Health Scout Programme.

I am confident that NFI will always remain a bright affirming flame in the sea of despair we currently witness in the national and international nutrition scenario.

N. 8. dramathin

New Delhi May 5, 1995

M.S. Swaminathan





Dedication Day, May 6, 1995



Dr C. Gopalan, President, NFI with Shri Atal Bihari Vajpayee, Prime Minister, India, 2004



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Shri K.C. Pant inaugurating the IX Asian Congress of Nutrition, February 2003



IX Asian Congress of Nutrition - Members of the Organizing Committee



PREFACE

The Nutrition Foundation of India (NFI) has now completed 25 years of service in the cause of the promotion of the nutritional well-being of our people. These have been eventful years, when hopes of eventual success helped to overcome temporary frustrations.

Several publications based on the Foundation's work (100 issues of the *Bulletin*, 15 *Scientific Reports*, nine *Special Publications* and 13 other publications) during the last 25 years have served to promote increased awareness and better understanding of nutritional problems among the public and policy makers. These publications provide a panoramic overview of India's nutritional problems, programmes and policies.

The present publication, brought out on the occasion of the Silver Jubilee of the Foundation, seeks to provide a brief overview of the genesis, objectives and contributions of NFI over the last 25 years.

NFI recognises the enormity of the unfinished tasks that lie ahead, and will continue to strive in the future as in the past, to fulfill its basic objectives. The Silver Jubilee is just a milestone; and there will be many more such milestones in the long journey which the Foundation has embarked upon.

Prema Ramachandran Director, NFI





Dr Ramesh Bhat, Coordinator IXth Asian Congress of Nutrition, February 2003



On Uton Rafic releasing the NFI 5 Year Report, November 1999



FOUNDER'S REMINISCENCES

Almost 25 years ago, on the completion of my five-year tenure as Director-General, Indian Council of Medical Research (DG-ICMR), the Government of India graciously offered to extend my services for a further term. After some deliberation, I politely declined the offer and decided instead to devote the rest of my life to the establishment and development of the Nutrition Foundation of India (NFI). In doing so, I was aware that I was embarking on a rather perilous and uncertain voyage in an uncharted sea with no material resources.

The setting up of the Nutrition Foundation of India in 1980 was, to me, the logical culmination of my long years of involvement in the study of nutrition and nutrition-related problems. This 'involvement' started over 50 years ago with my decision to join the Nutrition Research Laboratories (later to blossom into the National Institute of Nutrition during my stewardship) and to opt for nutrition research. That decision, taken after my having acquired a post-graduate degree in Medicine following on a reasonably bright academic career in the Madras Medical College, was an unwelcome surprise to my ardent well-wishers. Why would a bright, well-qualified young man with the promise of a successful medical career ahead opt for an unglamorous 'cul-de-sac' with limited opportunities? And this was a time when, following the disastrous Bengal Famine of 1943, India was a veritable museum of florid nutritional deficiency diseases, such as famine oedema, classical kwashiorkor, keratomalacia, beri beri, pellagra, peripheral neuropathies, etc!

The years that followed were years of hard



work. Many challenges had to be overcome, and many hurdles to be crossed. Links had to be forged with different sectors of the Government; with potential donors and donor agencies; with the scientific community; and with the public. The necessary trained and motivated manpower had to be mobilised with respect to the scientific programmes and publications. NFI had to establish its credibility and usefulness in the eyes of the scientific world, of the public and of the Government. These were truly formidable requirements that had to be met in the face of extremely limited manpower and material resources.

It can now be legitimately claimed that NFI has emerged successful from the tests and ordeals of the formative First Phase of its development, as is evident from the projects that it has undertaken and successfully completed; by its several publications; and by the stature it has built for itself nationally and internationally. NFI is now poised to



enter the Second Phase, of consolidation of its gains and expansion of its services.

During the last 25 years, despite limited resources, using cost-effective management strategies that ensured maximal returns for minimal material inputs, NFI was able not only to sustain a vigorous tempo of work but also to harness funds needed for putting up its permanent home. The building, which has now come up and houses the Foundation, is located in the Qutab Institutional Area, adjoining the Department of Science and Technology in South Delhi. The infrastructural facilities that are available at this new location now enable the Foundation to undertake programmes which it was unable to undertake earlier because of accommodation constraints. The Dedication of NFI to the continued service of the Nation on May 6,1995 by Shri K.R. Narayanan, the then Vice-President of India, is indeed a major landmark in NFI's history.

I had held the dual posts of President and the Director-General of the Foundation for the initial 24 years of the Foundation. Dr Prema Ramachandran has now been appointed as the Director, NFI, and she joined the post on January 1, 2004. She brings to her office considerable experience and competence. She has held important senior positions as Deputy Director, National Institute of Nutrition (DD-NIN); Deputy Director-General, Indian Council of Medical Research (DDG-ICMR); and Advisor (Health & Nutrition) in India's Planning Commission before she joined NFI.

NFI's programmes in its initial years were mostly confined to the investigation of Community Nutrition Programmes. In recognition of the importance of Clinical Nutrition in the hospital setting, a separate Centre for Research on Nutrition Support Systems (CRNSS) was formed as a registered society. The Centre is headed by Dr Sarath Gopalan, a paediatric gastroenterologist with special training in Clinical (hospital) Nutrition. The Centre is located in the NFI building and is working in close collaboration with it. With the establishment of the Centre, the overall joint programmes of the Foundation and the Centre have now been broadened.

The Contributions of NFI

What have been the major achievements of NFI? The chapters that follow, which carry some details regarding NFI and its programmes, may possibly provide some answers to the above question. Some major contributions may be briefly highlighted here.

- It is perhaps legitimate to claim that NFI, through its several publications (all of which have regularly been brought to the notice of important policy makers), has succeeded, in some measure, in keeping 'nutrition' in focus as an important factor in national development, and also in ensuring that the 'nutrition movement'– aimed at combatting undernutrition in the country proceeded on the right track without undue distortions imposed by either internal 'populist' pressures or 'external'commercial forces.
- It was the publications of NFI that served to alert the Government about the then 'sad' state of the National Goitre Control Programme, and to the need for revamping it. NFI's forthright views expressed through its publications also ensured that the National Goitre Control Programme rested solidly on the strategy of iodisation of common salt and not on injections of iodised oil.
- NFI's publications also helped to put 'growth monitoring' in its proper perspective and to correct the wasteful aberration



which almost led to growth monitoring being viewed and operated as an 'end' in itself, instead of being no more than a good 'means'. NFI's views, published at a time when there was international euphoria surrounding growth monitoring, had evoked criticism but a sober view of growth monitoring – in consonance with the views that NFI had propagated – now finds general acceptance.

- The Foundation carried out a series of studies on the growth and development of children and adolescent girls. Physical growth retardation is often used as an index of undernutrition. NFI's studies helped to identify standards of optimal growth for Indian children, against which prevailing growth performances could be compared. Studies on the growth of adolescent girls served not only to highlight the differences between the affluent and poor but also indicate the current differences with respect to the growth performance of Indian and American adolescent girls from affluent backgrounds and the possible reasons thereof. Apart from studies on physical growth, studies on the learning disabilities of undernourished school children carried out by the Foundation served to highlight the prevailing erosion of the quality of our human resources attributable to undernutrition.
- NFI played a pioneering role in drawing attention to the importance of 'adolescent girls' as being the crucial segment that must demand major attention in further nutrition programmes. At a time when NFI made this plea (over 11 years ago), not much was being said or done on this subject. Today, however, there is near universal acceptance of this concept and strategy, though a great deal more needs to be done in this area. The Foundation developed a programme of 'Education for Bet-

ter Living' beamed to adolescent girls in rural areas. For this purpose, training modules were prepared and published, and communication methodologies worked out. It was shown that even illiterate rural adolescent girls in the countryside can be 'educated' and enthused, and that their competence and self-esteem could be enhanced.

- NFI has now further enlarged this concept and is now pleading for the education and mobilisation of youth - adolescent girls and boys - for a massive 'National Health Scout Movement'. Such an imaginative movement could help achieve multiple goals. Youth could be educated; they could be weaned away from socially disruptive and futile agitations; they could become active participants in programmes national development. of Such programmes, when combined with income-generating programmes of vocational training, could transform the countryside. The strategy here is to achieve nutritional improvement as part of the overall improvement of the country's youth.
- Studies on infant feeding and lactation threw light on the extent of use of commercial baby foods in the slums of metropolitan cities in India. The study brought out the surprising finding that commercial baby foods were being more widely used by urban slum dwellers of Kolkata than those of Chennai or Mumbai; and they were being so used not because mothers preferred such foods but because of the failure of lactation due to maternal malnutrition and the inability to exclusively breast-feed infants even up to three months.
- The vast chain of rural schools in the country constitutes an excellent readily available infrastructure for the organisation



and conduct of a massive national programme of health/nutrition education, beamed not just to the school children but to the community as well. This could also help to reduce school dropout rates. The Foundation carried out a study and brought out a report recommending this approach. Unfortunately, the rural school system, which can be imaginatively used for extending basic health care and for promoting community awareness, is not being put to effective use.

- NFI, for some years now, has been carrying on what is almost a 'crusade' for reliance on a food-based rather than a drugbased strategy for combatting vitamin A and other micronutrient deficiencies. This stand has brought it into conflict with powerful international/commercial forces. New knowledge regarding the inter-relationship of nutrients and the multiplicity of beneficial phytochemicals besides conventional nutrients present in horticultural plant foods, has served to strengthen NFI's plea. It is now clear that no single nutrient, or even a combination of such synthetic nutrients, can 'mimic' the beneficial effects achieved through overall dietary improvement. The Foundation is now drawing up regional and seasonal calendars of carotene-rich foods with information on ways in which these foods can be cooked with minimal loss of nutritive value. Innovative ways of incorporating green leafy vegetables into diets and readyto-eat foods are also being investigated.
- Studies on nutrition in pregnancy served to focus attention on the need to review and reinforce the present strategy for control of anaemia in pregnancy, which consists of the administration of iron-folate tablets in the last 100 days of pregnancy; and to emphasize the importance of improved maternal nutrition as being the key

to improved foetal, neonatal and infant nutrition.

In all the 'nutrition programmes' in the country today, the mother is out of focus – indeed she is not even in the picture! The pregnant woman is expected to 'deliver', no matter what her nutritional status is; and the nursing mother is expected to 'exclusively' breast-feed her infant for at least six months, no matter how emaciated she may be. These aberrations have been largely the results of such slogans and false leads as 'reaching the preschool child' and 'child survival'. The mother must once again be restored to her rightful place. In NFI's publications, and in my own writings, I have tried to drive home this point. The above account is by no means an exhaustive list of NFI's contributions; but it briefly indicates the range of its activities.

Dreams of the Future

It may be appropriate to end these reminiscences of the past with some dreams of the future.

As long as NFI had no 'home' of its own, there was some subdued anxiety about the future. The spacious building into which NFI has now moved, and all the facilities that have been created – library, Extension/Education Unit, seminar hall, international division and research and publication division – will henceforth be the inalienable assets of the Foundation. This must remove at least one source of 'anxiety' regarding the future.

However, it is not brick and mortar, but dedicated and competent people that ensure the success of institutions. The challenges with respect to maintenance of the highest scientific standards in its programmes and publications will remain. NFI will be increasingly called upon to provide support



to national efforts aimed at nutritional upliftment. Indeed, with the further expansion of the scope of NFI's programmes, these challenges will be even greater in the years ahead.

The future programmes of the Foundation may be expected to be even more broadbased than at present. A beginning in this direction has already been made. While action-research programmes in communities will continue, more vigorous efforts at investigation of Clinical Nutrition programmes in the hospital settings, spreading the nutrition message to the community and the health care-givers, will be intensified. The agenda for this purpose, drawn up by the Education/Extension Unit, is already being implemented. The community education programme is now being addressed to children from school, youth from urban slums and adults from middle/high income groups. The library is being better equipped to benefit students and scholars interested in studies on nutrition problems. A series of lectures on nutrition by outstanding Indian and foreign scientists are being organised. These programmes will, doubtless, gain increasing momentum in the years ahead.

Over the years, NFI has steadfastly followed the policy of articulating its views freely and fearlessly; it has never resorted to the strategy of trimming its sails to suit selfish ends and achieve short-term gains. Its programmes and pronouncements have always been 'people-oriented' and not 'donor-oriented'. This 'culture' will continue to inform and guide the Foundation's activities in the future.

> C. Gopalan President, NFI





Present Staff of Nutrition Foundation of India.



OBJECTIVES AND ORGANISATION



OBJECTIVES AND ORGANISATION

Objectives

The scope of functions of the Foundation, at the time it was set up, was spelt out as follows:

- to highlight and focus public and government attention on national problems connected with malnutrition, assess their causation, magnitude and implications, and offer short-term as well as long-term action plans;
- to initiate, conduct and support coordinated action-oriented studies and research on these problems through existing institutes, university centres and other suitable bodies in order to evolve appropriate solutions capable of application in the current context;
- to investigate means to offset existing deficiencies in the pattern of predilection and distribution of foods and to ensure the wholesomeness and nutritive value of foods sold for public consumption;
- to disseminate information on diet and nutrition, promote nutrition education in schools and through mass media; publish periodically a bulletin in order to disseminate information on important facets of nutrition; and
- to interact with the Planning Commission and governmental and non-governmental agencies in facilitating the formulation, implementation and evaluation of nutrition programmes.

In the years since its formation, the Foundation has tried to adhere to these broad objectives.

During the years since Independence, India has registered remarkable progress in the fields of agriculture, industry and science, and science and technology. However, though India's Constitution (Article 47) specifically lays down that the raising of the levels of nutrition of her people must rank among the top priorities of the country, large sections of her population still suffer from varying degrees of undernutrition.

The quality of a substantial part of the most precious of India's resources, namely her human resources, is being impaired because of lack of proper nutrition and this is reflected in stunted stature, poor physical stamina, poor productivity, and lack of enthusiastic participation in national programmes of social and economic development. This qualitative dimension of India's population problem does not generally get the 'hearing' and attention which the quantitative dimension (with which it is closely interconnected) does.

Poor attendance in primary schools, poor learning ability, apathy towards (and nonutilisation of) social services such as health and family planning, high rates of absenteeism, and high morbidity (and mortality, especially among children), leading to an enormous increase in the 'curative work load' of our health services to the detriment of their preventive and promotive health programmes, can all be traced to the mental attitude and the physical state characteristic of the undernutrition syndrome.

To say all this, is not to belittle the very real advances the country has made in several sectors related to nutrition. Apart from the significant success in augmenting food production, large-scale famines which used to wipe out vast numbers of people in different parts of the country and which used to recur with distressing frequency have been eliminated. Acute emergencies caused



by floods and droughts are now being efficiently managed and promptly controlled. But the problem of 'chronic hunger', which does not hit the headlines in the media and which cannot be handled with short-term 'crisis-management' strategies, continues to take its steady and silent toll, especially among children of the poor.

We witness today the cruel paradox of widespread undernutrition in a country which has done so remarkably well on the food front that it produces enough food not only for its enormous population but also for export. Huge buffer stocks of food in the context of widespread undernutrition represent no more than a pyrrhic victory. 'Adequate per capita availability' in the current national socio-economic context is a statistical illusion. With a domestic food market which continues to be restricted because of poverty, it may not be long before the enterprising farmers decide to gradually switch over from food crops to cash crops.

The Foundation continues to make strenuous efforts to convince the policy makers that:

- the policies for food production of the country should have a nutrition orientation. While the Green Revolution had succeeded in augmenting the production of cereals, the production of pulses, vegetables and, to some extent, milk has been neglected. This distortion needs to be corrected.
- adequacy of nutrition for large sections of our people will not necessarily follow as an automatic and inevitable by-product of successful macro-economic development or achievement of overall national self-sufficiency in food production, but that special efforts in this regard are necessary.
- improved nutrition of the people could

indeed become an important instrument for national development through improved productivity and efficiency and so 'nutrition' is more than just a 'welfare operation'. The message has still to get across that achieving adequate nutrition for the great mass of people in this country must not remain a presumed 'derived objective' but must become a 'direct objective' of the planning process.

It is this situation that calls for a vigorous, independent and well-informed National Movement for Better Nutrition for India's masses. The Nutrition Foundation of India was set up with the purpose of spearheading and promoting such a movement.

There are excellent institutes in the country devoted to research in nutrition and food technology. It has been the policy of the Foundation, since its inception, not to duplicate the efforts of such institutions. It was decided that the contribution of the Foundation to the Nutrition Movement would be catalytic, additive and synergistic. In view of the inter-disciplinary nature and the wide range of efforts needed to combat undernutrition, the Foundation has sought to promote coordinated programmes that could lead to nutrition upliftment of poor communities through harnessing the support and active involvement of several existing institutes and university centres.

The objective has been to develop a total coordinated effort addressed not just to the symptoms of undernutrition but to its root causes, and to create in this process a national grid of institutions, and an inter-disciplinary scientific fraternity in the country, devoted to securing for our people the basic foundation of health, namely an adequate level of nutrition.

Nutrition has, for long, been the exclusive purview of health scientists and bio-



chemists. The Foundation has striven to enlarge the scope of the Movement for Better Nutrition in the country by enlisting economists, social scientists and the enlightened citizens as well. This has resulted in the forging of a broad national front for combating undernutrition, and for promoting sustained public and governmental consciousness and a national awareness of the nutrition problem and its immediate and long-range implications. It has tried hard to explore ways of clearing the bottlenecks (social and bureaucratic) which are responsible for the current gap between the accumulation of academic knowledge on nutrition in laboratories, and the application and utilisation of such knowledge in the field.

Organisation

The Foundation is a non-governmental voluntary agency registered under the Indian Societies Act, and recognised officially by the Government of India as a scientific research body, donations to which are 100 per cent exempt from income-tax.

The financial support which the Foundation receives for its programmes falls under two categories:

- Corpus Support, not specifically tied to any one project, to help the Foundation build and maintain its infrastructure, and to undertake scientific programmes including specific projects; and
- Project Support for specific projects identified by the Foundation.

Corpus support has been generously extended by a number of private Indian entrepreneurs. Unlike in the case of the nutrition foundations of Europe and the USA, support from food industries has been minimal. This is perhaps to be expected because the programmes of the Foundation are largely addressed to the problems of the poor and the underprivileged who have limited access to processed foods and who can hardly afford them in any case.

It must be said to the credit of the enlightened organisations and citizens who have lent their support to the Foundation that no donation to the Foundation had any strings attached to it; and in any case, the Foundation, according to its firm policy, would not have accepted any conditional support. The Foundation does not undertake any project at the behest of a donor or render any routine service such as analysis of proprietary foods or professional advice to private firms.

The Foundation greatly values the goodwill and moral support which the highest echelons of the government have generously extended to it; in fact, it is this goodwill that has enabled the Foundation to raise a considerable part of its project support from national, international and bilateral agencies. It was also this moral support that ensured a proper 'hearing' of the considered views of the Foundation on various issues governing nutrition policy at different levels of the government.

Project support for specific projects identified by the Foundation has been extended by the Government of India, national and leading international and bilateral agencies. The Foundation deeply appreciates the sustained and generous support extended by these agencies. It must be gratefully acknowledged that these agencies have allowed the Foundation full freedom in the formulation and implementation of the programmes, and in the publication of results.

The Government of India, through its Ministries of Human Resource Development, Women and Child Development, and Health, has extended support to specific projects.



Governing Body

A Governing Body (GB), composed of scientists and enlightened citizens interested in the objectives of the Foundation, meets periodically and provides general overall policy guidance. The GB consists of :

 Dr C. Gopalan, FRS, MD (Madras), DSc (London), DSc (BHU HON)

FRCP (London), FRCP (Edin), President

- Dr S. Padmavati, FRCP (London), FRCP (Edin), FAMS: Director, National Heart Institute, New Delhi, Secretary General, Treasurer
- Dr Mrunalini Devi Puar, PhD: Chancellor, MS University, Baroda.
- Mr M.M. Sabharwal: President, HelpAge India and HelpAge International.
- Dr Shanti Ghosh, FAMS: Senior Consultant in Child Health, New Delhi.
- Dr Kamala Krishnaswamy, Director, National Institute of Nutrition, Hyderabad
- Mr S. Viji: Director, Brakes India Ltd and Chairman, Sundaram Finance, Madras.
- Mrs Malini Sheshadri, MSc, ACS: Freelance writer and Company Secretary, Madras
- **Dr B.K. Nandi**, Sr Food & Nutrition Officer, FAO, Regional Office for Asia and the Pacific, Bangkok.
- Dr Prema Ramachandran, MD (Madras), FAMS, Director, NFI
- Dr Sarath Gopalan, MD (Paediatrics): Consultant in Clinical Nutrition and Paediatric Gastroenterology, Pushpawati Singhania Research Institute for Liver, Renal and Digestive Diseases (PSRI), New Delhi; Hon Director CRNSS; Deputy Director, NFI.

Former Governing Body Members

- Dr Rajammal P. Devdas, PhD, DSc: Chancellor, Avinashlingam Institute for Home Science and Higher Education for Women, Coimbatore (Deceased)
- Dr S. Rangarajan, MD : Chief, Sundaram Medical Foundation, Madras (Deceased)
- Mr T.S. Santhanam: Managing Director, TV Sundaram Iyengar and Sons Ltd, Madras (Retired)
- Dr K. Haldar, MD, PhD: Former Professor of Nutrition, All India Institute of Hygiene and Public Health (Retired)

Staff (As on October 1, 2004)

Dr Prema Ramachandran, Director Dr Sarath Gopalan, Deputy Director, NFI, and Executive Director, CRNSS

Scientific Staff

Ms Anshu Sharma, Sr Scientific Officer Ms Rita Patnaik, Scientific Officer Ms Shilpa Wadhwa, Scientific Officer Ms Sakshi Kapoor, Scientific Officer Ms Deepti Khanna, Scientific Officer Ms Karuna Sharma, Scientific Assistant Mr Kanti Mathur, Laboratory Technician Mr Chandresh Kumar, Computer Operator

Mid-day Meal Project

Dr Sushma Sharma, Consultant Dr Santosh Jain Passi, Consultant Dr Hema Sarath Gopalan, Scientific Coordinator at NFI Ms Misha Sharma, Field Scientist Ms Shavika Gupta, Field Scientist Ms Nidhi Goel, Field Scientist Ms Shruti Marjara, Field Scientist



Extension/ Education Unit

Mr J.P. Sharma, Artist

Library And Documentation Mr Mohd Naseem Hasan, Librarian

Administrative Staff

Mr J.L. Tikku, Administrative Officer Ms Sussama George, Reception Ms Shobha Bhambri, Secretary Mr R. Prasad, Maintenance Supervisor Mr Kanwal Singh, Office Assistant

Consultants

Dr Shanti Ghosh, Maternal and Child Health

Dr B.S. Narasingha Rao, Nutritional Biochemistry

Dr Vinodini Reddy, Clinical Nutrition

Dr Kamala Krishnaswamy, General Medicine & Nutrition

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Some members of the Governing Body and Staff



RESEARCH STUDIES



RESEARCH STUDIES

NFI undertakes research projects in identified priority areas and third party evaluation of major national programmes. A brief outline of some of the major Research Projects and Evaluation Studies is given in the following sections.

The Foundation undertakes research projects with the objective of:

- elucidation of causal factors underlying specific nutrition problems in the country;
- gaining insights into the epidemiology of under- and over-nutrition;
- identification of appropriate strategies to combat these problems; and
- identification of factors inhibiting the application of available knowledge for the control of specific nutritional deficiencies and methods to overcome these problems.

Priority nutrition problems to be studied are identified by the Foundation from available data, through extensive consultations with leading scientists with first-hand experience/knowledge of the subject area and through actual field visits to potential project sites. The problem so identified usually fulfills the following three major criteria:

• it is one of the major public health concerns, affecting large numbers of people,

• there are still some aspects of the problem that require further elucidation through carefully designed field studies, and

• such studies could provide concrete, feasible recommendations and leads for practical action, which could be actively taken up for implementation by the government.

The outline of the proposal for each study

is drawn up with the help of a Task Force consisting of participants from different institutions and experts from specific fields. These Task Forces act as Standing Committees which help to formulate and monitor the research projects. Task Forces which have assisted NFI in various projects are listed in the Appendix.



A Task Force meeting being conducted

As India is a vast and varied subcontinent, many of the research projects are multi-centre studies carried out in different parts of the country, using a uniform study design and protocol. The centres which participated in NFI collaborating studies are indicated in the map. The financial support to carry out the project is obtained from an appropriate agency. A list of completed research projects is provided in the Appendix.

A brief description of some of the major research projects carried out in the last 25 years on:

- Birth weight and growth during infancy
- Growth and development during childhood and adolescence
- Micronutrient nutritional status
- Overweight and obesity

is given in the following pages.



COLLABORATING CENTRES FOR RESEARCH PROGRAMMES OF NFI





BIRTH WEIGHT AND GROWTH DURING INFANCY

Low birth weight is a major public health problem in India. About 30 per cent of all infants born in hospitals weigh less than 2.5 kg at birth. Studies carried out by ICMR in the late 1970s showed that both in urban and rural areas in India, women from low income group do not have ready access to antenatal care or food supplementation through ICDS; maternal undernutrition, anaemia and pregnancy induced hypertension (PIH), were major factors responsible for high maternal morbidity and mortality and high incidence of low birth weight and high neonatal mortality. NFI had undertaken studies to assess time trends and factors influencing birth weight and the effect of supplementation during pregnancy on incidence of low birth weight.

Time Trends in Birth Weights

Studies carried out in Safdarjung Hospital in the late 1960s and early 1970s showed that approximately a third of all infants born in the hospital weighed less than 2.5 kg at birth. Neonatal and infant mortality rates were higher and the growth trajectory was lower among the low birth weight babies. During the last two decades, there has been some improvement in socio-economic status and antenatal care. NFI undertook a study in Safdarjung Hospital to assess the impact, if any, of these changes on birth weight.

Data from Safdarjung Hospital on about 13,000 births in 1989 and about 16,000 births in 1998 collected and analysed showed that over the last decade, there has not been any significant change in the mean birth weight or incidence of low birth weight in Safdarjung Hospital (Figure 1). Incidence of pre-term birth was 10.8 per cent in 1989 and 13.4 per cent in 1998, suggesting that there has not been any substantial improvement in these vital parameters of neonatal survival over a decade in this major hospital.

There was a progressive improvement in the mean birth weight and reduction in the incidence of low birth weight with increasing maternal body weight (Figure 2).

The mean birth weight was significantly lower and incidence of low birth weight was significantly higher in women who had haemoglobin levels below 8g/dL (Figure 3).



These data suggest that maternal under-







Source: NFI study, 1999

nutrition and anaemia continue to be major problems in pregnancy and are responsible for substantial proportion of low birth weight and pre-term births in Safdarjung Hospital.

Effect of dietary supplementation during pregnancy

Studies carried out at National Institute of Nutrition (NIN) showed that food supplementation during the second and third trimester of pregnancy results in improvement in birth weight. These findings were later confirmed by several investigators.

Available data indicate that Punjabi women are taller and weigh more than women in Andhra Pradesh suggesting that they may be better nourished than women in Andhra Pradesh. However, prevalence of low birth weight in Punjab is as high as in Andhra Pradesh.

NFI undertook a study in Punjab to investigate

- the dietary intake and nutritional status of pregnant women in Punjab
- the impact of food supplementation on
 - maternal weight gain in pregnancy and birth weight

 lactational performance and infant growth during first six months.

The study was undertaken in five villages with 6,851 population in Dera Bass block of Patiala District.

Women were enrolled at 28 weeks of pregnancy. Dietary intake, nutritional status and clinical examination findings were recorded at 28 weeks, 32 weeks, and 36 weeks. Pregnant women in two villages did not get supplements and served as the control group. All pregnant women in the remaining three villages were given *kaju pinni* (energy 450 Kcal and 15 g protein) daily under supervision from 28 weeks of pregnancy till delivery.

Anthropometry and dietary intake in control and supplementation group is given in Figure 4. Punjabi women were heavier and had higher energy and protein intake as compared to women in Andhra Pradesh. Weight gain during pregnancy was higher in the supplemented group whose energy intake was higher by 450 Kcal and protein by 7 g as compared to the control group.

In women who received supplements, mean birth weight was higher by 100 gms; pre-term and low birth weight rates were significantly lower as compared to control group. The improvement in birth weight was



Anthropometric assessment of rural women





highest in women whose dietary intake was lowest prior to supplementation. These findings are in line with the reports from Gambia that the benefits of food supplements were seen mainly in women who have lower dietary intake.

Ever since 1975 under the ICDS programme, pregnant women from below the poverty line families were to receive food supplement (600 Kcal with 15 g protien) during pregnancy. There is no information on the impact of programmes either on maternal nutrition or birth weight.

In the 10th Five Year Plan a pilot project has been initiated in 51 backward districts. It envisages that all pregnant women will be weighed and those with body weight less than 40 kg will be provided with 6 kg of food grain per month free of cost for three consecutive months. The impact of such targeted intervention has to be evaluated. If found to be associated with improvement in maternal nutrition and birth weight, it may represent a feasible option to improve the nutritional status of undernourished pregnant women and birth weight.

Effect of iron, folic acid and GLV supplementation during pregnancy

Multiple micronutrient deficiencies that coexist and interact in pregnant women may affect the pregnancy outcome. Micronutrients, which could contribute to IUGR, include folate, vitamin A, zinc, vitamin B12, riboflavin and iodine. NFI undertook a study to assess the effect of iron-folic acid supplementation (Fe 100 mg, folic acid 500 µg) as early as pos-

sible in pregnancy (instead of the last 100 days) and the additional effect of administration of a dietary supplement consisting of dehydrated spinach (providing 6,000 μ g of β -carotene) on the haemoglobin and serum vitamin A profile of pregnant women and birth weight.

The control group consisted of pregnant women belonging to the low-income group, coming for delivery in the General Ward labour room of the Suchetha Kriplani Hospital. Information on anthropometry, hae-



Dietary intake being recorded.



moglobin, vitamin A, iron and zinc status of mothers, birth weights of infants, and cord blood levels of iron, vitamin A and zinc were obtained in all.

The study group consisted of women coming to the MCD Maternity Centres in Srinivaspuri for antenatal care. They were divided into two sub groups.

Group I consisted of 55 women recruited during the second trimester and given iron and folic acid (IFA) supplements regularly.

Group II consisted of 49 women recruited during the second trimester and given IFA and 10 gms of dried green leafy vegetable supplement containing 6,000 μ g β -carotene daily.

The height, weight and haemoglobin level of the women at the recruitment were recorded. Both groups of women were regularly followed up and the importance of consumption of supplements was explained. Weight gain during pregnancy was noted. At the time of delivery, cord blood was collected and birth weight of the baby was recorded.

Both in the control and study groups, the taller as well as the heavier mothers had newborns with higher birth weight and lower incidence of low birth weight. Prevalence of anaemia was higher in controls followed by those receiving IFA alone and lowest in those receiving IFA with GLV supplement. The mean Hb was higher in those receiving IFA with GLV supplement than in controls and those receiving IFA alone. None of these women had vitamin A level less than 25 µg/ dl. Moderate or severe vitamin A deficiency did not seem to be a problem in the control or the study group. Supplementation of GLV preparation did bring about a fairly significant increase in the maternal vitamin A levels.

The percentage of newborns with birth weight below 2.5 kg were 36.3, 18.2 and 6.1 respectively in control, IFA and IFA with GLV supplement groups. The additional supplementation of GLV preparation along with IFA did bring about an increase of 130 gms in the mean birth weight, but this was not found to be statistically significant as compared to the birth weight in those receiving only IFA.

Actual composition of the micro and phytonutritents in the dried green leafy vegetable preparation was not estimated. However, the fact that GLV supplementation resulted in improvement in Hb levels and birth weight emphasises the need for ensuring increased consumption of GLV in pregnancy.

The study clearly demonstrates the impact of green leafy vegetables on improving maternal haemoglobin and birth weights of the infants. It is essential that nutrition education emphasising the importance of dietary diversification to improve vegetable intake is included as an essential component of antenatal care.

Effect of n-3 fatty acid supplementation on low birth weight

Studies carried out on pregnant women in developed countries showed that n-3 fatty acid supplementation in the form of fish oil resulted in reduction in the incidence of both pre term and low birth weight deliveries. It has been shown that iron and folic acid are essential to activate the metabolism of n-3 fatty acids. In India, a large proportion of the population is vegetarian. Soya oil is a vegetable oil which is rich in alphalinolenic acid and may be culturally acceptable, readily available and low cost source of n-3 fatty acids. NFI therefore undertook a study to assess the effect of supplementation of 15 ml of soya oil containing 900 mg



of alpha-linolenic acid (ALNA) in pregnant women from the 22nd week of gestation till delivery on the incidence of low birth weight.

Women coming to antenatal clinics in Defence Colony and Kamala Nehru Maternity Homes between 13-20 weeks of pregnancy were screened by the medical officers. Apparently healthy women who were living in nearby areas with no systemic or obstetric problem were informed about the proposed supplementation study, and that they would receive either IFA or IFA + Soya oil. Those who were willing to participate in the study were given IFA or IFA + Soya oil daily at home by the Mahila Karyakarta (MKK) in the area for one week. Women who did not complain of gastrointestinal side effects and were able and willing to take the supplement daily under supervision for one week were enrolled for the study. Women from the same neighbourhood who received routine antenatal care in these centres including access to IFA tablets but did not have any supervision while consuming them formed the control group.

A total of 1,122 pregnant women were recruited. During the course of the study there were 168 dropouts (15 per cent) and data on 954 singleton deliveries in whom birthweight was available were analysed.



Antenatal checkup at one of the centres



The overall mean birth weight of neonates born to mothers who received soya oil and IFA supplementation was about 100 grams more than the birth weight of infants born to the control and IFA group of women. There was a shift to the right in the birth weight in the soya oil and IFA supplementation group (Figure 5). There was a significant improvement in the mean birth weight and reduction in low birth weight rate in the soya oil and IFA supplementation group.

The study has provided a lead regarding potential benefits of soya oil supplementation in pregnancy in combatting the problem of low birth weight in India. The results have to be confirmed by independent investigators from different parts of the country. If these studies also confirm the findings of the NFI study, it is important to take up studies to ascertain the mechanism by which soya oil exerts this beneficial effect. Simultaneously operational research studies soya oil and IFA supplementation in primary health care settings may have to be taken up to assess the feasibility and effectiveness of the supplementation under programme conditions.

Maternal nutrition and infant growth

The Foundation conducted a multi-centre study among the poor slum dwellers in three major cities – Mumbai, Kolkata and Chennai to document the relationship of ma-



ternal nutrition, birth weight of offsprings and the subsequent growth of infants.

The average weight gain durint pregnancy in mothers in these communities was around 6 kg. Prevalence of iron deficiency anaemia was a higher in women from Kolkata, which could be partly attributed to poorer iron intake, poorer absorption and possibly also due to higher morbidity and because of infections in Kolkata. The percentage of mothers who delivered low-birth-weight babies was highest in the category of mothers with weight less than 40 kg and lowest in those with weight above 45 kg. In women with prepregnancy weight less than 40 kg, one third of infants weighed less than 2.5 kg at birth. Lactation performance as assessed by infant growth in Kolkata was also found to be poorer than other two centres, perhaps due to inadequate dietary intake and high infection rates.

The data from the study showed that the low body weight of the mother was a more important determinant of low birth weight in the offspring than low maternal height. Even for mothers who were significantly stunted, achievement of preconception body weight of 45 kg resulted in substantial reduction in the incidence of low birth weight deliveries. This is a finding of considerable practical significance. Stunting in the present generation of mothers cannot be corrected through nutrition intervention, but weight gain during pregnancy can be augmented through dietary improvement and rest during the last weeks of pregnancy.

Infant feeding practices and infant growth

Breast-feeding provides adequate and appropriate nutrients for infant growth and development, protects infants against infections and promotes their survival; for the mother it offers some protection against pregnancy. In the seventies public health specialists recognised the adverse consequences of erosion in the traditional breastfeeding practices on infant health and nutrition especially in developing countries and invested in massive educational efforts to protect and promote the traditional practice of universal prolonged breast-feeding. These efforts have by and large succeeded and in India today lactation is nearly universal. However the message that exclusive breast-feeding up to six months and introduction of energy dense semisolid supplements at six months is critical for prevention of under-nutrition and morbidity in infants has not been as effectively communicated. Consequently too early introduction of breast milk substitutes and too late introduction of semisolid complementary feeds are common and are responsible for the rapid increase in the prevalence of undernutrition between 6-24 months.

The Foundation undertook a multi-centre study on infant feeding practices and the use of commercial infant foods in low and middle income groups in Mumbai, Kolkata and Chennai. The study was conducted by an inter-disciplinary team of social and medical scientists.

Data from the study showed that breastfeeding is almost a universal practice, especially among the lower income groups. Majority of women introduced milk or commercial infant food before four months; 21 per cent of infants at Mumbai, 14 per cent at Kolkata and 9 per cent at Chennai were exclusively breast-fed, without any supplements at the end of eight months.

The use of commercial milk (CM) foods as supplements to breast milk was higher in Kolkata and Chennai than in Mumbai. CM had been started within the first month in 3 per cent of infants at Mumbai, 7 per cent in Kolkata and 2 per cent at Chennai. Commer-


cial cereal (CC) foods were used as supplements to breast milk in 22 per cent infants in Mumbai, 14 per cent in Kolkata and 37 per cent in Chennai.

In all the three cities, growth of infants from the middle-income group was better than those from the low-income group (Figure 6). Growth of Mumbai and Chennai children was better than growth of children in Kolkata. During the first six months prevalence of severe under nutrition was lower exclusively breast fed infants as compared to those receiving milk or commercial milk substitutes or commercial cereals. These data clearly demonstrate that breast milk alone is sufficient to support growth during infancy in the first six months. Prevalence of morbidity due to infection was higher in infants who received supplements as compared to exclusively breast-fed infants in the first six months.

The Foundation recommended that in order to ensure good health and nutrition of infants, the National Policy should be

 promotion of exclusive breast-feeding for the first six months of infancy;



- introducing a judicious combination of food items from the habitual family diet such as cereals, dal (legumes) and vegetables, after six months, while continuing breast-feeding as long as possible;
- promotion of better hygiene, and cleanliness in the preparation and handling of foods meant for the infant;
- education regarding avoidance of, and care during, infections; and
- regulation of the use of commercial infant foods.

NFI continued its advocacy for the exclusive breast-feeding in the first six months. India spearheaded to international efforts and the World Health Assembly in May 2001 passed the resolution recommending exclusive breast-feeding for the first six months, continued breast-feeding with family food till two years of age as the most appropriate infant and young child feeding practice.

India's Tenth Five Year Plan has emphasised the need to correct faulty infant feeding practices through nutrition education in order to prevent the steep increase

in undernutrition in the 6-24 months age group and laid down the following goals:

- enhance exclusive breast-feeding for children upto the age of six months from the current rate of 55.2 to 80 per cent;
- enhance complementary feeding at six months from the current level of 33.5 to 75 per cent; and
- reduce severe undernutrition by 50 per cent and undernutrition rates in the under three from current level of 47 to 40 per cent.



GROWTH AND DEVELOPMENT DURING CHILDHOOD AND ADOLESCENCE

Nutritional status in childhood and adolescence is one of the critical determinants of adult nutritional status. Height-for-age and weight-for-age are two indicators that are used widely to assess the nutritional status of children and adolescents. However, these two parameters do not take into account the appropriateness of weight for the given height. As India enters the dual nutrition burden era, where undernutrition remains a major problem and overnutrition is also emerging as a public health problem, it is important to start using BMI-for-age as the parameter to assess nutritional status so that both under/overnutrition can be detected early and appropriate intervention initiated. The Nutrition Foundation of India has conducted several studies on the nutritional status of children in the past 25 years. Data from some of the major studies are summarized.

Growth during early childhood

The NCHS/WHO norms for weight-for-age and height-for-age have been used by all countries of the world for assessment of nutritional status of children. If these norms are used, nearly half of the Indian children are undernourished (low weight-for-age) and stunted. The question is often raised whether the level of stunting and undernutrition is due to poor health and nutritional status or due to genetic factors. In an attempt to answer this question, NFI undertook a multicentre study on growth pattern of affluent children in 0-6 years of age who had adequate access to nutrition and health care.

The study carried out in Bangalore, Mumbai, Kolkata, Delhi, Kota, Ludhiana and Varanasi showed that the best level of growth performance was observed in the children of Ludhiana, with Delhi following as a close second. The growth performance of children from other centres was relatively lower but these differences were not statistically significant. These data suggest that there is no need to develop different growth standards for Indian children. As the growth of affluent Indian children are similar to the NCHS/ WHO growth norms, it is obvious that Indian children have the potential to grow, provided that there are no nutritional and health constraints.

Interstate differences in growth

India is a vast and varied sub-continent with substantial differences in the nutritional and health status between states. Most of these differences are attributable to poverty and poor access to health care. In order to find out the dimensions of regional differences in the nutritional status among children who do not face any nutritional constraints, NFI carried out a study on the growth performance of affluent Indian children (0 - 6 years) in 5 major cities – Ludhiana, Varanasi, Kolkata, Bangalore and Delhi. Data from the study showed that there







were significant differences in the heights and weights of affluent children in the different regions of the country. Children from Varanasi and Kolkata were shorter than children from the other 3 cities, who had heights comparable to NCHS height-for-age norms (Figure 7). The gap in the heights of children between the cities seemed to be widening with age (becoming as much as 4 cm by 6 years of age). When weight-for-age was computed, Delhi children weighed more than children from Ludhiana. Children from Bangalore had the lowest median weightfor-age (Figure 8). However none of these differences were statistically significant. Therefore there is no need to develop different growth standards for Indian children living in different states of the country.

Growth status of tribal children

In most of the states in India there are urban, rural and tribal populations living under different socio-economic and environmental conditions. It is possible that there may be substantial differences in the nutritional status of the urban, rural and tribal populations living in the same locality. NFI conducted a study on growth performance of 0-5 year old children from urban, rural and tribal populations in Kolkata and Jabalpur. Data of children from the three population groups in Kolkata is shown in Figure 9. There were no significant differences in the mean heights and weights of boys belonging to these three groups of population. However, among girls the urban slum children were shorter and weighed less. In Jabalpur there were no significant differences in growth between the three groups.





Effect of socio-economic status on linear growth

Height-for-age is one of the most important parameters used for assessment of nutritional status. Height is the only parameter that provides information on cumulative effect of nutritional status upto the time of examination. Studies carried out by NFI in low-income group (LIG) and high-income group (HIG) children in Delhi indicated that the median heights of HIG children are comparable to the NCHS median (Figure 10). However, those of LIG are far lower than NCHS median. The median height of children reported by NNMB are lower than even the LIG of Delhi.

Data from all the surveys indicate that in any locality in India, the median height of children from HIG are essentially similar to the median height of children in NCHS. However, the low-income group children are substantially shorter indicating that due to health and nutritional constraints, they are unable to achieve their full potential in height. Early detection of linear growth faltering and appropriate nutrition intervention are essential in order to bridge the gap in heights between the HIG and LIG.

Analysis of data from studies carried out by NFI over the last two decades indicate that in the upper income group, there has been some improvement in the linear growth in children. Data from NNMB also showed that there has been some improvement in linear growth in children from LIG (Figure 11). However, the improvements in the linear growth both in LIG and HIG are relatively small. Unlike wasting, stunting is not readily reversible; while early detection and intervention can enable the children to grow along the trajectory for their current height, fully bridging the gap in height between the two income groups may take at least a generation.





Effect of income on body weight of children

In order to assess the magnitude of differences in the nutritional status between the different income groups in the same locality, NFI is carrying out a study in Delhi school children between 6-16 years of age from low and high-income groups. As expected, the low-income group boys and girls weighed less than the children belonging to high-income groups (Figure 12). The median weight of children in the 5-9 yr age group from the affluent schools are similar to NCHS (1976) standards. The median weights of





low-income group Delhi children is higher than those reported by NNMB. This might partly be due to socio-economic (school children are from better-off segments of low middle income groups) and partly due to regional differences in growth. Data on time trends in weight of both the affluent and poor school children in India is shown in Figure 13. The results of the studies indicate that over the last few decades, weight of children belonging to both the rich and poor segments of the population in India have improved; the magnitude of improvement is, however, small.

Growth during adolescence

Though the linear growth of well-to-do Indian children during the pre-school years does not appear to be very different from that of American/European children, it is noteworthy that the adult height of even well-to-do Indians is lower than those of American/European adults. It became important, therefore, to obtain more data on the pattern of growth of Indian children during their adolescence.

NFI carried out a study to assess growth patterns of adolescent girls in urban areas of four different cities of the country – Delhi,



Mumbai, Kolkata, and Coimbatore. Linked cross-sectional study design was employed and the subjects were girls aged between 9 and 18 years. The subjects were enrolled in high schools and junior colleges, which charge high fees and mostly cater to the affluent segments of the population in the cities.

In all regions, the nutrient intake of affluent adolescent girls exceeded the dietary allowances for energy and protein recommended by ICMR for that age group. As expected, affluent girls consumed a well diversified diet; about 94 per cent of girls in Delhi and 83 per cent in Mumbai and Coimbatore were consuming at least one glass of milk every day, apart from milk intake in the form of tea and coffee. Unlike them, girls from poor families consumed diets in which staple foods constituted nearly 90 per cent. The mean age at menarche was 12.4 years in Delhi and Mumbai as compared to 12.9 years in Kolkata and 13.4 years in Coimbatore. In all centres, the mean weight of girls was about 40 kg and the mean body mass index (BMI) was about 18 around the time of menarche.

The mean height of the subjects at 18 years was found to be comparable with that of







their mothers. The girls in Coimbatore showed a delayed growth spurt as compared to girls from Delhi and Mumbai. There were significant differences between centres in the mean height (up to 15 years) as well as weights (almost up to 18 years) of the girls.

The mean height of girls in Delhi at the age of 18 years was 97 per cent of the corresponding height of American girls and the mean weight was only around 90 per cent of the American reference value for weight. The entire deficit in height and almost the entire deficit in weight of these affluent Delhi girls had accrued after 11.5 years of age (Figure 14, 15).

The debate whether the observed difference in height and weight between the affluent Indian adolescent/adult versus NCHS norm is due to genetic or dietary difference continues. In the meanwhile, it is essential that appropriate nutrition and health interventions are initiated to ensure that the large gap in height and weight between affluent and poor Indian children is bridged rapidly.

Calcium supplementation to adolescent girls and its effect on growth

More than a third of adult weight and nearly a fourth of adult height is acquired during the period of adolescent growth spurt. It has been computed that a minimum of 900 mg of calcium per day would be necessary during the phase of active skeletal growth. Indian dietaries are largely cerealbased and it is known that phytates in cereals inhibit the absorption of calcium, iron and zinc. There has been an ongoing debate regarding the contribution of low calcium intake and absorption to the observed gap in height both between affluent and poor Indian children and affluent Indian and American children. NFI undertook a longitudinal study on the effect of calcium supplementation on growth of Indian urban adolescent girls from poor and affluent families.

The study was carried out among girls from families of lower socio-economic group living in rehabilitation colonies and in affluent girls from Springdales School in Delhi. All the girls received 600 mg of CaCO₃ every day. The age at menarche in the lower socioeconomic group (LSG) experimental group was 12 years which was higher than that of the higher socio-economic group (HSG) experimental group (11.5 years). However, no difference was observed between the LSG control group and LSG experimental group (11.8 years) in the age at menarche. Varia-





A session during the study being carried out with the adolescent girls

tion in percentage of compliance in calcium supplementation also did not have any impact in the age at menarche.

The mean values of height, weight, height and weight velocity were found similar in control and experimental groups in all age groups in LIG and HIG. There were no differences in the mean values of the above parameters between groups of girls who received calcium supplementation for less than or more than 75 per cent of the days.

Thus, data from the study suggest that calcium supplementation for 6 months did not have any impact on increment in height either in affluent or poor adolescent girls. It would appear that low calcium intake might not be the limiting factor for growth performance of the adolescent children. It may, however, be argued that the diets of children belonging to the low socio-economic group in the study were not adequate with respect to other essential nutrients needed for growth, and that in the face of such deficiencies, growth promoting effect of calcium supplementation could not be demonstrated.

Use of BMI-for-age for assessment of nutritional status in children and adolescents

As India is entering the era of dual nutrition burden of under and overnutrition, it is important that under/overnutrition are correctly diagnosed taking into account appropriate weight-for-height. Though weight / (height)² (BMI) is widely used as a criterion for assessment of nutritional status in adults, this index has not been used to assess nutritional status in childhood. This is mainly because the BMI in children and adolescents varies with age and so it is not easy to use it to assess the nutritional status. Realizing the importance of a uniform reference for international comparisons, the Working Group on Childhood Obesity of the International Obesity Task Force (IOTF) has recently proposed age and sex specific BMI









criteria to define overweight and obesity in children (Cole et al 2002) (Figure 16). CDC has also developed a similar BMI-for-age norm which is also widely used. Though, the BMI-for-age curves were developed for assessment of overweight and obesity, logically they should be used for assessment of both over and undernutrition. This index however, has not yet found widespread acceptance and use by nutritionists.

The data from an ongoing study on nutritional status of children studying in government schools in Delhi using BMI-for-age and weight-for-age using (CDC criteria 2000) is shown in Figure 17. It is obvious that weightfor-age over-estimates the prevalence of undernutrition because most of the children are short (low height-for-age). BMI-for-age which takes into account current height correctly identifies wasted (thin) children who are in need of nutritional inputs to achieve optimal weight for their current heights (Figure 18 and 18a). If this can be achieved rapidly, it is possible that these children will grow along the optimal trajectory for growth for their current height. This timely intervention should enable the country to bridge the gap in height between income groups relatively quickly.

Using BMI-for-age is also very useful in identifying overnutrition in children especially those who are short and overweight and institute appropriate exercise regimen so that they can attain appropriate weight for their height (Figure 18b).

In the last decade, NFI has also carried out two studies to assess nutritional status in children attending public schools. The first study involved data collection on nutritional status of children between 5 and 18 years (n=4399; 2497 boys and 1902 girls) studying in a Public school in Delhi (2000). Data from the study on prevalence of under/overnutrition using CDC (2000) weightfor-age and BMI-for-age criteria (calculated as percentiles) is given in Figure 19. as compared to weight-for-age BMI-for-age was useful in early detection of short and overweight children who had higher BMI. Similarly BMI was also effective in identifying the tall lean children who had lower BMI-for-age inspite of having similar weight-for-age.

Analysis of data from another ongoing study (2004) in public school children (n=







700; 408 boys + 292 girls), showed similar results (Figure 20). Comparison of the data from these two studies also highlights the fact that there are significant differences in prevalence of under and overnutrition in public schools.

The prevalence of under/overnutrition in children and adolescents varies with age. Age specific prevalence of under / overnutrition in boys from the study in public schools (2004) is shown in Figure 21. This reinforces the need for using age and sex specific BMI cut-off points for assessment of nutritional status in children and adolescents.

Studies have shown that Indian children are not as tall as their western counterparts.





In the context of emerging problem of overnutrition it becomes all the more imperative to take into account appropriate weightfor-height while assessing the nutritional status (Figure 18, 18a, 18b). Data from all the studies presented in this section clearly show that BMI-for-age is a sensitive method for early detection of under and overnutrition in children belonging to any income group. It is, therefore, essential that wherever possible, BMI-for-age should be used as the criterion for detection of over and undernutrition in children and adolescents.

India is rapidly undergoing socio-economic, demographic, health and nutritional transition. The extent and the rate of change

> vary substantially between different socio-economic groups. It is essential to track the ongoing changes in nutrition and health status of the population and ensure that emerging:

- Problems are identified early and corrected expeditiously.
- Opportunities for improving nutritional status are identified and fully utilized.

Currently, the National Nutrition Monitoring Bureau (NNMB) is col-



lecting data on nutritional and health status of children in only 10 states, mostly from peninsular India. The National Nutrition Policy envisages the monitoring of nutritional status in all states of India. It is essential to carry out nutrition monitoring in all states of India in order to ensure that state/ district specific data on nutritional status is available and appropriate interventions can be initiated.

Nutritional status, physical work capacity and mental function

Undernutrition is known to have an adverse effect on work capacity. Undernutrition and poor home environment may have adverse effect on cognitive function in children. NFI undertook a study to investigate the effect of nutritional status on work capacity and cognitive function in 22 primary schools with a total of 1,366 children between the ages of six and eight years. Gomez classification was used to assess nutritional status of children; only 15.8 per cent children were normally nourished; 50.3 per cent had mild, 31.5 per cent moderate and 2.4 per cent had severe undernutrition. Over half of all children were found to be anaemic.

Impairment of muscular efficiency and physical stamina were found to be linearly related to the degree of undernutrition as



Preparing the children for cognitive test

judged by height deficit, weight deficit, or both. Height deficit was particularly associated with impaired efficiency, irrespective of whether such height deficit was accompanied by 'wasting' or not. Deficits in anthropometric status appeared to be reflected in impaired intellectual function. Thus, the relative risk of having an IQ below 90 was 4.5, 2.4 and 1.7 times higher in children with 'severe', 'moderate' and 'mild' forms of undernutrition, respectively, as compared to the normal children (Figure 22).

Analysis of the relationship between height and IQ, irrespective of weights of girls and boys, showed that the performance of those who had normal heights for age was significantly better than those who were short. Children suffering from undernutrition showed poor performance in visual perception and motor coordination tests. The study thus revealed that even the 'mild' and 'moderate' degrees of undernutrition could contribute to impairment of muscular efficiency, physical work capacity and intellectual development.

The effect of 'nutrition supplementation' was studied in a sub-sample of children using matched controls. The children received a supplement, which provided a third of





their daily calorie requirement for 175 days (that is, school days) in the year. There was no significant difference between the control and the supplemented group with respect to weight and height increments, physical performance tests, intelligence quotients and cognitive functions of children. Thus, it appeared that the food, iron and vitamin B-complex supplementation of the type and frequency provided in the present study did not result in any measurable improvement in physical growth, stamina or mental function.

Nutritional status and cognitive function

The expression 'optimal development' connotes both physical growth and psychosocial development. The factors that contribute to children's development include health and nutrition on the one hand, and care and stimulation on the other. Poverty limits the access to, and adequacy of intake of food for the families; women and children are the worst sufferers. Intrafamilial distribution of food is significantly influenced by the knowledge, attitude and behaviour of the parents. This impact is mediated by the behaviour of parents who control the child's food intake. Maternal poverty is associated with stress, poor nutrition and poor child health. The guality of the home environment in which the child is growing up could play as an important role as diet in the development of the child.

NFI undertook a study to assess the impact of nutritional status and home environment on cognitive function. In the first phase, 90 children between 3-5 years from low-income group were investigated. In the second phase, 150 children in 6-10 years of age attending primary school run by Delhi cantonment were investigated. The data showed that 19.9% children had 'normal' nutritional status; 30.41%, 25% and 25.4% children had mild, moderate and severe undernutrition respectively.

Separate coefficients of correlation were cal-



culated to study the relationship between the three variables (nutritional status, home environment and cognitive scores) at 3-5 yrs and 6-10 yrs. For the former group, the three observations showed a positive correlation, signifying that at pre-school age, when social class is controlled, better quality home of the child contributes to a better nutritional input, and both factors (home environment and nutritional input) contribute to cognitive competence in children. Severely malnourished children were found to have the poorest cognitive and home scores. Home and cognition, and, nutrition and cognition were found to be significantly correlated for the severely malnourished children, emphasizing the fact that these children were at maximum risk in terms of both mental development and nutrition, because of a poor home environment. It was observed that for this age group maternal education was positively correlated with home scores. Also, children having both parents educated, performed better on cognitive tasks.

In the age-group 6-10 yrs, the coefficients of correlation between the three variables were not significant. On the other hand better home scores were found to be related to learning meaningful pictures at all ages from



6-10 yrs. The nutritional status was positively correlated with the cognition of figural classes. Among these children it was found that parental education did not show any significant correlation with both measures of child's outcome, implying that for the school age child, external stimuli (outside the home) could play a more important role in relation to mental development, than in the case of the pre-school age. Even so, it was found that children of educated parents had better mean cognitive and home scores than the children of uneducated parents. Also, children of educated mothers had better mean cognitive and home scores than those of uneducated mothers.

These observations show that in early childhood i.e. between the ages of 3 and 6 years, children's mental development is influenced by both the home environment and the child's nutritional status, the latter essentially influencing the former. The findings revealed that parental education (especially maternal education), even upto primary school, contributed to improving the quality of home environment and children's cognitive functioning during the pre-school age, thus underlining the importance of maternal education from the point of both nutritional status, environment and cognitive development in the early years.

MICRONUTRIENT NUTRITIONAL STATUS

Anaemia in pregnancy and lactation

Nutritional anaemia due to iron and folate deficiency is a major global Public Health problem. Low dietary intake and poor iron and folic acid intake are major factors responsible for high prevalence of anaemia in India. Poor bioavailability of iron in phytate fibre rich Indian diet aggravates the situa-



Haemoglobin estimulation being done.

tion. Hospital and community based studies conducted by ICMR and other research agencies have shown that prevalence of anaemia is highest in pregnant women – estimated prevalence range between 50-90 per cent. Association between anaemia and adverse pregnancy outcome including increase in maternal morbidity and mortality, higher incidence of pre-term and low birth weight deliveries and associated high neonatal morbidity and mortality have been demonstrated when maternal haemoglobin level falls below 8g/dl.

The National Health Survey (NFHS-2) was the first national survey to undertake measurement of haemoglobin levels of all evermarried women in the age group 15-49 years and their children under three years of age in a representative sample of the population using the same technique for haemoglobin estimation. Data from NFHS-2 showed that prevalence of anaemia among





pregnant women was 49.7 per cent. The reported prevalence was substantially lower than earlier reports from smaller community surveys. There was an uncertainty, whether this lower prevalence was due to the improvement in haemoglobin levels following improved antenatal coverage or difference in the method used for estimation of haemoglobin. Data from NFHS-2 indicated that there was substantial interstate difference in prevalence of anaemia. Prevalence of anaemia was substantially lower in Kerala as compared to adjoining Tamil Nadu; Himachal Pradesh had markedly lower prevalence of anaemia as compared to neighbouring Haryana.

The Department of Family Welfare funded NFI to carry out a research study in seven states

- to estimate haemoglobin (Hb) levels, using classical cyanmethaemoglobin method, in reproductive age women, and compare them with Hb values reported in the NFHS-2 survey
- to obtain data on dietary intakes and food consumption patterns in the selected households and individuals
- to assess access to and utilization of health services including receipt and consumption of iron-folic acid tablets



• to identify the possible factors underlying the interstate differences with reference to the prevalence of anaemia.

The study was taken up by NFI as a Task Force study in seven states – Assam, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Orissa and Tamil Nadu. Pregnant and lactating woman from the villages in which NFHS has earlier conducted the survey were enrolled for the study. Detailed information on socio-economic status, reproductive performance and dietary intake was collected in all women. Physical examination findings including anthropometric indices were recorded. Haemoglobin estimation was done by cyanmethaemoglobin method in all women.

The data from the study showed that the prevalence of anaemia is higher both in





pregnant and lactating women as compared to the reported levels in NFHS-2 survey in every state (Figures 23 and 24). Inspite of the significantly higher haemoglobin level and lower prevalence of anaemia reported in the NFHS-2 survey, the pattern of interstate differences in prevalence of anaemia was similar in NFI and NFHS surveys; prevalence of anaemia was lowest in Kerala while Madhya Pradesh had the highest prevalence of anaemia.

Comparative data on prevalence of anaemia among pregnant women in seven states from NFI and DLHS (2002) Survey Phase I in which cyanmethaemoglobin method was used for the estimation of haemoglobin are shown in Figure 25. Both DLHS and NFI survey reported higher prevalence of anaemia than NFHS-2. NFI, DLHS, NNMB, ICMR micronutrient surveys have clearly shown that the filter paper collection of samples and Hb estimation by cyanmethaemoglobin method represents the most economical and accurate method of estimation of Hb in community based surveys.



Examining a woman for anaemia



Higher dietary intake of iron and folic acid, better family formation patterns (higher age at marriage, lower parity, higher inter birth intervals) and better utilisation of antenatal care (higher coverage, better quality of care and higher level of consumption of IFA tablets during pregnancy) were some of the major factors responsible for the lower prevalence of anaemia in Kerala and Himachal Pradesh.

Anaemia in the elderly

Elderly men and women living in slums face several adverse factors and are vulnerable from health and nutritional point of view. NFI undertook an in-depth study to:





- collect data related to socio-economic status and living conditions of the families of the aged
- investigate their health and nutrition status
- examine dietary intakes to identify shortcomings and deficiencies
- identify practical inexpensive ways of improving the quality of the diet and health and productivity of the aged.

The study was carried out in two slum units of the Nutrition Foundation of India in Kirby Place and Brar Square. A total of 100 men and 100 women in the age group of 60 years and above were investigated.

Dietary intake of elderly men and women was low with respect to energy, protein and all macro and micro nutrients. Mean dietary intake of iron was about 10 mg per day and vitamin C intake was about 50 mg/day.

Nearly 40 per cent of elderly men and women were undernourished (Figure 26). Prevalence of over weight and obesity was low. All of the elderly men and women were anaemic; however prevalence of severe anaemia was less than 10 per cent both in men and women.

Oral iron and folic acid supplementation for eight weeks resulted in an increase in haemoglobin levels in most patients suggesting that anaemia was mainly due to low dietary intake (Figure 27). It is therefore imperative that there should be dietary diversification so that iron and folate intake doubles.

Control of Anaemia in adolescent girls of poor communities

In India, anaemia in adolescent girls is very common and antedates anaemia in pregnancy. In view of the fact that teenage pregnancies are common, iron supplementation in adolescent girls may be a useful intervention to reduce anaemia in pregnancy. The bioavailability of iron is low in predominantly cereal based diets because of their high phytate content. It has been suggested that the bioavailability of iron may be significantly improved by ascorbic acid supplementation. Studies had shown that with continued daily administration, iron absorption could decrease due to "tiredness" of the intestinal mucosa.

NFI conducted a study to

- obtain baseline data on haemoglobin (Hb) levels of adolescent girls belonging to low socio-economic groups
- investigate the comparative efficacy of once 'weekly' and 'daily' administration of IFA tablets in improving the Hb levels and
- find out the effect of added ascorbic acid supplementation.

Adolescent girls of poor communities in urban areas of Delhi (Delhi Government school) and rural parts of Bharatpur (Rajasthan) formed the study subjects. Urban girls were school going and rural girls were predominantly out of school. They were divided into the following three treatment groups:

Group 1: One tablet of ISA (100 mg elemental iron + 500 μ g folic acid) once





Initial Hb and change in Hb in Study Groups				
S.No	Study Groups	Initial Haemoglobin (g/d	I) Change in Haem	oglobi(g/dl)
			0-3 months	0-6 months
Urban				
(<i>a</i>)	Folic acid (weekly)	10.8°±0.70(55)	0.62°±0.65 (55)	0.79ª±0.80 (54)
(<i>b</i>)	Folic acid/Vitamin C (weekly)	10.5 ^b ±0.95(57)	1.05 ^b ±0.91 (57)	1.17 ^b ±1.06 (55)
(<i>c</i>)	Control	10.8ª±0.78 (55)	_0.06°±0.88 (55)	0.63ª±0.85 (55)
	'F' ratio (df)	3.56 (2,164)	25.53 (2, 164)	4.98 (2, 161)
	Level of significance	0.0306	0.0001	0.0080
Rural				
(<i>a</i>)	Folic acid (weekly)	10.8ª±0.63 (28)	0.71ª±0.81 (28)	0.98°±0.52 (22)
(<i>b</i>)	Folic acid/Vitamin C (weekly)	10.7ª±0.70 (38)	0.76°±0.90 (38)	1.30 ^{ab} ±0.81 (32)
(<i>c</i>)	Folic acid (daily)	10.4ª±0.82 (37)	0.99°±0.92 (37)	1.57 ^b ±0.78 (28)
	F' ratio (df)	2.88 (2,100)	0.99 (2, 100)	4.10 (2, 79)
	Level of significance	0.0600	0.3800	0.0200

Difference in superscripts between the group indicates that the difference is statistically significant (p<0.05); values represent mean \pm SD (sample size)

weekly;

Group 2: One tablet of ISA and Vitamin C (100 mg elemental iron + 500 μg folic acid + 25 mg vitamin C) once weekly;

Group 3: One tablet of ISA (100 mg elemental iron + 500 μ g of folic acid) daily.

The subjects in both the urban and rural areas were randomly allocated to three groups. In the school the tablets were distributed to the subjects by a research worker immediately after lunch time. In the rural area, two field workers were responsible for the distribution and ensuring intake of tablets by the subjects after the mid-morning meal.

The urban adolescent girls were taller, heavier and had higher haemoglobin levels than the rural girls (Figure 28). Part of the difference could be attributed to income differences and better access to health care.

Data from the study showed that:

• the IFA supplementation given weekly

brought about significant improvement in the mean haemoglobin level of urban subjects, both at 3 months and at 6 months, as compared to the control group

- the response obtained with IFA given daily was superior to that obtained with IFA supplemented weekly and
- with the inclusion of vitamin C onceweekly supplementation, improvement in Hb levels was comparable to daily administration of IFA.

Thus, from the point of view of feasibility, cost and compliance, once-weekly IFA vitamin C administration to the adolescent girls through school system may be suitable as a public-health measure for the control of anaemia in adolescent girls.

Studies on Green Leafy Vegetables (GLVs)

Vitamin A deficiency in India ranks among the four major public health nutritional



problems affecting not only children but also women of the reproductive age group and others. However, over the last two decades there has been marked declined in keratomalacia and nutritional blindness. The problem to contend with now is the less severe but more widespread moderate deficiency such as night-blindness and/or Bitot's spots and low serum levels of vitamin A, with their attendant functional impairment. In the long run, improvement in dietary intakes of β -carotene is the most promising approach to combat milder form of vitamin A deficiency. Against this backdrop, the NFI conducted two multicentric studies.

NFI carried out the study on green leafy vegetalbe in Guwahati, Baroda, New Delhi and Coimbatore.

Objectives of the study were:

- to obtain as complete a listing as possible of all key carotene- rich foods available in the markets, homegrown and plucked from nearby areas in the four regions of India in different seasons.
- to prepare a seasonal calendar of carotene-rich foods, and provide estimates of the quantity and cost of these foods to meet the RDA of vitamin A for the preschool children, pregnant women and nursing mothers in India.
- to study the consumption pattern of carotene-rich foods, especially GLVs in urban and/or rural and tribal households in the four regions
- to study the social, cultural and economic influences on dietary behaviour related to the consumption of carotene-rich foods in the four regions
- based on the above, to identify the constraints to adequate consumption of carotene-rich foods and suggest strategies for overcoming them

- to estimate β-carotene content of the different GLVs and the losses that occur in common household processing methods by HPLC
- to standardise recipes that will contain adequate quantities of β-carotene per commonly eaten portion sizes, using cooking methods that retain β-carotene
- to carry out a field trial (educational/social marketing) to increase the consumption of carotene-rich foods.

The Centres identified 52 carotene-containing foods. In all regions, 60 per cent or more of these were green leafy vegetables (GLVs). Household consumption patterns revealed that preformed vitamin A intake from animal foods was low. The consumption of β-carotene containing foods contributed to 60 per cent or more of the total vitamin A intake at the household level. The freguency of consumption of β -carotene-rich foods varied widely depending on seasons, which in turn was related to availability, cost and quality of the vegetables and fruits. The intake of β-carotene-rich GLVs was very infrequent in summer season all over the country and in the monsoon season in the Northern and Western regions. Mangoes formed a part of the diet during summer, although consumption was infrequent due to its high cost. Retention of β -carotene was higher in sauteing and shallow frying, followed by pressure cooking and steaming. Cooking in vessels uncovered or covered with the lid resulted in considerable losses.

A seasonal calendar of common and uncommon β -carotene-rich foods has been prepared. The calendar lists all available β carotene rich foods separately for each season – winter, summer and monsoon along with the quantity necessary for a pre-school child, pregnant women and lactating women to meet their β -carotene requirements. The



calendar along with the recipes can help everyone directly or indirectly involved in encouraging dietary diversity to improve Vitamin A nutritional status in India.

Studies on Red Palm Oil (RPO)

The RPO study was carried out in Coimbatore, Trivandrum and New Delhi.

Objectives of the RPO Study were:

- to introduce product containing RPO into the diets of the pre-school and school children in two regions of India
- to evaluate the vitamin A status of the children before and after the introduction of the red palm oil
- to document the acceptability of RPO containing food products by children to facilitate further social marketing of these products.

Data from the study showed that:

- RPO recipes were well accepted by the children and pregnant/lactating women.
- the amount of RPO used was 4-5g/day / child and 8-10g/day/adult
- the impact of RPO consumption was seen clearly in the subjects, eg, disappear-

ance of Bitot's spots.

Based on these two studies, NFI recommended that:

- there is an urgent need to selectively promote cultivation of the already existing βcarotene-rich foods and the uncommon alternate sources such as the oil palm
- the consumption of β-carotene-rich foods, especially GLVs, prepared by appropriate methods need to be promoted using a wide variety of methods both in the national and regional supplementary feeding programmes and at the household level for which the seasonal calendar prepared in the present study will be of great value
- Low-cost technologies for preservation of β-carotene foods to make them available in summer and monsoon seasons need to be developed and popularized. At the same time, analysis of fresh and processed carotene-rich foods for their β-carotene content by appropriate methods must be pursued
- Red palm oil which is an exceptable, very inexpensive and a rich source of β-carotene is acceptable. Incorporation of RPO into national supplementary feeding programmes and promotion of RPO at the household level needs to be pursued.

OVERNUTRITION AND OBESITY

Obesity in the urban middle class in Delhi

While the country is yet to overcome problems arising from underdevelopment and poverty, it is increasingly facing problems related to affluence. With industrialisation, urbanisation and economic betterment, more individuals survive to enter middle age. With increasing affluence, undesirable lifestyle alterations such as consumption of diets rich in saturated fats, salt and excess calories, decreased physical activity, addiction to tobacco and alcohol, and increase in psychosocial stress has been reported.

 assess the prevalence of obesity in adult men and women, from different socio-economic groups by using the criteria of BMI



and waist-hip ratio (WHR)

- determine the severity and type of obesity in men and women
- assess alterations in blood pressure, blood glucose, insulin and blood lipid profile in relation to BMI and WHR
- compare prevalence of these alterations in different income groups.

The study was carried out in National Council of Education Research and Training (NCERT) employing several hundreds of people drawn largely from what may be termed the "middle class", consisting of officers (high income), clerks (middle income) and peons/attendants (low income), and a slum in Delhi inhabited mostly by the poor who were working in the unorganised sector.

Men and women from the middle income group were taller, heavier and had higher waist and hip circumferences. The prevalence rate of overweight was 1 per cent for men and 4 per cent in women in the slum population, the corresponding figures for the high-income group among the middle class, were 32.2 per cent and 50 per cent (Figure 29).

The prevalence of overweight (BMI between 25-29.9) and obesity (BMI > 30) was higher both in women and men over 40 years. The prevalence of 'overweight' was higher by 11 per cent and of 'obesity' by 3 per cent in men; 'overweight' was higher by 24 per cent and obesity by 10 per cent in women over 40 years of age.

The prevalence of abdominal obesity was significantly higher in the middle class. In slum dwellers, the prevalence of abdominal obesity was very low. The overall prevalence of abdominal obesity in the middle class was 29.2 per cent in men and 45.5 per cent in women while in slum dwellers it was 5.5 per



cent and 8.0 per cent in men and women respectively (Figure 30). In all income groups, the prevalence of abdominal obesity was higher among women.

In this study the prevalence of abdominal obesity was higher than the prevalence of overweight/obesity (BMI>25). The third tertile value of BMI was 23.6+ for men and 26.5+ for women. The waist circumference, hip circumference and WHR were significantly higher both in men and women in the higher tertile value of BMI.

The greater the BMI, the greater was the abdominal adiposity. However, nearly a third of overweight men and more than 40 per cent of the overweight women did not show abdominal obesity. On the other hand, 19 per cent of men and 22 per cent women with normal BMI had abdominal obesity (Figure 31). Thus 'abdominal obesity' and general obesity would appear to be two distinct entities. While general obesity could aggravate abdominal obesity, each of these could occur in the absence of the other.

The higher the BMI and WHR, the higher were the prevalence rates of hypertension both in men and women (Figure 32). The prevalence of high blood pressure in the normal and overweight subjects was higher





when WHR was high.

The systolic and diastolic blood pressure were significantly in higher tertiles of BMI in men and women. Elevated systolic and diastolic pressure among men were noted with increasing tertile value of WHR while only systolic blood pressure showed significant elevation with increasing tertile of WHR in women. Overweight/obese subjects of both sexes with abdominal adiposity had higher systolic and diastolic blood pressure as compared to those without abdominal obesity (Figure 33).

Serum cholesterol and triglycerides in men were significantly higher in subjects in the third tertile of BMI. There was a positive trend of increase in blood sugar with increasing tertile values of BMI both in men and women. Serum cholesterol and triglycerides increased significantly with increasing BMI and WHR both in men and women. A similar trend was seen in the ratio of total cholesterol and HDL cholesterol (Figure 34). Cholesterol levels greater than 180 mg % and blood sugar levels of 140 mg % were mostly seen in subjects with high BMI, and those with greater WHR. Insulin values, however, were mostly similar in all tertiles of BMI and WHR in both sexes.





Analysis of ECGs of 172 subjects using the Minnesota code (1982) revealed that 41 subjects had abnormal ECGs. Though, there were no significant differences in the ECGs of the normal and obese individuals, left axis deviation were seen in 18 subjects; this abnormality was highest in overweight/obese men with abdominal obesity. The number of subjects with normal ECG decreased with increasing BMI and this decrease was more marked in subjects with abdominal obesity.

Foods having relatively high fat content and high energy content was more fre-





quently consumed by the obese men and women. Mean monthly frequency of specific food intake indicated that the consumption of refined oil, fast food and cheese was higher in subjects with higher BMI. Intake of mustard oil and vegetables were significantly less frequent in obese males. In obese women, mustard oil, boiled rice, saturated fats were less frequently consumed.

Percentage of individuals who were on "desk jobs" was significantly higher in the higher tertiles of BMI. Desk jobs were also the general rule in men at higher tertiles of

WHR. The conveyance used for commuting between home and office does not seem to be significantly different between obese and non-obese individuals. Obese subjects spent more time on walking than nonobese subjects. Data showed that they started to pay increasing attention to physical exercise after obesity or overweight was recognised.

Though the rates of overweight and obesity reported from the present study are low as compared to those reported from the industrialized countries, complacence is unwarranted. Appropriate measures to prevent further increase in obesity rates must be taken right at this stage.

Obesity is not only a problem of developed countries but is rapidly becoming a problem of developing countries as well. The problem appears to be increasing with affluence, urbanisation and industrialisation. There are indications that even rural populations may not be exempt. The striking

finding of the present study is that the urban Indian middle class seems to exhibit abdominal obesity rather than general overweight/obesity. More than total body fat, abdominal obesity is a stronger predictor of risk for chronic diseases. In the present study, abdominal obesity was observed in a considerable proportion of subjects with normal BMI. Abdominal obesity is associated with increased risk of hypertension/diabetes/CVD. Dyslipidaemia, an independent risk factor for CHD, was also shown to be associated with abdominal obesity.







It is important to adopt positive strategies that would be effective in combatting obesity, such as an intensive programme of health education, on the problem of overweight/obesity, the need to promote healthy dietary practices and regular physical exercise using all channel communication.

The provision of facilities for dietary counselling and short periods of daily physical exercise/training in establishments (public/ private sector) employing a large number of people in sedentary occupations might prove to be a valuable and cost effective approach for the prevention of obesity. Overweight and obese people would need special dietary advice and guidance regarding exercise.

Over years there has been increasing consumption of sweets and deep fried savoury items. The sales of such items are higher than other foodstuffs available in fast food eateries. High levels of consumption of such calorie-dense food items is one of the factors responsible for the rising obesity among all segments of population. Nutrition education on the importance of avoiding consumption of excessive amounts of empty calories from beverages and fast foods is essential to reduce the risk of overnutrition, especially among urban middle and high income group.

Street and convenience foods in urban areas

Street foods are low cost ready-to-eat or cooked on the spot foodstuffs and beverages prepared and /or sold by vendors and hawkers in schools, railway stations, bus terminals and shopping centres. The Foundation undertook a study to

• identify street foods currently in use and urban populations that regularly eat street foods and the

possible reasons for their preference

- identify possible deficiencies in preparation, serving and food-handling practices of these foods
- identify the quantities and patterns of consumption of these foods.
- conduct microbiological analysis of street foods
- Identify steps to improve the quality and wholesomeness of these foods including a short-term training of street food vendors in the project area.

The study showed that street foods – included meals and side dishes, snacks, sweets, frozen foods and drinks – recipes are very simple, involved limited utensils and material for the preparation.

'Street foods' is a small-scale industry providing employment opportunity to vendors between 18 to 40 years of age who participate in purchasing, preparation, and distribution of street foods. Majority of the street food vendors are illiterate and earn Rs 1,000 to 3,000 per month. Majority of the consumers were from low middle income group, not aware of or concerned about food safety, good food handling practices and nutritional



aspects of foods. Non-availability of home made food, cost of foodstuffs, taste and variety of the food were some of the factors responsible for consumption of street foods by the consumers.

Pathogenic organisms especially E.Coli, Klebsiella were isolated from some street food samples. Poor sanitation in the cooking area/environment, improper food handling practices, use of contaminated water in washing of raw materials, fruits, utensils and cooking of foods, poor quality of raw materials used, use of ice made from contaminated water, contamination of the prepared foods through exposure to dust and flies, poor packing and storage and improper environment (nearness to sewer, garbage dumps) and inadequate facilities for garbage disposal were some of the factors responsible for the observed bacterial contamination.

Street foods play an important socio-economic role in terms of employment generation and in serving the food to consumers at prices affordable by the low and low middle-income groups. To safeguard the interest of consumers of street foods, NFI recommended that

- there is a need for technical training of vendors and food handlers regarding safe food preparation, storage and handling
- MCD may issue renewable licence every year to vendors who have undergone the orientation
- public need to be educated about precautions that it should take before purchasing and consuming street foods.

Studies on body composition

Currently, body mass index is used to assess under/overnutrition widely because of the relative ease and accuracy of the basic



Assessment of body fat by bioelectrical impedance

measurements. However, BMI does not distinguish between weight associated with muscle mass from weight due to excess body fat. Body composition differs between races, sexes and ages. The distribution of body fat is another important determinant to health especially in terms of development of chronic diseases. Taking the waist and hip measurement and deriving waist-hip-ratio (WHR) is useful to assess prevalence of abdominal obesity.

Two commonly used methods for assessing body fat in surveys are fat-fold thickness measurement and bioelectrical impedance analysis. It has been shown that Asian adults have higher body fat as compared to the Caucasians with similar height, weight and BMI. There are some studies, which suggest that Asian neonates and children have higher body fat as compared to Caucasians. The currently used anthropometric method of assessing body fat is through measurement of skinfold thickness (SFT) and WHR. In thin and obese individuals measurement of SFT is often difficult and not accurate. Bioelectrical impedance (BIA) is being increasingly used in recent years as an indirect method for assessment of body composition because it is non-invasive, inexpensive and can be readily used in surveys. NFI is currently undertaking a study to assess body fat in children using bioelectrical impedance.



3

EVALUATION OF NATIONAL NUTRITION PROGRAMMES



EVALUATION OF NATIONAL NUTRITION PROGRAMMES

The Government of India has been a pioneer in initiating national programmes to combat macro- and micro-nutrient undernutrition. These programmes have been evolved on the basis of research studies in the country, on the ecological factors responsible, the magnitude of the nutritional problems and feasible interventions, that could be implemented within the existing infrastructure.

At the request of the concerned departments, NFI had undertaken independent third party evaluation of these programmes at the National or State level, identified lacunae in ongoing programmes and recommended remedial measures to improve performance. A summary of some of the evaluations undertaken by NFI are given in the following pages.

National Goitre Control Programme

lodine deficiency disorders (IDD) continue to be a major public health problem in India even though the National Goitre Control programme has been in operation since 1962.

NFI carried out an evaluation of the ongoing Goitre Control Programme in 1980 to:

- assess reasons for failure of control programmes so far
- identify newly emerging dimensions of this problem and
- set out practical recommendations for future action, based on detailed consideration of causes of earlier failures.

The study showed that the existing salt iodisation facilities were inadequate to meet

the country's needs and even they were working far below their installed capacity. Quality control at the production site was inadequate and iodine loss during transport and storage was very high. Awareness about the need to use iodised salt was low even among the population groups with high IDD prevalence.

NFI made the following recommendations for ensuring universal access to iodised salt:

- opening up iodisation of salt to private sector to ensure adequate production to meet national needs
- ensuring quality control at production site
- packing salt in poly packs to reduce iodine loss during transport and storage
- testing iodine content of salt at consumer level
- improving awareness about the need to consume only iodised salt.

Over the next two decades many of these recommendations have been implemented. Iodisation of salt has been opened to private sector and production capacity has increased many folds. Quality control both at



Source: Salt Department



production and consumer level is improving. Surveys in the 1990s showed that utilisation of iodised salt is high in erstwhile goitre prone states; but in spite of ready availability consumption of iodised salt is low especially in the areas where IDD is not perceived as a problem by the population (Figure 36).

The Tenth Plan had recommended the following steps to achieve the elimination of IDD as a public health problem by 2010:

- improve access to iodised salt through TPDS, if necessary, with subsidy to cover cost differential between iodised salt and uniodised salt
- improve awareness in areas where use of iodised salt is low.

Lathyrism

Lathyrus sativus (*kesari dal*) is a hardy crop grown easily on unirrigated land. Till the sixties, this inexpensive pulse was given as wages to bonded labourers in Madhya Pradesh who consumed it in the form of chappatis. The toxin from the pulse, β -oxalyl aminoalanine (BOAA) caused neurolathyrism characterised by spastic paraplegia. In the 1950s, the reported prevalence of lathyrism was 1.5 per cent but studies carried out at NFI in 1981-82 showed that there was a steep reduction in the prevalence of lathyrism (Figure 37).

NFI recommended that:

- cultivation of lathyrus should be prevented
- payment of wages to workers in the form of lathyrus sativus must be prohibited
- ban on inter-state movement of lathyrus must be strictly enforced
- laboratory facilities for detection of BOAA in pulse flour must be made freely avail-



able in food testing laboratories to detect the adulteration of other pulses with lathyrus.

 research to develop low toxin strains of lathyrus sativus should be encouraged.

Agricultural scientists were not very successful in developing low toxin (BOAA) strains of Lathyrus and the other recommendations were not implemented effectively. Subsequent studies in the nineties have shown that lathyrism has become rare. The decline was due to the fact that cost of *kesari dal* had increased several folds and so it was no longer given to laborers as 'wages'. Lathyrism is an example of the 'nutritional' problem, which was solved by 'market forces'.

Integrated Child Development Services (ICDS)

The ICDS programme, initiated by the Government of India in 1975, is the largest and perhaps one of the most imaginative, progressive and ambitious programmes for 'human resource development' to be attempted by any developing country. The programme is designed to facilitate and promote the 'total development' of the child by making available, at the doorstep of poor communities, a coordinated package of mutually reinforcing child development services – health, nutrition and education. The emphasis is on the most crucial stages of child



development the intrauterine phase and early childhood (0-6years). In response to a request from the Ministry of Social Welfare and Women's Affairs of the Government of India, the Foundation undertook an evaluation of the ICDS programme.

The evaluation showed that:

- training received by the anganwadi workers (AWWs) is inadequate
- the AWW's knowledge regarding some basic concepts about vaccines, diseases and treatment was incomplete and inaccurate
- she needed better training about nonformal preschool education, supplementary nutrition, immunisation, health check-up and referral services, growth monitoring and record keeping
- there were no functional linkages between the ICDS and PHC set-up either for providing primary health care or referral services.

The Foundation recommended that:

- apart from the three-month pre-service training, AWW should receive refresher orientation courses and in-service training. It was suggested that different training modules suited for various regional conditions may be used
- effective system of referrals from anganwadis should be worked out through joint consultations between the health system and the ICDS system and arrangements formalized
- it will be useful if officers-in-charge of ICDS, and health officers periodically attend joint orientation programmes. The National Institute of Public Cooperation and Child Development (NIPCCD), with its regional centres and network of Home

Science colleges in the country, could be entrusted the task of organizing such orientation programmes.

During the 1980s and 1990s, ICDS has undergone substantial expansion. The GOI-World Bank reviews in 1997 and 2001, showed that the content and quality of resources under ICDS remain suboptimal because of gaps in training and supervision of anganwadi workers, and there was a lack of intersectoral coordination and community support.

The Tenth Plan envisages that there will be improvements in coverage, content and quality of services provided by ICDS for reducing macro and micronutrient undernutrition, so that the goals set in the Tenth Plan are achieved.

Nutrition Health Education and Environmental Sanitation (NHEES)

India has a vast infrastructure of rural schools offering primary education to poor children. It is estimated that in spite of poor enrolment and high dropouts, the total number of children in rural primary schools is nearly 60 million. Practically, every village in the country has a school within a radius of 1 km.

In recognition of the enormous potential of the rural school system, the Government of India launched the Nutrition Health Education and Environmental Sanitation (NHEES) Project in 1975. This project was coordinated by the National Council of Education Research and Training (NCERT) and funded by UNICEF.

The NHEES project attempted to provide a more intensive focus and purposeful direction to the health/nutrition component in the primary education system. Perhaps the most daring and innovative part of the



NHEES project was the attempt to reach the community through the rural school system.

Between 1975 and 1983, the Project was developed and expanded in two stages. In the first stage (1975-79), the project was confined to school children. In the second phase it was extended to the entire school community, namely, the pupils, the parents and the village community as a whole.



Community contact programme

Government of India (Min-

istry of Education), NCERT and UNICEF (the international agency funding the project) requested the Nutrition Foundation of India (NFI) to undertake an evaluation of the programme.

NFI found that the curriculum at the primary education level had an urban elitist bias. A few statements were found to have no scientific validity. Some instructions in the curriculum were unimaginative, complicated and repetitive. The curriculum was rather weak on information with regard to the effects of poor diets on health, which is perhaps one of the most important areas. 'Population education', even in a very elementary form, did not find a place in the curriculum; coverage of important community health problems related to poor environment, such as diarrhoea in children, and communicable diseases received inadequate coverage.

The Foundation recommended that an expert group consisting of experts in home science, child health and preventive medicine, with practical experience and first-hand knowledge of rural health problems and education may be convened for the purpose of reviewing and modifying the curriculum and the syllabus.

The community contact programme was initiated in the second phase when it became clear that nutrition/health education confined to pupils within the four walls of the schools had not made any significant impact on their health/nutrition behaviour. The communication strategy for the delivery of the messages adopted in the project included the following two approaches:

- periodic door-to-door home visits by the teachers
- organisation of periodic meetings and exhibitions, group discussions on community problems and groups singing in the school where the same messages were to be explained to the village community.

The community contact programme had ceased for nearly two years before NFI's evaluation study. Despite the two-year gap, many community members could still offer useful comments and reactions. It was found that the programme had, in fact, promoted better awareness of nutrition/health problems among some sections of the commu-



nity. The Foundation recommended that every attempt must be made to develop this part of the project, not as an isolated activity of the Department of Education, but as the common concern and responsibility of all departments engaged in rural development in the village, with the rural school system acting as a focal point and playing a coordinating role.

Evaluation of health and nutrition interventions in Madhya Pradesh

Anaemia and Vitamin A deficiency are major public health problems in pregnant women, lactating women, and children under five years of age. Dietary inadequacies and malaria aggravate anaemia. To combat these problems, the Ministry of Health & Family Welfare, Government of India, has initiated various steps to facilitate procurement, storage, supply and distribution of the needed micronutrient supplements, antihelminths, and antimalarials. However, it has been reported that the programme is not being implemented well. The Nutrition Foundation of India undertook an evaluation to identify bottlenecks, so that programme managers, health administrators and health care providers take steps to improve implementation of these programmes.

The evaluation was carried out in the Bhopal Division of Madhya Pradesh in two districts; 505 pregnant women, 395 lactating women and 900 children under the age group of five years living in 24 remote villages were interviewed. Health care providers in four Primary Health Centres (PHC) and 24 sub centres (SC) were interviewed about their knowledge and practices; pharmacists were interviewed about the availability of drugs. Focus group discussions were undertaken at the district, PHC, SC and village level.

The supply of antihelminths, antimalarials and micronutrients was not regular. Supervision and monitoring of the supply of the supplements and their distribution was poor. Though health care providers were found to have knowledge regarding the programme, their actual performance was poor. The number of pregnant and lactating women receiving IFA tablets showed an increase in comparison to previous years. However, a similar increase was not seen in children up to five years of age. Actual levels of consumption of IFA tablets were low. It is possible that the health care providers do not effectively communicate the importance of the regular consumption of IFA tablets. Massive dose Vitamin A coverage had increased in comparison to previous years. However there was no change in number of persons taking antihelminthic and antimalarial drugs. The focus group discussions revealed that greater attention was needed towards educating the community regarding the beneficial effects of these programmes. If these problems are sorted out, the vulnerable groups can get the expected benefits from these programmes.

Mid-day Meal Programme

Primary school children (6-14 years) form about 20 per cent of the total population. Free and compulsory education up to the age of 14 years is the constitutional commitment. However, even now school enrolment is not universal and about 40 per cent of the children drop out of primary school. Poor enrolment and high school dropout rate are attributed to poor socio-economic conditions, child labour, lack of motivation and poor nutrition status of the children. Data from the National Nutrition Monitoring Bureau (NNMB) Surveys (2000) indicate that majority of children in the school-going age are undernourished and anaemic.



Mid-day meal programme (MDM) also referred to as 'Nutrition Support to Primary Education' is considered as a means of promoting improved enrolment, school attendance and retention. Simultaneously, it may improve the nutritional status of primary school children. With children from all castes and communities eating together, it is also a means of bringing about better social integration.

The MDM scheme, initiated in 1995s aims to provide each school child roughly a third of the daily nutrient requirement. The Central government supplies food grains for the programme. The Supreme Court of India's Interim Order dated 28th November 2001 directed the State Governments/Union Territories to implement the Mid-day meal scheme by providing every child in every Government and Government assisted schools with a hot cooked Mid-day meal with a minimum of 300 Kcals and 8-12 grams of protein on each school day for a minimum of 200 days. In compliance with this Order, the Government of Delhi, in July 2003, initiated the programme in 410 schools for serving hot meals to the children. The programme is being extended in a phased

manner to cover all the schools. At the request of MCD, NFI undertook a third party evaluation of the programme being carried out in schools run/aided by MCD.

The objectives of the evaluation were to assess

- the infrastructural facilities available at the food supplier level
- the hygienic aspects of the food prepared by the food suppliers
- the system for receiving, storage and distribution of the meals at the schools
- overall quality (with special emphasis on nutritional quality) of the food served.

In addition, an attempt was made to obtain the feedback from children and teachers on the MDM programme through focus group discussions.

NFI helped MCD in standardisation of the food items to be given to the children in MDM, taking into account nutritional adequacy (calories and protein), variety and taste. Initially in the mid-day meals, 18 dishes were being served. Subsequently, most of the schools started serving one of the following seven items: *chhole* rice, *rajma* rice, *puri*



Children having MDM at school



sabji, vegetable *pulao*, *dal* rice, *sambhar* rice and stuffed *paranthas*.

The Nutrition Foundation of India (NFI) carried out surprise visits to 79 kitchens of suppliers of MDM and visited 316 schools to assess distribution of the MDM at school level. Evaluation of the kitchens was done on the basis of the "Code for Hygienic Conditions for Establishment and Maintenance of the Mid-Day Meal School Programmes" laid by the Indian Standards Institution (1972). Kitchens were rated on the basis of their infrastructure facilities, procurement and storage of raw material, pre-preparation and preparation activities, management of the left over food, personal hygiene of the food handlers, sanitary conditions of the cooking area, kitchen waste disposal, and transportation of the cooked food.

There was wide variation in the infrastructure facilities. Some of the kitchens had a big multipurpose room where all the activities were carried out. Only a few kitchens had well demarcated areas for different activities. There were no special pest control measures in most of the kitchens. The hygiene of cooks/food handlers was not up to the mark. They were not provided with aprons/headgears or gloves. Management of kitchen waste disposal in most kitchens was not satisfactory. None of the kitchens could be graded as good; majority were graded as fair and some as poor.

Some of the kitchens were located in very unhygienic environments, with open drains in front of the kitchens or the garbage dumps in close proximity. The choice of location of the kitchen seems to have been made on the basis of availability of space without due consideration to hygiene and sanitation of the location.

The schools were evaluated on the basis of their organization, personal hygiene of food handlers, cleanliness and hygienic condition of receiving, storage and distribution area and utensils, evaluation of food quality and drinking water facility. NFI also evaluated the personal hygiene of the children, quantity of food served per child, and consumption pattern of children at class level. Focus group discussion was held with school teachers as well as children to find their



Cooking of mid day meals at one of the kitchens.

views about the MDM programme in their schools.

It was observed that some schools were functioning without proper buildings, drinking water facilities, toilets, furniture and staff. Most of the afternoon shift schools were not as clean as the morning shift schools. The toilet facilities provided were generally in poor condition. Some



children never took midday meals; others took the food when they liked the preparation. Many children did not completely eat all the food provided. The schools were maintaining records of children who took MDM; but they should also maintain written records of the number of children who do not avail MDM and the reasons for not availing the MDM.

Personal hygiene of the children was graded on the basis of cleanliness of their

nails, hair, uniform and general appearance. It was observed that majority of the children did not wash their hands before eating their meals, even though they used their hands to eat. In terms of hygiene, majority of the children were rated as fair, but about a third were rated as poor.

Based on the findings, NFI recommended that

- the MCD may have to look into availability of space and environmental hygiene in the vicinity of the kitchen
- there is a need to provide orientation and training to the suppliers chosen for supplying MDM on the basic principles laid by the Indian Standards Institution in 1972. NFI suggested that the suppliers should be trained in large scale institutional catering and should be oriented regarding the parameters for qualitative assessment of the various areas in the



Transportation of a cooked mid-day meal in covered utensils

kitchens preparing MDM, so that they themselves can assess the shortfalls and make necessary modifications

- public health personnel and the MCD officials should carry out continuous monitoring of preparations, transport and distribution of MDM and make appropriate mid-course corrections
- the school should develop a system in which the teachers play a key role in:
 - Monitoring and ensuring quality and quantity of food served
 - Persuading children to consume all the food provided
 - Observe hygienic practices such as washing hands before eating and ensuring that utensils are clean
 - Ensuring that left over food is not thrown in and around the school to prevent environmental deterioration.





Inauguration of the Food Safety Workshop, December 2003



Dr Prema Ramachandrana (Director, NFI) making a presentation at the workshop in the Medical Curriculam





CENTRE FOR RESEARCH ON NUTRITION SUPPORT SYSTEMS (CRNSS)



CENTRE FOR RESEARCH ON NUTRITION SUPPORT SYSTEMS (CRNSS)

The main thrust of programmes being promoted by Nutrition Foundation of India fall within the purview of Community Nutrition and Preventive Nutrition. Dietary management of diseases especially in a hospital setting also needs attention, especially in view of great advances in therapeutic techniques and the increasing realization that diets play an even more important role than hitherto recognized with respect to the pathogenesis, course and outcome of diseases. With advances in therapeutics, it has become increasingly necessary to sustain patients nutritionally for fairly long periods of time while they are under therapeutic care using the techniques of Enteral and Parenteral Nutrition. In recognition of these needs, the Foundation has encouraged the formation and location within its premises of the Centre for Research on Nutrition Support Systems (CRNSS).

CRNSS was set up on December 11,1997 as a Registered Scientific Society under the Societies Registration Act of 1860, with Dr S. Padmavati as the Chairman, Dr Sarath Gopalan as Secretary and Honorary Direc-



The Director of NFI with the Executive Director of CRNSS

tor and seven distinguished scientists on its Governing Body. Its main objective is the promotion of knowledge in the field of Clinical Nutrition and in the dietary management of diseases. CRNSS works in close association and collaboration with the Nutrition Foundation of India and has its own website: www.crnssindia.org

Objectives

The CRNSS has the following objectives:

- To undertake, promote, and co-ordinate research on systems and procedures for providing critical nutrition support to subjects suffering from acute or chronic diseases and from disabilities arising from old age or other causes. Such research may be undertaken by the Society on its own initiative, or at the instance of the Government, company or association or body of individuals whether incorporated or not
- To promote and foster the application of such research for the benefit of the diseased and the disabled
- To identify indigenous and low cost technologies for providing nutrition support to the diseased and the disabled
- To undertake testing and investigation of locally available food products in order to evolve appropriate and low-cost methods of providing enteral and parenteral nutrition. Such testing and investigation procedures will be undertaken purely for research purpose and not as a routine activity or for profit
- To exchange information and to co-operate for the promotion for the objects of



the Society with other institutions, associations and societies within India or elsewhere interested in the same subjects

- To collect and disseminate information in regard not only to research but on the importance of maintaining proper nutrition support in diseases and disabilities
- To advise the Central and State Governments on the best procedures for ensuring Nutrition Support to the diseased and the disabled
- To foster training of research workers in fields related to activities of the Society
- To establish and award research studentship and fellowship
- To prepare, print and publish bulletins and periodicals in furtherance of the objectives of the Society
- To establish and maintain a Research Reference Library in pursuance of the objectives of the Society.

Research Project on Use of Fermented Foods to Combat Stunting and Failure to Thrive

With the adoption of vigorous "child survival strategies", including oral rehydration, infant and child mortality in India has significantly declined even among the poorest undernourished segments of the population. Most of the surviving children, however, continue to remain stunted and undernourished and fail to thrive. As a result of this expanding pool of substandard survivors, 52% of India's under-five population is stunted.

Probiotics are foods that contain live bacteria, which are beneficial to health. The bacterial genera most often used as probiotics are lactobacilli and bifidobacteria. They can be administered in the form of fermented foods such as curd or yoghurt. A number of health-related effects of probiotics such as alleviation of lactose intolerance, decrease in the duration of morbitity in rotaviral diarrhoea and in disorders with symptoms involving the gastrointestinal tract such as Inflammatory Bowel Disease(IBD) and Irritable Bowel Syndrome(IBS) have been documented. Yoghurt contains a significantly higher concentration of folic acid, niacin and riboflavin than milk. Colonic fermentation has been shown to be altered following probiotic intake, either as fermented milk or as freezedried cultures.

The use of lactic acid producing bacteria in foods, especially members of the genus lactobacillus, has a long history and most strains are considered commensal microorganisms with little or no pathogenic potential. The ubiquitous presence of lactobacilli in intestinal epithelium and human gastrointestinal tract and their traditional use in fermented foods and dairy products attest to their safety and they have been designated as "Generally Recognised As Safe" (GRAS). The administration of Lactobacillus acidophilus in prevention and as an adjuvant in the treatment of gastrointestinal disorders in children and adults has been advocated in many parts of the world. Activated cultures of Lactobacillus acidophilus can be used as probiotic food supplements.

CRNSS carried out a study to investigate the effect of probiotic supplementation on diarrhoeal morbidity (with respect to frequency, severity and duration of diarrhoeal episodes) and the effect of physical growth in two-to-five years old children from a very poor socio-economic background residing in an urban slum in New Delhi. There was significant reduction in both severity and duration of diarrhoea in those who received the probiotic supplement.


Other research projects undertaken by CRNSS in collaboration with NFI have already been described under the earlier section of Research Projects in this report and are listed below:

- Feasible strategies to combat low birth weight and intrauterine growth retardation
- Obesity in children and adolescents in Delhi
- Comparison of different techniques to measure adiposity in children.

Evaluation of the Efficacy of a Probiotic Preparation in Children with Irritable Bowel Syndrome

The CRNSS is now participating in a multicentric study to evaluate the efficacy of a probiotic preparation VSL#3 (Table) in paediatric patients with Irritable Bowel Syndrome. The intervention will be carried out at the Indraprastha Apollo Hospital, New Delhi. The study population will be subjects

TABLE

VSL#3 is a patented probiotic preparation of live freeze-dried lactic acid bacteria containing 450 million lactic acid bacteria per sachet, comprising 8 different strains:

- Bifidobacterium breve
- Bifidobacterium longum
- Bifidobacterium infantis
- Lactobacillus acidophilus
- Lactobacillus plantarum
- Lactobacillus casei
- Lactobacillus bulgaris
- Streptococcus thermophilus



Research projects being discussed.

4-18 years of age who have been diagnosed as having the Irritable Bowel Syndrome according to the internationally accepted criteria.

The Effect of Ketoanalogues of L-Essential Amino Acids on Nutritional and Renal Status of Patients with Chronic Renal Failure Undergoing Regular Dialysis

The extent of dietary protein restriction in patients with chronic renal failure is a subject which has been extensively debated in recent years. Based on evidence obtained from several clinical trials over the past decade, clinicians favour a minimum daily dietary protein of 0.6-0.8 gm per kg body weight per day, which is the minimum amount of dietary protein to be consumed daily in order to offset protein catabolism in patients. However, there is recent evidence from literature that a liberal protein intake can be allowed during dialysis.

Some recent clinical trials studying the effect of significant protein restriction along with oral supplementation of ketoanalogues of L-essential amino acids on nutritional status and clinical outcome of patients with chronic renal failure have aroused considerable interest. The results of these studies showed that due to the preservation of nutritional status and correction of uremic symptoms, the initiation of dialysis can be deferred in these patients. This finding can



have considerable potential for clinical application in a setting involving patients with chronic renal failure who do not have access to dialysis. However, in a setting where dialysis is available as a treatment option, there is adequate evidence to support a daily protein intake even upto 1.2 gm per kg body weight per day in these patients.

CRNSS will be taking up a study to determine whether oral supplementation of ketoanalogues of L-essential amino acids in a clinical setting, which permits liberal protein intake in patients with chronic renal failure, has an effect on frequency of dialysis as well as serum protein level.

Diet Counselling and Research Unit (DCRU)

The role that diets plays in the health of people is established beyond doubt. There has been an upsurge of diseases related to dietary imbalances and changes in lifestyles since the last few decades. It was this concern that prompted the Centre for Research on Nutrition Support Systems (CRNSS) to start a Diet Counselling and Research Unit which will provide dietary counselling service to the public and promote research towards providing an approach to health that is preventive and supportive rather than



Examintion of a patient in DCRU

prescriptive. Trained nutrition scientists, practicing dietitians and clinicians supervise and guide the activities of this unit. The objectives of this unit are:

- dissemination of information on wholesome diets in order to promote healthy eating habits within the existing meal pattern and lifestyle of the client
- guiding and instilling correct dietary and lifestyle practices to promote health and well-being in the community
- providing nutritional support to patients afflicted with diet-related diseases, such as obesity, diabetes, hypertension, anaemia, cardiovascular diseases and gastrointestinal diseases



promoting research activities to

strengthen the role of dietetics in prevention and alleviation of malnutrition and maintenance of health in chronic disease conditions.

 publish guidelines for maintenance of health through food and nutrition updates, exhibitions, demonstrations, lectures and

Diet counselling in progress



workshops, thus bringing the results of research to people who can put them into practice in their daily lives.

- collaborate with specialist institutions of traditional medicine and yoga, to provide expert advice on herbal health preparations and exercise patterns suitable for those suffering from the diseases of affluence
- work on Food Laws and help their implementation to ensure that every packaged food product provides nutritional information to guide the scientist, dietitian, nutritionist, medical practitioner and citizen. This will enable them to make the right choices for health.

DCRU seeks to provide service to the community that will contribute to the enhancement of the nutritive and health promoting diets which are feasible and culturally acceptable.

Advice to the Food Industry

A major objective of the CRNSS is to help in the promotion of the wholesomeness and nutritive value of foods through food processing technology. For this purpose, the CRNSS undertakes to advise industry on appropriate methods of food processing in order to achieve wholesomeness and enhanced nutritive value of foods. The Centre was involved in an effort to suggest ways of improving the nutritive value of wheat flour, an important ingredient in many food preparations in India. A detailed write-up providing an explanation of the scientific basis for steps to improve nutritive value of wheat flour and suggestions as to how it could be implemented was provided to the industrial establishment.

Training Programmes in Paediatric Nutrition

The CRNSS and the Apollo Centre for Advanced Paediatrics (ACAP) at the Indraprastha Apollo Hospital, New Delhi, have jointly organized four annual Courses in Practical Paediatric Nutrition. The principal objective of these Courses is to equip the participant with practical working knowledge regarding the appropriate use of enteral and parenteral nutrition in a hospital setting for paediatric patients based on the latest scientific information. The participants consist predominantly of paediatricians, dietitians and nutritionists. The Courses are conducted over 2-3 days and consist of information dissemination regarding nutritional intervention in specific clinical settings.

Nutrition in Disease Management-Update Series

A major activity being undertaken by the CRNSS is the quarterly publication of "Nutrition in Disease Management - Update Series". Dr. Sarath Gopalan is the Editor of the publication. An important objective of this publication is to present the latest information on aspects of clinical nutrition for the benefit of consultants, medical practitioners and dietitians. The emphasis is laid on issues which are particularly relevant to Indian conditions. One thousand copies of the publication are being distributed free of cost to scientists, clinicians, dietitians and various medical institutes and home science colleges both in India and abroad. The first issue of the Update Series was published in January 1999 and 23 issues of the series have been published till date. The topics discussed in the issues of the Update Series have been serially listed in the Appendix.



5

ICMR "ADVANCED CENTRE" FOR NUTRITION RESEARCH



ICMR "ADVANCED CENTRE" FOR NUTRITION RESEARCH AT NFI

The Nutrition Foundation of India is happy that in this Silver Jubilee year, the Indian Council of Medical Research (ICMR) is establishing an Advanced Centre for Nutrition Research at NFI and it will support the Centre for the next five years.

The ICMR Advanced Centre for Nutrition Research will take up long-term sustained :

- Nutrition Policy research
- Clinical research
- Research aimed at operationalisation of newer strategies proposed in the Tenth Plan for tackling some major nutrition programmes
- Capacity Building for nutrition and health education.

The brief outline of the research projects proposed and expected outcome of the projects is indicated in the following paragraphs. Initiatives under capacity buildings are indicated in the chapter on capacity building.

NUTRITION POLICY RESEARCH

Nutrition Policy Research is an emerging priority area of research because it enables research workers to

- review available data from ongoing surveys and research efforts and assess rapidly changing nutrition and health scenarios
- review ongoing basic, clinical and operational research studies in the identified priority areas and assess the feasibility, cost effectiveness and efficacy of the interven-

tions required

- suggest appropriate modifications in policy strategy and programmes for tackling the existing and emerging nutrition problems
- enable the policy makers and progamme managers to make informed and rational choices regarding priority interventions.

Some of the major areas of the proposed policy research are summarised below.

Policy Implications of Changing Energy Requirement of Indians

The ICMR has reconstituted its Expert Committee on RDA which will take into account changing lifestyles and energy requirements of Indians and come up with appropriate recommendations regarding the dietary intake of Indians. NFI would participate in this exercise reviewing the available information from research studies to define the energy requirements of healthy adult Indian men and women, adolescents, children and the elderly in their current lifestyles.

RDA forms the basis of many policies and programmes. For instance, the poverty line in India has so far been defined on the basis of cost of basket of food stuffs which will provide 2,200 calories to the urban and 2,400 calories to the rural population. The President of NFI is a member of the newly constituted Committee to define poverty line and will contribute to evaluation of policies in this critical area.

NFI would work out policy implications of the redefined RDA for other sectors concerned including agriculture, PDS, poverty



alleviation, nutrition and health and sensitise the policy makers to the new paradigm so that they all move synchronously to achieve nutrition security for all within the stipulated time frame.

Criteria for Defining Overnutrition in the Indian Context

There are substantial differences in the anthropometric indices as well as prevalence of communicable and non-communicable diseases between countries and between communities in the same country. As both Chronic Energy Deficiency (CED) and obesity are associated with adverse health consequences, it has been suggested that each country should develop its own norms for BMI and cut-off points indicative of various degrees of undernutrition and overnutrition based on their own data on health problems in persons with varying BMI levels. NFI will review the association between various anthropometric indices including body mass index, which are currently in use for defining under- and over-nutrition and health problems in India. This exercise will help in building up a database on which rational decisions can be made on appropriate cut-off points in each of these indices which could be used to screen the population and identify those at higher risk of developing health problems.

Changing face of undernutrition in children and its policy implications

In the early sixties poverty was the major factor responsible for under nutrition. Review of the recent data from NFHS and NNMB indicate poor infant feeding and caring practices, poor intrafamily distribution of food, poor access to health and contraceptive care are becoming important factors

associated with undernutrition in children. These data clearly indicate the there is an urgent need to reassess the relative role of economic factors, knowledge, attitude and practice regarding infant and young child feeding and rearing, access to health and contraceptive care as determinants of current high levels of undernutrition in childhood and initiate appropriate interventions. Finding from such a study would be of help in fine tuning of the country's programmes aimed at achieving rapid reduction in undernutrition through convergence of health, Family Welfare and ICDS services and enable the country to achieve the goals set in the Tenth Plan.

Implications of the Paradigm Shift from Household Food Security to Nutrition Security

There are numerous policy implications of the paradigm shift from food security to nutrition security proposed in the Tenth Five Year Plan. There is a need to

- undertake in-depth analysis of the implications of this shift to the definition of poverty line and also all the concerned sectors involved including agriculture, horticulture, and food processing
- identify points of convergence which will enable rapid improvement in the situation and
- identify potential areas where problems could arise, so that appropriate measures can be taken up to eliminate the problems.

The Advanced Centre for Nutrition Research will undertake research on the policy implications of the paradigm shift to different sectors of the population and sensitise the policy makers and programme managers regarding the most appropriate modality for achieving the desired goals within the existing constraints.



OPERATIONAL RESEARCH

Detection and treatment of anaemia in pregnancy in primary health care institutions

It is a matter of serious concern that over the last 50 years there has been no decline either in the prevalence or adverse consequence of anaemia in pregnancy. The Tenth Plan has laid down specific strategies and goals for reduction of anaemia in pregnancy. The objective of the study is:

- to assess the prevalence of different grades of anaemia in women attending antenatal clinics and delivering in the urban primary health care institutions in Delhi
- to assess the relationship between maternal haemoglobin levels and birth weight in women delivering in these institutions
- To operationalise screening for anaemia by cyanmethaemoglobin method in all women attending antenatal clinics, detect anaemic women and provide them with appropriate therapy as envisaged in the Tenth Plan and assess its impact on haemoglobin status and birth weight.

This study will help in:

- assessing the magnitude of anaemia in antenatal clinics, and
- operationalising the Tenth Plan strategy for the appropriate management of anaemia in primary health care settings.

Operationalising the Tenth Plan Strategy for reduction in undernutrition in pre-school children

Over the years there has been improvement in the per capita income, reduction in poverty, and increase in access to food and health care. However, there has not been a commensurate decline in undernutrition in children. The objective of the proposal is to assess feasibility of operationalising the Tenth Plan strategy for prevention, detection, and management of undernutrition in pre-school children, and achieving the goals set in the Tenth Plan within the existing constraints in selected anganwadi centres.

The focus will be to document

- the current modalities of implementation of nutrition education, growth monitoring, supplementary feeding components of ICDS programme in the 6-72 month age group.
- coverage of all the children in the age group 0-6 years by weighment and identification of varying grades of undernutrition
- reasons for relatively low coverage under supplementary feeding and weighment
- extent to which undernourished children got the additional rations/priority in access to food supplements and health care
- the impact of these interventions on the nutritional status of the child.

The study will also assess the feasibility of operationalising the strategy proposed in the Tenth Plan for

- intensive nutrition education to ensure appropriate infant and young child feeding
- health education to improve access to health care
- universal screening, identification of undernourished children, appropriate interventions





CAPACITY BUILDING



CAPACITY BUILDING

India is currently undergoing economic, demographic, nutritional and health transition. The pace of the transition varies between states and different segments of the population. Even now, undernutrition remains the major public health problem but unlike the earlier era where poverty and lack of purchasing power had been the major determinants of undernutrition, newer factors such as poor infant and young child feeding and caring practices, metabolic disorders, malignancies and HIV infection are emerging as important factors associated with undernutrition in different age groups.

The country has entered the era of dual disease burden where prevalence of overnutrition, obesity and associated increased risk of non-communicable diseases is rising. The major effort to combat this will be through dietary and lifestyle modifications. There is an urgent need to update the knowledge of all segments of population on:

- changing trends in nutritional problems and their health consequences
- appropriate dietary lifestyle modifications for prevention of these problems
- available services for early detection of these problems and appropriate management.

NFI has always been at the forefront of institutions engaged in the task of capacity building at all levels. Some of the major activities in capacity building at various levels – policy makers, programme implementators, professionals and paraprofessionals, undergraduate and postgraduate students, educational institutions and people themselves – are described in the following pages.

EXTENSION EDUCATION

The Foundation has always recognized that the growing knowledge regarding diet and nutrition should be widely disseminated to the public in order to promote healthy dietary habits and lifestyles. Much of the macro and micro nutrient deficiencies in the country can be ameliorated through the judicious use of locally available inexpensive foods, which are within the economic reach of even poor families. Nutrition education emphasizing the importance of special attention to mothers and children (the vulnerable groups) by appropriate intra-familial distribution of food based on need is urgently required to reduce undernutrition in women and children. A crucial segment of population which has been totally neglected are the mothers- to- be - the adolescent girls

who will usher in and shape the generation of tomorrow. Sustained nutrition/health education programmes beamed to different sections of the populations must form part of health services of the country.

With the emergence of obesity and related chronic degenerative diseases due to altered dietary intake and lifestyles in the emerging affluent segments of the population, nutrition education aimed at correcting lifestyles and eating habits to prevent obesity become important. The Extension Education programmes of the Foundation are aimed at reaching out to the poor communities in the rural areas and the urban slums of Delhi as well as well-to-do sections of the society.



Education for Better Living in Rural Areas

In 1992, NFI's Extension Division adopted two villages - Chiksana and Undra in the Bharatpur District of Rajasthan for exploring the role of education for better living in rural adolescent girls; NFI attempted to demonstrate appropriate and effective methodology for the mobilization and training of rural youth (especially adolescent girls), many of whom had not had the benefit of even primary school education. Health brigades (Swasthya Sainiks) comprising 20 adolescent girls were formed in village Chiksana and Undra. The youth were trained so that they were aware of health/nutrition/environment problems and of ways of overcoming them; they were motivated to actively participate in local development programmes and to disseminate the knowledge and skills they had gained to other youth in the community. A perceptible qualitative change in knowledge, attitude and practice among youth and the community was brought about through nutrition and health education.

Nutrition Education in Urban Slums

Poor and illiterate communities bear the brunt of the problems of ill health and undernutrition. The promotion of personal and environmental hygiene, sound food handling and dietary practices can help alleviate to a large extent the ill effects of poor environment and inadequate food resources. This process may be effective if planned and executed keeping in view specific requirements of slum communities.

NFI developed three field urban units at Kirby Place, Brar Square and Purana Nangal. The residents of these urban slums are chiefly migrants from nearby rural areas. Majority of residents were employed as sweepers or daily wage earners in skilled or unskilled jobs. Both areas have access to schools for children and adult literacy centres set up by NGOs.

A number of lecture and demonstration sessions were held for the beneficiaries at these field units by the Extension Education Unit of the Foundation. The target group consisted mainly of adolescent girls, women and children. The demonstrations were planned keeping in mind the nutritional deficiencies common in the population targeted. After each demonstration, the group were given pictorial hand-outs prepared in Hindi to enable them to recapitulate the topic discussed and share it with the other family members, neighbours and friends. They were encouraged to interact with trained staff answered all their of queries.



Health checkup of children in an urban slum

The broad areas covered under this extension programme included hygiene and sanitation; balanced diets for healthy living;



Demonstration of low cost nutritious recipes at NFI extension unit



the common nutritional deficiencies and ways of overcoming them through dietary modification. They were taught to make low cost nutritious recipes incorporating iron and vitamin A rich foods. The mothers were given nutrition education about the importance of breast-feeding, weaning foods and immunization of their infants, and care of infants during illness such as diarrhoea. The population in these areas benefitted from these demonstrations and attempted to make optimal use of their own resources and available services to improve their health and nutritional status.

Nutrition/Health Education For Children And Adolescents In Schools

Through the vast network of schools, children can easily be approached in large numbers at a given time, for imparting the necessary nutrition and health related education. This education will not only create awareness among the children but the nutrition knowledge could gradually be transferred to their families as well. Schools can, therefore, serve as an important avenue for imparting nutrition knowledge to hundreds



Some of the exhibits being prepared and displayed at the Extension Education unit.

of children under one roof. Hence, there is a need to explore the potential of the school education system for imparting nutrition health education effectively. The two approaches to this are:

- ensure, through the good offices of NCERT, that adequate focus is given to nutrition and health education in future textbooks/curricula
- reinforce this by drawing special attention to the importance of nutrition through sensitizing school children and teachers towards this issue.

NFI-NCERT Collaboration

Nutrition Foundation of India has been preparing informative and handy visual aids to increase awareness about the nutritional aspects of the diet in school children and in general population. NFI has been exploring feasibility of collaboration with NCERT for wider dissemination of nutrition and health education messages among school children.

NFI has also been making efforts to collaborate with NCERT to improve the content and quality of educational material for 'Nutrition and Health' in primary school by utilizing NFI's expertise as well as educational material developed by NFI.

The knowledge about food and nutrition, emerging nutritional problems and their prevention can be incorporated in the existing school curriculum and in the teachers' pre- and in-service training modules so that the entire system moves synchronously and optimal improvement is achieved within a short time.

NFI has given their comments on the content of nutrition education material currently incorporated in the text books prepared by NCERT for primary school teaching.



Nutrition Education at NFI

In order to provide information to all the visitors, a series of exhibits on relevant health and nutrition related issues have been developed by NFI and are displayed. The development and production of audiovisual aids for imparting Nutrition Education to different groups is a constant and continuous process and is being continuously updated and tailored to suit the needs of different groups that visit the Foundation. The exhibits cover a wide range of subjects such as:

- exhibits on nutrition, health, hygiene and sanitation
- information on nutritional deficiencies and chronic degenerative diseases
- adolescent nutrition is the major focus of this section
- exhibits on infant and child nutrition
- information on ongoing research activities at NFI.

These aids have been developed at NFI for use in demonstration lectures and spreading awareness about different aspects of health and nutrition.

Using these materials, NFI attempted to conduct need-based nutrition and health education to children and adolescents in schools. The basic themes for the education cum discussion sessions included:

- Diet for good health and
- Fast food/Street foods some nutritional aspects.

At a time, a group of about 50-70 students and 2 to 3 teachers were invited for the lecture cum discussion sessions. Adolescent children and teachers of various schools came to NFI and attended specially arranged sessions. The school teams (students and teachers) participating in the sessions at NFI



School children after a session on nutrition education at NFI

were taken around to the Nutrition education/ exhibits section and the library. Children were encouraged to participate in the discussions related to health and nutrition so as to clarify any doubts and misconceptions.

A half-day Nutrition Seminar/workshop was organised for school teachers, wherein apart from discussion on diet for good health and the nutritional aspects on Fast foods/ street foods, emphasis was also being laid on Nutrition games as a way of entertainment coupled with nutrition education. Preparation of nutrition games by the participating teachers helped in generating a wide array of indoor/ outdoor nutrition games which the school teachers could employ for enhancing the nutrition/ health knowledge of the children while they were at play.

It is hoped that some of the students and teachers, who had been sensitised under this programme, were able to support and organise nutrition education activities for the community as part of non-formal education outside the school system and thus help to build a cadre of Health/ Nutrition Scouts in the community.

An entire spacious floor of the building of the Foundation is set apart for dissemination of nutrition information to the com-





A session during "Nutrition Awareness Programme" at the Mothers International School

munity for persons from different age groups and socio-economic status ranging from slum dwellers to persons from affluent sections of the society. The facilities available at the Education/ Extension Unit include: a series of exhibits on relevant health and nutrition related issues; a demonstration unit for the preparation of nutritious recipes; and facilities for conducting diet counselling clinics.

'Nutrition Awareness Programme' was held at the Mother's International School as a part of their Heritage Week. The events planned were Nutrition Quiz followed by Group Discussion, Food Pyramid, Cross Word Game and Slogan Contest. It is expected that children/adolescents would carry these nutrition and health related messages to their homes and would thus act as nutrition/ health scouts not only for their families but even for the community as a whole.

The recent awakening of interest in implementation for National Mid-day Meal Programmes in schools following on the Supreme Court judgment has created a favourable climate for parallel reinforcing initiatives. The benefits of School Meal Programme will vastly improve with a wellorganized School Health Service. The ongoing School Health Programme is apparently not designed to effectively converge with the School Meal Programme in a synergistic fashion. The Foundation has already been requested by Delhi Administration to evaluate the Mid-Day Meal Programme. The Foundation hopes to undertake the initiatives to revamp the School Health Service in order to make it an effective instrument for the health of children.

The Foundation had earlier envisaged the



Nutrition Education Material for Schools: A Food Pyramid



Health Education Material for Schools: An Activity Pyramid







metric techniques.

A practical demonstration of the anthropo- A lecture cum demonstration session for the participants of training programme

formation of a National Health Scout Movement based on the following considerations:

- national development depends upon guality of human resource, especially adolescents
- concentrating on training adolescents will pay rich dividends - both in promoting community acceptance and in shaping the attitudes of youth.

Unfortunately, due to multiplicity of overlapping programmes involving youth, it has been difficult to carve out a meaningful National Health Scout Movement. The Foundation proposes to take a fresh initiative towards evolving such a movement. It is expected that the National Health Scout Movement will provide a new direction to health programmes in the country.

Training Programme at NFI

NFI has been participating in the Reproductive Health Training Programme for master trainers, programme officers, medical college faculty and health care providers by National Institute of Health and Family Welfare, New Delhi. In addition to lectures to update the knowledge on nutritional components of RCH programme, NFI staff undertakes practical demonstration of techniques used for assessment of nutritional status and quality control measures to be used to ensure accuracy in measurement of parameters used for assessment of nutritional status. NFI has undertaken a similar lecture cum demonstration session on nutrition for the participants in field epidemiology training programme of National Institute of Communicable Diseases, Delhi.

LIBRARY AND DOCUMENTATION CENTRE

Dr. Mrunalini Devi Puar, Chancellor of the M.S. University, Baroda, a member of the Governing Body and well-wisher of the Foundation had made a generous donation for setting up a Library for the Foundation. The ground floor of the NFI building now houses the Library. Over the years the Foundation had collected several useful publications related to nutrition, health and related subjects from India and abroad. Many journals, periodicals, bulletins and newsletters so collected are now available here. The Foundation is receiving a number of journals (national and international) and newsletters on complimentary/ exchange basis. The library also maintains a collection of 'fu-





Inauguration of the Library

gitive' literature of the type not available in standard libraries such as mimeographed department reports and research theses. Special attention has been paid to the collection of literature from developing countries especially from Asia.

The Library is being developed as a 'Nodal Nutrition Information Centre' with the following objectives:-

- to provide information with respect to nutrition and related topics, specially those Asia
- to create a national database related of international standards, on nutritional topics of relevance to India from materials which are presently not covered in international databases
- to establish a modern audio-visual information system for community nutrition education programmes.

The Nodal Nutrition Information Centre serves a wide spectrum of users such as scholars and scientists (Indian and foreign) interested in community nutrition problems, policy makers and planners interested in the implementation of nutrition/ development programmes, enlightened lay public seeking information on dietary guidelines for healthful living and nutritious diets, and schools and college students.



The Library

The Library plans to provide completely computerized services like Selective Dissemination of Information (SDI) and Current Awareness Service (CAS) for scientists and research workers. It also plans to create a bibliographic database for the books as well as journals, index of the selected journals and provide press clipping and an Online Public Access Catalogue (OPAC) serving for all users.

In order to effectively disseminate information, the NFI has acquired Internet facilities, which have helped NFI research scientists to keep pace with the latest development in the field of nutrition. Scientists have used this facility to acquire information and research material from other parts of the world, which might not be available in print. The Internet has also helped NFI in developing an information network with other research institutes and organizations engaged in research in nutrition and community health. Thus, with the help of the Internet, NFI is able to be in touch with the most recent developments in research being carried out in universities and research centres around the world.

Website of NFI

In order to disseminate information related to nutrition more effectively, NFI has



created its own website (www.nutritionfoundationofindia.org). This has enabled people around the world to become aware of research being carried out at the Foundation. The NFI Bulletins as well as studies carried out by NFI since its inception have become available to researchers across the world. Feedback from users is being encouraged to enable NFI to further strengthen and improve the website.

CONFERENCES AND WORKSHOPS

An important objective of the Foundation has been to bring together the scientists and experts in the field of nutrition to discuss major nutritional problems and to identify practical leads for action. A brief report of the international and national conferences, symposia and workshops organized by the Foundation is presented below.

International Symposium on 'Recent Trends in Nutrition'

The International Symposium on 'Recent Trends in Nutrition', was organised by the Foundation on December 5 and 6, 1991, to mark the successful completion of 10 years of service. The participants in the symposium included leading scientists from India and abroad. Over 350 delegates participated in the symposium. sic issues were Reflections of stunting; Adaptation in chronic undernutrition, Thermogenesis in chronic undernutrition and Energy requirements in infancy; Protein Nutrition; Nutrition, immunity and infection interactions; Trace elements in nutrition; PUFA in Indian dietaries; Neonatal hypothyroidism and Undernutrition and cognitive development.

Symposium on Nutrition Related Chronic Diseases of Asia

A symposium jointly sponsored by the Asian Nutrition Forum and WHO was organised by the Nutrition Foundation of India at the India International Centre from February 10th to 12th, 1997.

There were in all 75 participants including leading Physicians, Nutrition Scientists, Dietitians, planners and policy makers. The

The eight sessions which covered the ba-



Delegates participating in the symposium on "Nutrition Related Chronic Diseases of Asia".



Symposium discussed the issues related to the current status of degenerative diseases such as coronary heart disease, diabetes mellitus, hypertension, osteoporosis, obesity and cancer which are showing disturbing evidence of escalation in Asia. Guidelines with respect to diet, lifestyles and environment, which would help in their prevention and control, were identified. The experiences of the participating countries were considered and report was drafted.

Launch of Report on Food, Nutrition and the Prevention of Cancer: A Global Perspective

The Foundation organized the Launch of the Report on "Food, Nutrition and the Prevention of Cancer. A Global Perspective" prepared by a group of well-known international experts sponsored by the World Cancer Research Fund and American Institute for Cancer Research, on October 15, 1997 at the India International Centre, New Delhi.

This Report contains the scientific information on the possible role of diets in the prevention of cancer, and sets recommendations for appropriate dietary practices of global relevance. The Launch was an attempt to disseminate scientific information to Scientists, Policy makers, Press and the lay Public regarding the fact that cancer, in a considerable proportion of cases is preventable with correct dietary habits and lifestyles.

IUNS - Sneha Symposium on Foetal Origins of Cardio-vascular Diseases

The Foundation organised an IUNS -SNEHA symposium on "Foetal origins of cardio-vascular diseases" on 14th October 1999. This brought together the views of renowned national and international scientists on 'Foetal programming of adult degenerative diseases'. The scientific programme of the symposium covered important topics like

- Maternal Influences on diabetes in the Offspring
- Fuel-mediated teratogenesis
- Foetal Origins of Cardio-vascular Diseases
 : animal studies and mechanisms
- Fetal growth: genes and Gene-environment interaction
- Can We Alter Foetal Growth interventions in Pregnancy,
- Indian studies and foetal origins of cardiovascular diseases

IX Asian Congress of Nutrition

The IX Asian Congress of Nutrition, Organised by the Nutrition Society of India and the Nutrition Foundation of India under the auspices of Federation of Asian Nutrition Societies (FANS), was held in Hotel Ashok, New Delhi, from February 23-27, 2003. India hosted the Congress for the second time. The First Asian Congress of Nutrition hosted by India was held in 1971 at Hyderabad. The President of IX Asian Congress of Nutrition, Dr C Gopalan was also the President of the First Asian Congress of Nutrition and had initiated this series.

The Congress was attended by over 1,350 delegates from 46 countries. The Scientific Programme consisted of 6 Plenary Lectures, 6 Plenary Sessions, 30 Symposia, Oral Free Communication and Poster Sessions. The Scientific Programme presented a balance between the basic scientific research and practical applications. The Congress provided an opportunity for scientists from different countries to interact with each other and share experiences.

The Plenary sessions included:

• Changing Nutrition Scene in Asia -





IX Asian Congress of Nutrition in progress

Chaired by Dr C. Gopalan and Dr Vinodini Reddy

- Diet and Genes : Nutrigenetics/ Nutrigenomics – Chaired by Dr Artemis Simopolous
- Newer Technologies for Augmenting Food Production in the 21st Century – Chaired by Dr M.S. Swaminathan
- Traditional Health Promoting Foods of Asia – Chaired by Dr H. Ohigashi and Dr Kamala Krishnaswamy

The Gopalan Oration on "Impact of nutrition improvement on economic development" was given by Dr Chen Chunming from China.

The Srikantia Memorial Lecture was delivered by Dr M.S. Swaminathan on "Ensuring ecological, social and economic access to balanced diets and safe drinking water".

Dr Cecilia Florencio from Philippines gave the Keynote Address on "Nutrition as a human right – context, concepts and challenges"

The other Plenary Lectures delivered at

the Congress were:

- Towards attaining food and nutrition security in Asia by Dr Kraisid Tontisirin
- Changing views on women nutrition in Asia by Dr Sook He Kim
- Nutrition and ageing by Prof Mark Wahlquist

The symposia dealt with the following major areas:

- Nutrition in the vulnerable groups
- Micronutrients and Nutrition
- Clinical Nutrition
- Chronic diseases
- Technology and Agriculture
- Public Health

A unique feature of the Congress was "Meet the Professors" session which provided an opportunity for senior professors like Prof Gabr and Prof Waterlow to present their experiences and reminiscences for the benefit of younger generations.

Another important session was "Science Industry Interaction" in which both leading industrialists and scientists participated and interacted.



National Workshop on 'Combating Vitamin A Deficiency through Dietary Improvement

A National Workshop on 'Combating Vitamin A Deficiency through Dietary Improvement' was conducted by the Foundation on January 9 and 10,1992. All important governmental agencies and National institutes, as well as WHO and UNICEF, were represented at the workshop. Experts from different disciplines such as home science, agricultural sciences, food technology and nutrition, as well as senior administrators belonging to different sectors, were brought together for the first time, in order to find practical and feasible solutions to the problem of vitamin A deficiency within the framework of dietary improvement. Participants in the workshop were scientists with considerable experience with respect to the problem of vitamin A deficiency and the production and consumption of carotene-rich foods. UNICEF supported the workshop financially.

Emphasis was laid on the promotion of breast-feeding and colostrum feeding along with other measures to combat vitamin A deficiency, particularly in the poor sections of the rural and urban communities.

The two days of discussion at the workshop generated a broad consensus that the approach to combat vitamin A deficiency must be based on dietary improvement. It should also be possible to achieve this, within a specified period of time, by promoting the production and consumption of a whole range of foods rich in β -carotene. A definite policy decision to taper off the current near-exclusive reliance on synthetic vitamin A massive dosage approach within a period of five years, in a phased manner, will inject the necessary sense of purpose and urgency in this regard. This will also imply that the present ill-conceived efforts to further expand the use of synthetic vitamin A in public health programme, are misplaced and unwarranted.

Symposium on Nutrition and Brain

A symposium on Nutrition and Brain was organized by the Nutrition Foundation of India at the India International Centre on 1st August, 1998. This served as a forum to bring together renowned scientists from the fields of nutrition, neurobiology, psychology and provided the scientific community an opportunity to discuss and understand important issues related to the interactions of nutrition and brain development, especially when there is widespread malnutrition prevalent in the population as is the case in our country.

Symposium on Science and Human Resource Development

To felicitate the Director-General of the Foundation on his 80th birthday, his friends and well-wishers organized a Symposium on 'Science and Human Resource Development' which was presided by Dr R.A. Mashelkar, Director General, Centre Scientific and Industrial Research. It was an attempt to bring together associates of Dr Gopalan and renowned scientists with the objective of highlighting the need for spreading scientific knowledge among the new generation of the country and thus ensure the betterment of our Human Resource. The topics covered under the scientific program included

- Training in the Super Specialities: Cardiology
- National Programmes for Child Development
- The joy of entering Medical Research early in life and



• Fluorosis Research: Scientific flow from East to West – Beginning of a new era.

ICMR-NFI Workshop on Priorities in Nutrition Research

A two-day Meeting was held on January 15-16, 2000, in order to identify specific research problems that may need to be supported by the ICMR in major areas of national interest in the field of nutrition. The meeting was a brainstorming session and resulted in leads for action-oriented research in key areas related to nutrition. The three sessions covered in the meeting were

- Maternal nutrition and pregnancy outcome with special reference to micronutrients
- Child and adolescent nutrition
- National programmes.

National Consultation to Review the Existing Guidelines in ICDS Scheme in the Field of Health and Nutrition

A two-day meeting to review the existing guidelines in ICDS was held on March 16-17, 2001 at NFI. The consultation was organised by the Nutrition Unit of the All India Institute of Medipact of supplementary feeding, fortification of supplementary foods with micronutrients, nutrition counselling of mothers, homebased care of new-borns by anganwadi workers, early childhood care for survival, growth and development of children in ICDS. Besides these issues, specific areas of strengths and weaknesses in the ICDS scheme were also deliberated upon.

Workshop on 'Mid-day Meal Programme in Schools in India – The Way Forward'

The Nutrition Foundation of India had organized a two-day workshop on 31st July-1st August, 2003 on 'Mid-Day Meal Programme in Schools in India – the Way Forward' – a subject which has gained greater interest in recent times owing to the Supreme Court judgment. The objective of the workshop was to examine all aspects and answer certain questions pertaining to the 'Mid – Day Meal Programme'. During the workshop, there were in-depth presentations and discussions on the experiences of various states regarding their School Meal Programme.

The workshop was well attended and participants included representatives of the

cal Sciences to review the existing guidelines and recommended operationally feasible and scientifically sound guidelines for efficient implementation of the ICDS scheme. Leading nutrition scientists of the country participated in the consultation. The broad areas of discussion were: utility of growth monitoring, im-



Representatives from different states sharing their experiences during the Mid Day Meal Workshop



Planning Commission, secretaries of the various State Education Departments, eminent academicians, and representatives from many organizations actively involved in the mid-day meal programme.

Workshop on Strategy for Ensuring Food Safety

A National Workshop on Strategy for Ensuring Food Safety was organised by the Nutrition Foundation of India in association with the Food and Agriculture Organisation (UN) in New Delhi from December 6 to 8, 2003. The major objective of the workshop was to develop a strategy which will strengthen activities in India for improving safety and quality of food. The workshop was attended by a multi-sectoral and a multi-disciplinary group consisting of experts in the areas of food safety, toxicology, microbiology, and epidemiology, as well as academicians, administrators, representatives of civil society, especially consumer organisations and industry.

The extent of the problem created in India due to food contaminants, toxicants, adulterants is compounded by the life style such as the use of street foods specially in urban areas, unhygienic situations in public catering places and sometimes even in households, various industrial pollutants such as heavy metals and other chemicals, widespread non-judicious use of various agrochemicals, especially pesticides. Even the use of the latest food technologies such as minimal processing hurdle technologies, developments of cold pockets during storage, use of unapproved varieties of genetically modified foods such as Starlink maize, could result in health hazards.

Considerable efforts in improving the food safety scenario have been made by many agencies and some success has been achieved. These include the role of a plethora of developmental agencies and orders such as the AGMARK, BIS. FPO, APEDA, MPEDA, FPO, M&MPO, EIC, MFPO and Commodities Boards such as coffee, tea, spices, coconut, bee (honey), horticulture, dairy, tribal produce (TRIFED), etc, in improving food safety. A detailed presentation of the functioning of the Export Inspection Council revealed that it has already moved from the inspection mode to quality control throughout the food chain in egg, milk, honey, poultry, meat and marine products. The challenges globalisation, of liberalisation and the post-WTO scenario were successfully met with the signing of equivalence agreements and MoUs with several countries, responding to complaints received from abroad, and appropriate unit monitoring.

Consumers organisations want to build a system which will give power to the consumer and emphasise the need to expose the truth, and are demanding a systemic change. They prefer to have a problem-free recognised system for consumer organisations to lift food samples. They also want public prosecutors to take charge of complaints lodged by consumer organisations, on the basis of public analysts reports. According to them, fines should be proportionate to the business turnover of the company. Following the principle of natural justice, they want opportunities to be given to manufacturers to react to the results of analysis carried out by them before making them public. They also exhort citizens not to suffer in silence and not to accept injustice. The National Human Rights Commission has begun to look at unsafe products as affecting the fundamental right of citizens to life and liberty. They want manufacturers to be accountable and unjust enrichments to be recovered from the par-



ties concerned. They prefer the consumers to be compensated for the loss suffered because of purchase of unsafe food.

Workshop on Nutrition in Medical Curriculum

India is currently in the midst of socioeconomic, demographic, nutritional and epidemiological transition. While undernutrition and anaemia continue to affect large segments of the population and cause ill health, obesity and associated health hazards are emerging as important public health problems especially among affluent segments of the population. The physicians have to play a critical role in combating the dual nutrition and disease burden through a multi- pronged strategy. Their responsibilities include:

- Health promotion and health protection through appropriate nutrition and lifestyle counseling
- Early detection of nutritional problems through appropriate screening of vulnerable population groups
- Effective management of both under- and over-nutrition and associated health hazards
- Providing nutrition advice during illness and convalescence

 Advances in therapeutic nutrition have resulted in improvement in enteral / parenteral nutrition during illness. These have not yet been internalized as a part of the medical curriculum either at undergraduate or at post-graduate level.

There is a growing awareness that it is essential to improve knowledge, skills and practices of medical undergraduates so that they can provide the individuals, families and communities appropriate care and advice so that they remain healthy and the country achieves rapid reduction in the disease burden due to nutritional problems. Currently different aspects of nutrition are being taught in different subjects to medical undergraduates. Modifications in the undergraduate Medical Curriculum are needed so that undergraduates acquire knowledge and skills to:

- Provide appropriate nutrition advice to the persons seeking health care for prevention and management of under / overnutrition and associated morbidity.
- Programme managers achieve optimal synergy between health and nutrition services to enable the country to achieve rapid improvement in health and nutritional status of the population.



A light moment during the Workshop on "Nutrition in the Medical Curriculum"

A three-day workshop on "Nutrition in the

Medical Curriculum" was organised from 28-30th April, 2004 at the India International Centre, New Delhi by Nutrition Foundation of India and Centre for Research on Nutrition Support Systems with technical support from Medical Council of India, Directorate General of Health Services, Ministry of Health and Family Welfare, Indian Council of Medical Research, National Academy of



Medical Sciences and Department of Biotechnology. The Workshop brought together nutrition scientists, physicians, medical educationists and programme managers to discuss the current curriculum and suggest the changes in nutrition component in undergraduate medical curriculum so that the students learn about:

- The current methods for prevention, detection and management of macro and micro nutrient deficiencies / excesses and their health consequences.
- Appropriate nutritional support during and after illness – especially in those suf-

fering from chronic illnesses – to prevent further deterioration and assist in rapid improvement in health and nutritional status of individuals.

A large number of academicians, scientists and policy makers participated in the Workshop and after intensive deliberations, a set of clear and concise recommendations for the incorporation of Nutrition in the 12 specific disciplines (anatomy, physiology, biochemistry, pharmacology, bacteriology, pathology, medicine, surgery, preventive and social medicine, pediatrics, obstetrics and orthopaedics) of the Undergraduate Medical Curriculum were drawn up.

LECTURE PROGRAMMES

One of the important objectives of the Foundation is to disseminate and exchage information on nutrition-related problems. Lecture Programmes of the Foundation have been one of the major means of meeting this objective.

C. Ramachandran Memorial Lecture

The C Ramachandran Memorial Lecture

which was instituted in 2001 is the highlight of the Annual Foundation Day which is held in the last week of November. C. Ramachandran was a brilliant student of Madras Medical College, whose promising career was unfortunately cut short by his premature demise while he was still a student. Mrs.Seetha Gopalan and Dr C. Gopalan initiated this series of annual lectures with an endowment in memory of their late son.



A Lecture Programme in the Seminar Room at NFI



The lectures in these series have been delivered by :

- Dr M.K. Bhan (Former Prof. of Paediatrics, AIIMS & currently Secretary, Deptt of Biotechnology) 2001
- Dr N.K. Ganguly (Director-General, Indian Council of Medical Research) 2002
- Dr R.A. Mashelkar (Director-General, Council for Scientific and Industrial Research) 2003

On November 29, 2004, the

C. Ramachandran Memorial Lecture will be delivered by internationally eminent scientist, Dr M.S.Swaminathan, (President, Dr M.S. Swaminathan Research Foundation), during the inaugural session of NFI's Silver Jubilee symposium.

Study Circle Lectures

NFI has been organising a monthly Study Circle Lecture as one of the mechanisms of dissemination of information and promotion of awareness on nutrition related knowledge. These lectures are held every month and are generally well-attended. The lectures bring together nutritionists, medical professionals and health administrators interested in the cause of nutrition and to provide a common forum for them to interact. The lecture in the Study Circle range from presentations of research findings to reviews of scientific papers and discussions on relevant National issues related to Nutrition.

The response of the scientific community to these lectures has been heartening. The audience includes staff of the medical colleges, home science colleges and non-gov-



Dr Mashelkar in conversation with delegates after delivering the C. Ramachandran Memorial Lecture

ernmental and bilateral agencies in the city. These lectures have helped in creating a strong scientific fraternity of Nutrition.

Special Lectures

Apart from the regular monthly lectures organized under its Study Circle programme, special lectures by outstanding visiting nutrition scientists are also organized.

Lectures by the President, Director and Deputy Director

As part of the lecture series, the President, Director and Deputy Director of the Foundation accept invitations from important organizations to speak on Nutrition-related trophics. A comprehensive list of all these lectures is given in the Appendix.

Journal Club

Meetings of the Journal Club are held every week which provide an opportunity for the scientific staff of the Foundation to present and discuss findings from important current research publications.



PUBLICATIONS

The objective of the Publication Programme is to create public awareness about the specific major nutritional problems and to focus the attention of the scientific community, the Government and the enlightened lay public, not only on the problems but on the policies and programmes needed for their eradication as well. This has been sought to be achieved through (1) the *NFI Bulletin* – the Bulletin of the Foundation; (2) the Scientific *Reports*; and (3) Special Publications (4) Other publications.

NFI Bulletin

The *Bulletin* is a quarterly publication and most articles in the *Bulletin* address important questions pertaining to current national food and nutrition policies and programmes. The articles fall under the fol-



Some of the major publications

lowing broad categories:

- those which deal with policy issues related to food, nutrition and agriculture
- those which deal with the nutrition problems of women, infants and children
- those which address the specific national food and nutrition programmes
- those which deal with diets in health and the dietary management of diseases and
- those which deal with basic physiological issues related to nutrition and with the etiopathogenesis of undernutrition and malnutrition.

Nearly 1200 copies of the *Bulletin* are distributed free to leading Indian citizens, parliamentarians, planners and Ministers, as well as food, nutrition, agriculture and health scientists in India and abroad. Papers in the *Bulletin* have generated 'questions' in Parliament and leading articles and reports in the Press, and are well-received by the scientific community. The past and current issues of the Bulletin are available on the NFI website. List of articles published in NFI Bulletin since inception is given in Appendix.

Update Series: This publication is brought out quarterly and is described under the section CRNSS.

Scientific Reports

The results of major research studies undertaken by the Foundation are published in the form of a Scientific Report. Each report describes the results of the study, sets out a series of concrete recommendations for practical action with respect to the problem in question. The reports are widely circulated both within India and abroad and



are sent not only to scientists but to planners, administrators, Ministers, Members of Parliament and the Press, and the attention of the appropriate circles of the Government is drawn to the recommendations.

The list of scientific reports are given below:

- The National Goitre control programme : A blueprint for its intensification
- The Lathyrism problem : Current status and new dimensions
- Nutrition and health education through the rural school system
- Infant-feeding practices with special reference to the use of commercial infant foods
- Nutrition programmes in Orissa state
- Nutritional status, physical work capacity and mental function in school children
- Integrated Child Development Services (ICDS): A study of some aspects of the system
- Profiles of undernutrition and underdevelopment : Studies of poor communities in seven regions of the country
- Maternal nutrition, lactation and infant growth in urban slums
- Growth of affluent Indian girls during adolescence
- Growth performance of affluent Indian children (under-fives): Growth standard for Indian children
- Use of Carotene-rich foods to combat Vitamin A deficiency in India: A multicentric study
- Effect of nutrition supplementary feeding in the third trimester of pregnancy on the birth weight and subsequent growth of the infant

- Relationship of current nutritional status and cognitive functioning in 3-10 years olds living in slums in Delhi
- Obesity in Urban middle classes in Delhi

Special Publications

While the Scientific Reports of the Foundation carry the results of research projects actually carried out under the auspices of the Foundation, Special Publications present other data and observations. Publications in this series are listed below:

- Nutrition and Health Care Problems and Policies
- Use of Growth Charts for Promoting Child Nutrition: A Review of Global Experience
- Combating Undernutrition: Basic and Practical Approaches
- Nutrition, Health and National Development: A Compilation of Six Lectures
- Women and Nutrition in India
- Combating Vitamin A Deficiency Through Dietary Improvement
- Education for Better Living of Rural Adolescent Girls (Training Modules English Versions) :
- Vol. 1 Health and Nutrition
- Vol. 2 Social Awareness
- Towards Better Nutrition: Problems and Policies
- Nutrition Research in South East Asia : The emerging agenda of the future
- Nutrition in Development Transition in South-East Asia.
- Nutrition Problems and Programmes in South-East Asia
- Recent Trends in Nutrition Proceedings of the meetings / workshops organized by



the Foundation are given below:

- Diet, Nutrition and Chronic Disease : An Asian Perspective
- IX Asian Congress of Nutrition: Proceedings – Nutrition Goals for Asia Vision 2020. February 23-27, 2003 New Delhi, India
- Report on "Mid-Day Meal Programmes in Schools in India – The Way Forward"
- A National Strategy for Ensuring Food Safety – Report of a workshop organized by NFI and FAO
- Diet, Nutrition and Prevention of Cancer : A Global Perspective.



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APPENDICES



Appendix I

RESEARCH PROJECTS UNDERTAKEN BY NFI

- The National Goitre Control Programme A blueprint for its intensification.
- The Lathyrism Problem Current status and new dimensions.
- Nutrition and health education the rural school system.
- Infant-feeding practices with Special Reference to the use of Commercial Infant Foods.
- Nutrition Programmes in Orissa state.
- Nutritional status, physical work capacity and mental function in school children.
- Integrated Child Development Services (ICDS) A study of some aspects of the system.
- Profiles of undernutrition and under-development (Studies of poor communities in seven regions of the country).
- Maternal Nutrition, Lactation and infant growth in urban slums.
- Growth of affluent Indian girls during adolescence.
- Growth performance of affluent Indian children (under-fives).
- Effect of supplementary nutrition during pregnancy on the birth weights and subsequent growth of babies.
- Education for better living of rural adolescent girls.
- Effect of calcium supplementation on the growth of school girls (11-14 years).
- Control of anemia in adolescent girls of poor communities.
- Relationship of current nutritional status and cognitive functioning in 3-10 year olds living in slums in Delhi.

- Identification of specific inputs in antenatal care to combat maternal undernutrition and low birth weights.
- Indicators for assessing Vitamin A deficiency and iron deficiency anaemia in the community.
- Comprehensive situational analysis study on demand and supply of micronutrient supplements (Iron & Vitamin A), Antihelminths and Antimalarials & their consumption patterns in Bhopal division of Madhya Pradesh.
- Use of low-cost technology and other measures for promotion of consumption of carotene-rich foods by poor communities.
- Street foods and convenience foods in urban areas.
- Use of carotene-rich foods to combat vitamin A deficiency.
- Seasonal fluctuations in haemoglobin levels.
- Secular trend and seasonality in the incidence of low birth weight deliveries.
- Current prevalence, nature and etiology of obesity in urban Delhi.
- Nutrition status of the aged in urban slums.
- Interstate and intrastate differences in the prevalence of anaemia in reproductive age women – A study of possible contributing factors.
- Investigation of feasible strategies for combating low birth weight and intra-uterine growth retardation.*
- Obesity in children and adolescents in Delhi.*
- ICMR Advanced Centre for Nutrition Research.*
- * (In Collaboration with CRNSS)



Appendix II

TASK FORCE MEETNGS

Members of the Task Forces which assisted the Foundation in carrying out research projects are listed below:

Infant-feeding Practices With Special Reference to the Use of Commercial Infant Foods

Prof M.S. Gore, Ms P.V. Gopujkar, Dr S.N. Chaudhri, Dr M.A. Ramaswami, Prof T.J. Ramaiah, Dr Kamala S. Jaya Rao, Dr Peter Greaves, Dr Padmini Ramaswamy, Dr Kamala Gopala Rao, Dr C. Gopalan.

Nutrition Status, Physical Work Capacity and Mental Function in School Children

Dr P.S. Sundar Rao, Dr S.K. Sood, Prof K.N. Agarwal, Dr V.N. Rao, Dr (Mrs) D.K. Agarwal, Mr D.J.O'Dell, Dr C. Gopalan.

Integrated Child Development Services – A Study of Some Aspects of the System

Dr S.G. Srikantia, Dr Shanti Ghosh, Dr K. Ramachandran, Dr Kamala S. Jaya Rao, Dr Meenakshi Mehta, Dr S. Jayam, Dr Mrunalini Devi Puar, Dr C. Gopalan, Dr K. Halder, Dr P. M. Udani, Dr D. G. Bankappa, Dr K.N. Agarwal, Dr S.P. Khatua, Dr P. C. Khanduja, Dr S.M. Gupta, Dr Usha Bhargava, Dr Sushma Sharma, Dr Ira Ghosh, Dr Rajammal P. Devdas, Dr Sheila Vir, Dr B.R. Santhanakrishnan, Dr S. Senapati, Dr P. Sivanandan.

Profiles of Undernutrition and Underdevelopment – Studies of Poor Communities in Seven Regions of the Country

Dr S.G. Srikantia, Dr P.S. Sundar Rao, Dr Vijay Kumar, Dr C.S. Reddy, Dr K.K. Kaul, Dr S.N. Chaudhri, Dr C. Gopalan, Dr Lincoln Chen, Dr (Mrs) N.V. Patel, Mr A. S. Prabhakar.

Maternal Nutrition, Lactation and Infant Growth in Urban Slums

Dr S.G. Srikantia, Dr Shanti Ghosh, Dr K.

Ramachandran, Dr Kamala S. Jaya Rao, Dr S.N. Chaudhri, Dr Meenakshi Mehta, Dr S. Jayam, Dr Mrunalini Devi Puar, Dr C. Gopalan, Dr K. Halder, Dr P.M. Udani, Dr D.G. Bankappa, Dr K.N. Agarwal, Dr S.P. Khatua, Dr P.C. Khanduja, Dr S.M. Gupta, Dr Usha Bhargava, Dr Sushma Sharma, Dr Ira Ghosh, Dr Rajammal P. Devdas, Dr Sheila Vir, Dr B.R. Santhanakrishnan, Dr S. Senapati, Dr P. Sivanandan.

Growth of Affluent Indian Girls during Adolescence

Dr S.G. Srikantia, Dr Shanti Ghosh, Dr K. Ramachandran, Dr Kamala S. Jaya Rao, Dr S.N. Chaudhri, Dr Meenakshi Mehta, Dr S. Jayam, Dr Mrunalini Devi Puar, Dr C. Gopalan, Dr K. Halder, Dr P.M. Udani, Dr D.G. Bankappa, Dr K.N. Agarwal, Dr S.P. Khatua, Dr P.C. Khanduja, Dr S.M. Gupta, Dr Usha Bhargava, Dr Sushma Sharma, Dr Ira Ghosh, Dr Rajammal P. Devdas, Dr Sheila Vir, Dr B.R. Santhanakrishnan, Dr S. Senapati, Dr P. Sivanandan, Dr Prema Ramachandran, Dr D.K. Agarwal, Prof K.K. Vadhera, Mrs. A. Wadhwa, Mrs Shobha Sobti, Ms Suminder Kaur, Ms Madhuri.

Growth Performance of Affluent Indian Children (Under-fives) – Growth Standards for Indian Children

Dr S.G. Srikantia, Dr Shanti Ghosh, Dr K. Ramachandran, Dr Kamala S. Jaya Rao, Dr S.N. Chaudhri, Dr Meenakshi Mehta, Dr S. Jayam, Dr Mrunalini Devi Puar, Dr C. Gopalan, Dr K. Halder, Dr P.M. Udani, Dr D.G. Bankappa, Dr K.N. Agarwal, Dr S.P. Khatua, Dr P.C. Khanduja, Dr S.M. Gupta, Dr Usha Bhargava, Dr Sushma Sharma, Dr Ira Ghosh, Dr Rajammal P. Devdas, Dr Sheila Vir, Dr B.R. Santhanakrishnan, Dr S. Senapati, Dr P. Sivanandan, Dr Prema Ramachandran, Dr D.K. Agarwal, Prof K.K. Vadhera, Mrs A. Wadhwa, Mrs Shobha Sobti, Ms Suminder Kaur, Ms Madhuri.



Use of Growth Charts for Promotion of Child Nutrition – A Review of Global Experience

Dr C. Gopalan, Dr Abraham Joseph, Dr D.K. Agarwal, Dr S. Anandalakshmy, Dr R.S. Arole, Dr Betty Cowan, Dr Molly Philip, Dr A.G. Patowary, Dr Shanti Ghosh, Dr Vijay Kumar, Dr Meera Chatterjee.

Effect of Calcium Supplementation on the Growth Performance of Adolescent Girls

Dr B.S. Narasinga Rao, Dr Visweswera Rao, Dr K.R. Sundaram, Dr Sushma Sharma, Dr C. Gopalan, Ms A. Wadhwa, Ms Anju Sood, Ms Rupinder Kaur, Ms Harvinder Kaur.

Education for Better Living of Rural Adolescent Girls

Dr C. Gopalan, Prof K.N. Agarwal, Dr S.N. Chaudhri, Dr Shanti Ghosh, Dr Tara Gopaldas, Dr Sharda Jain, Dr Harish Khanna, Dr Sumati Mudambi, Dr S.L. Gururaja, Dr D.N. Mathur, Ms C.P. Sujaya, Mr. T.K. Parthasarthy, Dr Mrunalini Devi Puar, Dr A.K. Govila, Dr (Mrs) D.K. Agarwal, Dr Amita Verma, Dr Saramma Mathai, Ms Harvinder Kaur, Ms Suminder Kaur.

Effect of Supplementary Nutrition during the Last Trimester of Pregnancy on the Birth Weights and Subsequent Growth of Babies

Dr Shanti Ghosh, Dr K. Ramachandran, Dr Prema Ramachandran, Dr B.N.S. Walia, Dr A. Narang, Dr U.N. Bhakko, Dr Sushma Sharma, Ms Ravinder Chadha, Dr C. Gopalan, Ms Suminder Kaur, Dr Saramma Mathai, Dr K.R. Sundaram, Dr H.P.S. Sachdev, Ms Harvinder Kaur.

Combating Vitamin A Deficiency through Dietary Improvement

Dr Faruk Ahmed, Dr K.L. Chadha, Ms Ravinder Chadha, Dr Malati Damodaran, Dr Y.G. Deosthale, Dr Rajammal P. Devdas, Dr C. Gopalan, Ms Harvinder Kaur, Mr K.S. Krishnamurthy, Ms N. Madhuri, Dr Saramma T. Mathai, Dr R.M. Pandey, Dr Mrunalini Devi Puar, Dr B.S. Narasinga Rao, Dr Chittema Rao, Mr Rowland Rome, Dr Subadra Seshadri, Dr Sharda Jain, Dr Sushma Sharma, Mr S. Sridhar, Dr G. Subbulakshmi, Dr B.N. Tandon, Dr V. K. Vijayaraghavan.

Combating Micronutrient Deficiencies through Dietary Improvement

Dr B. N. Tandon, Dr Vinodini Reddy, Dr Murli Krishnan, Dr K.S. Krishnamurthy, Dr K.R. Sundaram, Dr Sharda Jain, Dr Sushma Sharma, Dr C. Gopalan.

Relationship of Current Nutritional Status and Cognitive Functioning in Children of Urban Slums in Delhi

Dr H.P.S.Sachdeva, Dr Sharda Jain , Dr A.K. Vasisht, Dr Neerja Sharma, Dr C. Gopalan, Ms Rachna Bhandari.

Study of Haemoglobin Levels of Adolescent School Girls of Low Socio-economic Groups in a Locality and Identification of Approaches for Combating Anaemia among them

Dr S.K. Sood, Dr K.N. Aggarwal, Dr Manorama Bhargava, Dr A.K. Vashisht, Dr Maya Sood, Dr C. Gopalan, Ms Anshu Sharma.

Investigation of Current Prevalence, Nature and Etiology of Obesity in Urban Communities

Dr M.M.S.Ahuja, Dr Sushma Sharma, Dr C. Gopalan, Dr K.R. Sundaram, Dr Raghubir Singh.

Identification of Specific Inputs in Antenatal Care in Order to Combat the Problems of Maternal Undernutrition in Intra-uterine Growth Retardation based on Local Food Resources and Indigenous Technology

Dr K.R. Sundaram, Dr K. Sridharan, Dr K.N. Agarwal, Dr Subadra Sheshadri, Dr Maya Sood, Dr Uma Goyal, Dr Sushma Sharma, Dr M.M. Krishna, Dr C. Gopalan, Mr M.K. Rai, Ms Anshu Sharma.

Nutritional Status of Affluent School-going Children in Delhi

Seasonal Fluctuations in the Haemoglobin Levels

Secular trend and seasonality in the incidence of low birth-weight deliveries and

Investigation of the Efficacy of Probiotics in



Control of Diahhoea and Undernutrition in Poor Children in Urban Slums.

Dr C. Gopalan, Dr H.P.S. Sachdev, Dr Indrayan, Dr Harish Chellani, Dr R.N. Salhan, Dr Ramji, Dr K. Satyanarayanan, Dr Santosh Jain Passi, Dr Sarath Gopalan, Mr Rajeev Malhotra, Ms Anshu Sharma, Ms Bani Tamber, Ms Shailee Saran.

Investigation of Interstate and Intrastate Differences in the Prevalence of Pregnancy Anaemia – A Study of Possible Contributing Factors

Dr C. Gopalan, Dr Rajammal P. Devdas, Dr K.N. Agarwal, Dr D.K. Agarwal, Dr Prema Kumari, Dr Neelam Khetarpaul, Dr K.Vijayaraghavan, Dr M.K. Nair, Dr K. Ramachandran, Dr A.K. Govilla, Dr Shashi Mani Panda, Dr Lalrin Tluangi, Dr T.K. Roy, Dr M.C. Kalita, Dr Sarath Gopalan, Ms Anshu Sharma.

Investigation of Feasible Strategies for Combating Low Birth Weight and Intra-uterine Growth Retardation

Dr C. Gopalan, Dr Shanti Ghosh, Dr. Prema Ramachandran, Dr Sarala Gopalan, Dr Sarath Gopalan, Dr Raju Gupta, Dr Harmeet Kaur, Dr. Suman Garg, Dr Akshay Dharmarha, Ms Rita Patnaik.

Natural History of Stunting

Dr C. Gopalan, Dr Vijayraghavan, Dr K. Ramachandran, Dr A.V. Kurpad, Dr K.N. Agarwal, Dr Shahnaz Vazir, Dr Anupa Siddhu, Dr Sarath Gopalan, Ms Shilpa S. Wadhwa.

Comparison of Different Techniques to Measure Adiposity in Children

Dr C. Gopalan, Dr Vijayraghavan, Dr K. Ramachandran, Dr A.V. Kurpad, Dr K.N. Agarwal, Dr Shahnaz Vazir, Dr Anupa Siddhu, Dr Sarath Gopalan, Ms Shilpa S. Wadhwa, Ms Saakshi Kapoor.

Anthropometric Growth Assessment of Schoolboys

Dr C. Gopalan, Dr Vijayraghavan, Dr K. Ramachandran, Dr A.V. Kurpad, Dr K.N. Agarwal, Dr Shahnaz Vazir, Dr Anupa Siddhu, Dr Sarath Gopalan, Ms Deepti Khanna



Appendix III

LIST OF STUDY CIRCLE LECTURES

	1994	16.08.95	Nutritional Problem in Hot Desert:
23.11.94	The growing challenge of adult chronic diseases in developing societies: Prof W.P.T. James	15.05.95	Neural Tube Defects Genetic & Nu- tritional Aspect: Prof I.C. Verma
29.11.94	Safety and wholesomeness of street foods: Dr John Lupien	15.09.95	Combating lodine Deficiency Disor- ders: Challenges and Current Ap- proaches: Dr Shiela Vir
16.12.94	Management of Diarrhoeal diseases in Children – Latest trends: Prof M K Bhan	20.10.95	Metabolic Adaptation in Humans: Does it Occur?: Dr Prakash Shetty
16.12.94	The National Family Health Survey 1993 – Major Messages: Dr W. Goldman	29.11.95	Towards Better Nutrition for Women & Children – Problems & Programmes: Dr Sarala Gopalan
	1995		1996
16.01.95	Health & Nutritional Status of Tribals in Orissa: Dr Almas Ali	28.02.96	Nutrition and Molecular Biology: Prof Indira Nath
	Nutritional Status & Reproductive Performance of Quarry Workers &	27.03.96	Lathyrism: New Dimensions: Dr M. P. Diwedi
	A Prospective Study: Dr Sushma Kashyap	30.04.96	Changing Spectrum of Malnutrition in children – Lesson from Sri Lankan Experience: Prof Priyani Soysa.
25.01.95	Nutrition and Immunity – New In- sights: Prof R.K.Chandra	30.05.96	Nutrition and Brain: Dr K.N. Aggarwal
15.02.95	Nutrition and AIDS: Dr Prema Ramachandran	19.07.96	Vitamin Requirement in High Alti- tude: Dr K. Sridharan
15.03.95	Current Health Status of Urban Slum Communities in Delhi Results of Recent Studies: Dr H.P. S.	23.08.96	Role of Academician in National Nu- trition Programme: Prof B.N. Tandon
	Sachdev	20.09.96	Food-based Approach for Combating
18.04.95	Ensuring Food Quality & Food Safety – Emerging Challenges: Mr Raj Malik		Reddy
15.06.95	Hormones & Growth Factor in Ma- ternal Malnutrition & Foetal Growth	30.10.96	Foetal Origin of Adult Chronic Diseases: Dr Caroline Fall
	Retardation: Dr. N. Kochupillai	29.11.96	A Food and Nutrition Secure India – The Final Milestone: Dr M.S.
14.07.95	Selenium in Health & Disease: Dr R. Subramanium		Swaminathan



16.12.96	Fluoride: Nutrient or Contaminant: Dr. A.K. Susheela	30.06.98
	1997	24.07.00
24.01.97	Population Issues: New Fugitives from the NFHS: Dr K. Srinivasan	24.07.98
07.03.97	Use of Plant Foods for combating Mi- cronutrient Deficiencies: Dr Subadra Seshadri	10.09.98
29.04.97	Nutrition of Women & Children in India: Changing Trends: Dr H.P.S. Sachdev	15.12.98
19.05.97	Food Nutrition & Malaria Mortality: Dr Sheela Zubrigg	13.01.99
18.06.97	Enteral & Parenteral Nutrition: K. Sriram	19.02.99
02.07.97	Nutrition & Cancer: Dr. Kamala Krishnaswamy	05.03.99
30.09.97	Maternal & Child Health in the 9th Five Year Plan: Dr Prema Ramachandran	28.04.99
27.10.97	Issues & Options for India's Nutri- tion Programme: Dr James Levinson	26.05.99
24.11.97	RCH: MCH – Old wine in New Bottles?: Dr. Shanti Ghosh	20.07.99
30.12.97	Vitamin D Deficiency in North India: Dr N. Kochupillai	11.08.99
	1998	10.09.99
21.01.98	Street Foods: Dr. Indra Chakravarty	14.10.99
24.02.98	Fungal Toxins in Foods- Recent Stud- ies: Dr Ramesh Bhat	29.11.99
20.03.98	Recent advances in Immu- nonutrition: Dr Gill Hardy	
24.04.98	Stunting in Indian Under Fives – A Critical Re-examination: Dr M.K. Bhan	23.02.200
28.05.98	Common Mechanism of Diarrhoea and its interplay with Micronutri- tional Deficiency : Prof. N.K.Ganguly	26.04.200

06.98	Arsenic in Drinking Water – A Public Health Hazard: Dr A.K. Susheela
07.98	Nutrition and Bone Disease: Prof S.P.S. Teotia
08.98	Eradication of Goitre from India – Recent Initiatives: Dr. Umesh Kapil
09.98	Neural Tube Defects: Dr S.S. Agarwal

28 Control of Vitamin A Deficiency: Dr Alfred Sommer

1999

1.99	Maternal Caring Behaviour and Child Nutrition: Ms Purnima Menon
2.99	Nutrition in Aging: Dr Kalyan Bagchi
3.99	Synergising Fortification and Food- based Approaches for Combating Malnutrition: Dr V. Prakash
4.99	Nutrition in Extreme Environments: Dr W. Selvamurthy
5.99	Vitamin D Deficiency in Northern India: Dr N. Kochupillai
7.99	Genetic Modification of Foods: Dr Asis Dutta
8.99	Nutrition and Maternal Mortality: Dr David Rush
9.99	Strategies for Combating Malnutri- tion: Dr Meera Chatterjee
0.99	Foetal Origin of Cardio-Vascular Dis- ease: Dr David Barker
1.99	Nutrition and Degenerative Diseases: Dr S. Padmavati
	2000
2.2000	Global Warming: Possible Health Implications: Dr Subash C. Arya
4.2000	The National Nutrition Mission: Mrs

Veena S. Rao



9.06.2000	National Population Policy & After : Prof Ashish Bose	12.12.2001	Nu tin
7.09.2000	Possible Role of Antioxidants in Age- related Eye Diseases: Prof Astrid		
18 10 2000	Fletcher Probiotics - Nutritional Consider-	23.01.2002	Co Pro
10.10.2000	ations: Dr R.L. Bijlani	22.02.2002	W∉ Fit
24.11.2000	Towards better nutrition in a Knowl- edge-based society: Dr Prema Ramchandran	20.03.2002	Etl C.
13.12.2000	Newer Methods for Haemoglobin Estimation in the Field: Dr R.P. Britt	18.06.2002	lm Nu
	2001	16.07.2002	Na
19.01.2001	Promoting Grassroot Efforts for Nu- trition Programmes: Dr Siddharth Aggarwal	27.08.2002	Ma pr
9.02.2001	Nutrition & Physical Fitness : Dr Jana Parizkova	1.10.2002	Nu Ra
18.04.2001	Fast foods and Junk Foods: Dr Kumud Khanna	29.11.2002	Ur tio tri
31.05.2001	Nutrition in the Critically-ill Patients: Dr Sarath Gopalan		
19.06.2001	Food Adulterants: Dr Pulkit Mathur	17.06.2003	Bc Me
20.7.2001	Ethical Considerations in Medical Research: Dr Vasantha Muthuswamy		An
10.08.2001	Ensuring Food Safety: Dr Ramesh Bhatt	18.07.2003	An an Ag
7.09.2001	Good Nutrition for Good Health Nu- trition in infancy and childhood: Dr Shanti Ghosh	12.09.2003	Po an
	Nutrition and Reproductive Health Nutrition in the Elderly: Dr Prema	21.10.2003	Pe mo
	Ramachandran , Dr Sushma Sharma	29.11.2003	Fo be
23.10.2001	Behavioral Aspects of Complemen- tary Feeding: Dr Patrice L Engle		Mo
29.11.2001	Child Health in India: Dr M. K.Bhan		

001 Nutrition intervention in gastrointestinal fistulae: Dr Adarsh Chowdhary

2002

23.01.2002	Community Initiative in Anti-poverty Programme: Dr Meera Chaterjee
22.02.2002	Weight Management for Sports and Fitness: Dr Anupa Siddhu
20.03.2002	Ethics and Public Health Policy: Dr C.S. Pandav
18.06.2002	Importance of Fatty Acids in Human Nutrition: Dr Ghafoorunissa
16.07.2002	National Human Development Report 2001: Dr Ashish Bose
27.08.2002	Maternal Nutrition and Foetal Im- printing: Dr N. Kochupillai
1.10.2002	Nutritive Value of Rice Bran: Dr T.C. Raghuram
29.11.2002	Unmet Challenges, Possible Solu- tions and Future Challenges in Nu- trition in India: Dr N.K.Ganguly
	2003
17.06.2003	Body Composition: Techniques for Measurement and Implications: Dr Anura V. Kurpad
18.07.2003	Anaemias of Pregnancy: Interstate and Intrastate Differences: Dr K.N. Agarwal
12.09.2003	Population and Development: Myths and Realities: Dr Almas Ali
21.10.2003	Pesticide Residues in Food Com- modities: Dr M. Gopal
29.11.2003	Foundation Day: Building a Bridge between Traditional Wisdom and Modern Science: Dr R.A. Mashelkar



2004		20.05.2004	Nutrition Data from District Level
23.01.2004	Time Trends in Determinants of Nu- tritional Status: Dr Prema Ramachandran		Household Survey (DLHS) Phase 1: Dr C. Chandrasekhar
		28.06.2004	Assessing Human Energy Require- ments: Dr Prakash Shetty
27.01.2004	Iron Absorption and the Formation		-
	of Non-Transferrin, Bound Iron in Various conditions: Prof Catherine Geissler	30.07.2004	Census – 2001 – Implications for Social Sectors: Mr J. K. Banthia
		27.08.2004	An Analysis of Food Expenditures:
27.02.2004	WFP's Contributions to Nutritional Upliftment: Dr Minnie Mathew		Policy Implications: Prof Imrana Qadeer
31.03.2004	Early Origin of Adult Disease – Delhi Cohort Experience: Dr S.K. Bhargava	16.11.2004	Periconceptional Folates for the Pre- vention of Neural Tube Defects: Dr Asok Antony
Appendix IV



LECTURES DELIVERED BY DR C. GOPALAN (PRESIDENT – NFI)

- 'Changing Profile of Malnutrition in the developing World' at the International Symposium on Clinical Nutrition, at the All India Institute of Medical Sciences, New Delhi, on January 6, 1994.
- 'Education and Empowerment of Women for National Development' at the Avinashilingam Institute for Home Sciences, Coimbatore, on January 7, 1994.
- 'Public Health: The Need for a New Direction' at the International Conference of Medical Parliamentarians in Bangkok on February 7, 1994.
- Plenary lecture in 'The Changing Picture of Child Nutrition in Asia' at the VIII th Asian Congress of Pediatrics in New Delhi on February 11, 1994.
- 'Micronutrient Deficiencies: Public Health Implications' at the Conference on Food and Environmental Factors in Human Disease' at the Royal College of Physicians, London, on June 14, 1994.
- 'Maternal Nutrition New Insights and Challenges' at the Institute of Obstetrics and Gynaecology, Madras, on September 18, 1994 by Prof. P. K. Devi Memorial Oration on
- Lead oration on 'Low Birth Weights Significance and Implications' at the National Update on Nutrition in Children' organized by the Department of Maulana Azad Medical College, on September 25, 1994 at New Delhi.
- Academy oration of the National Academy of Medical Sciences on 'Expanding Frontiers of Nutrition Science' at Madras on March 18, 1995.
- Towards India's Food and Nutrition Security Keynote address at 50th Anniversary Celebrations of FAO, New Delhi, October 1995.
- Current Food and Nutrition Situation in South and

Southeast Asian Countries – Plenary Lecture at 7th Asian Congress of Nutrition, Beijing, October 1995.

- Supporting Food-based Programs to Prevent Micronutrient Malnutrition Plenary Lecture at FAO, Cornell- Thrasher- UNICEF Workshop on Food based approaches to prevent Micronutrient Malnutrition: Setting an International Research Agenda, Salt Lake City, USA, November 1995.
- Changing Profiles of Nutritional Diseases in India

 Seminar presentation at Harvard School of Public Health, Boston, November 1995.
- Undernutrition in Women and Children Major Challenges and Combating Undernutrition in Vulnerable Groups in India : Current Programmes and Limitations – Seminar presentation at World Bank, Washington, November 1995
- Dietetics and Nutrition: Impact of Scientific Advances and Development Keynote Address at the International Congress of Dietetics, Manila, February 1996
- Nutritional Repercussions of Developmental Transition – Lecture at the Nutrition Foundation of Philippines, Manila, February 1996
- Diet Related Non-Communicable Disease in Developing Countries in Rapid Transition The 6th Annual Public Health forum at London School of Hygiene and Tropical Medicine, London, March 1996.
- New Knowledge on the Possible Role of Nutrition in the Pathogenesis of Degenerative Diseases and Cancer, Professor K.S. Mathur Oration at the S.N. Medical College, Agra, August 1996.
- Fighting Hunger and Malnutrition in South and Southeast Asia The Emerging Agenda for the Turn



of the Century – World Food Day Symposium, FAO, Bangkok, October 1996.

- Developmental and Demographic Transition in Asia: Its Impact on Nutrition related Chronic Degenerative Diseases, Asian Nutrition Forum Symposium, New Delhi, February 1997.
- Health Development in Southeast Asia Region: A New Vision for a New Century, WHO Conference, Bangkok, June 24-26, 1997
- Malnutrition: Its Impact and Its Costs, South African Society of Parenteral and Enteral Nutrition (SASPEN), South Africa, September 7-10, 1997
- Lecture on 'Food, Nutrition and the Prevention of Cancer: A Global Perspective' on the occasion of the launching of the World Cancer Report, at India International Centre, New Delhi, Oct 15, 1997.
- Prevention and Control of Micronutrient Malnutrition Through Food-based Actions in SAARC Countries, Keynote Address at Sub Regional Workshop, Dhaka, Bangladesh, November 17-20, 1997.
- Modern Dietetics New Challenges and Opportunities. The first memorial lecture of Dr Amiakumar Bose, at the XXXth Annual National Conference of Indian Dietetic Association held at Sri Ram Chandra Medical College and Research Institute, December 10-12, 1997
- Lecture on 'Nutrition and Brain', at the Symposium on Nutrition and Brain organized by the Foundation at the India International Centre, New Delhi, August 1,1998.
- 'Malnutrition Due to Dietary Deprivation', Address at symposium on Malnutrition in Infancy, at the XXIIth International Congress of Pediatrics, in Amsterdam, August 12, 1998
- 'Nutrition and Disease Problems in Non-Industrialized Countries', Address at the Plenary session of the XXIIth International Congress of Pediatrics, in Amsterdam on August 13, 1998
- 'The Changing Epidemiology of Malnutrition in a

Developing Society', The J.C. Bose/ Blackett Memorial Lecture under the auspices of the Royal Society of London, November 5,1998

- 'Promotion of Food-based Dietary Guidelines and Nutrition Education in South Asia', Keynote address at the workshop of FAO / ILSI / ILSI-India at Manesar, December 8,1998
- 'Prevention of Cardiovascular Diseases: Role of Diet', Keynote address at the Symposium held under the auspices of the Indian Medical Association at Hyderabad, December 20, 1998
- 'Nutrition of the Girl Child and the Mother', Lecture at the plenary session of the Vth International Congress of Tropical Paediatrics, Jaipur, February 11, 1999
- 'The Rising Incidence of Obesity, CHD, and Diabetes in the Indian Urban Middle Class The Possible Role of Genetic and Environmental Factors', Lecture at the Conference on 'Genetics, Nutrition and Chronic Diseases ' in Metsovo, Greece, June 11-16, 1999
- 'Nutrition and Demographic Transition', Lecture at the special forum and 'Achieving Household Food and Nutrition Security in Societies in Transition in Asia: An Overview' at the FAO/ WHO workshop at the VIII th Asian Congress of Nutrition, August 29- September 2, 1999
- 'Towards Sustainable Nutrition Security and Food Safety in the 21st Century' at London School of Hygiene and Tropical Medicine, Centenary Celebrations, October 28-29, 1999
- Delivered the Inaugural Address at the two-day seminar on Foods and Nutrition Update: Challenges Ahead, on 14th January, 2000 to mark the 40 years of completion of Foods and Nutrition Department of Lady Irwin College.
- 'Health and Nutrition in Women, Infants and Children'. Keynote address at the Indo-U.S. Workshop held at Hyderabad, February 10-12, 2000.



- Keynote address on 'Nutrition and National Development' at the regional Workshop on Nutrition and National Development organised by the Government of India on 15 February at Chennai.
- Keynote Address on 'Central Role of Women in Ensuring National Nutrition Security' at the Golden Jubilee Celebrations of Care-India on 8th March, 2000.
- 'Role of Functional Foods in Health and Disease', keynote address in the symposium held on April 24-25, 2000, at National Institute of Nutrition, Hyderabad.
- Special Lecture on 'Improving the Nutritive Value of Indian Diets' at a National Seminar in New Delhi on April 27, 2000
- Inaugural address at the Conference on Micronutrient Malnutrition at Dr M.S. Swaminathan Foundation, Chennai, India, on June 29, 2001
- Golden Jubilee Oration of the Home Science Association of India on 'Empowerment of Women the Key to National Development' was held at the Lady Irwin College of Home Science on October 4, 2001.
- Participated in the International Symposium organized by the Rank Price funds on feeding a world population of more than 8 billion people: A challenge to science, December 6-9, 1996
- Led the Indian Delegation for the IUNS conference in Montreal, July 28 – August 1, 1997.
- Inaugurated the launch of the Report on Food Nutrition and Cancer – A Global Perspective at the India International Center, October 15, 1997
- Awarded Dr Amaiyakumar Bose Memorial Lecture Award at the Annual National Conference of Indian Dietetic Association, December 10-12, 1997.
- Participated in the joint FAO/WHO Expert Consultation Meeting on Vitamins and Minerals in Bangkok, September 21,1998

- Participated in a discussion on 'The Nutritional Challenges in South Asia' by the UN Nutrition Commission at the M.S. Swaminathan Research Foundation, Chennai, November 23, 1998
- Keynote Address at the workshop of FAO / ILSI / ILSI-India on the 'Promotion of Food-based Dietary Guidelines and Nutrition Education in South Asia' at Mannesar, India, December 8, 1998
- Participated in the conference on 'Genetics, Nutrition and Chronic Diseases' in Metsovo, Greece, June 11 to 16, 1999.
- Participated in the centenary celebration of the London School of Hygiene and Tropical Medicine October 28-29 and was awarded the honorary fellowship of the School on this occasion.
- ICMR Meeting on Strategies for Micronutrient Interventions, held at NFI, on January 15-16, 2000.
- Participated in the World Health Policy Forum, at Sestri Levante, Italy, September 24 to 27, 2000.
- Visited the Nutrition Division of the FAO in Rome from September 27 to 30, 2000.
- Delivered the first Rajammal P. Devdas Oration on 'Changing Nutrition Scene in India' on March 12, 2001 at Avinashilingam Institute, Coimbatore
- Participated in the National Consultation of the ICDS scheme on March 16 and 17, 2001, New Delhi
- Attended the24th Annual Conference of the Nutrition Society of India on 5th and 6th of December 2001 at Bhopal.
- Participated in the International Conference on 'Essential Fatty Acids and Human Nutrition and Health', at Shanghai, China from April 24 to 27, 2002
- President of the IXth Asian Congress of Nutrition, 2003. Chaired the Plenary Session on "Changing Nutrition Scene in Asia" and presented a paper on "Changing Nutrition Scene in South Asia"



LECTURES DELIVERED BY DR PREMA RAMACHANDRAN (DIRECTOR – NFI)

- 'Time-trends in Nutrition Status in India' at the workshop to discuss impact of ongoing developmental transition on nutritional status at FAO Rome, 11-13, October 2004.
- Anaemia a Major Contributory Factor to Maternal Morbidity and Mortality" in the Indo US Workshop on Risk factors for Maternal Morbidity and Mortality in India at India International Centre 28.9.2004.
- 'Health Sector Reforms' in the Training Course on quality of care for provision of RCH services at NIHFW 28.9.2004
- 'Convergence of Health, Nutrition and Education Services in Primary Schools' at World Bank meeting on 'Reaching out to the Child – an Integrated Approach to Development and Early Education of Children' on September 22, 2004.
- 'Current Strategies for Prevention and Control of Vitamin A deficiency' in the Workshop on Methodologies to assess micronutrient deficiencies at AIIMS on 14.9.2004
- 'Health Services in India' at the National Consultation on Institutes of Public Health in India – Moving from Concept to Reality on 16.9.2004.
- 'Disease Burden due to Communicable Diseases in India' at a symposium on 'Communicable Diseases – Recent Advances' – NICD on 30.7.2004.
- 'Planning Process and National Health Accounts' in the NIHFW training course of Health Economics and health Financing – NIHFW on 25.6.2004.
- 'Bridging the Patient Care Public Health Divide for Health, Family Welfare and Nutrition' at the

Regional level RCH Orientation workshop for Faculty of Medical Colleges at NIH & FW on 4th June, 2004.

- 'Public Health and Human Rights' at the summer Training Course for the interns organised by National Human Rights Commission on May 27th, 2004.
- 'Nutrition in the Tenth Five Year Plan' in Workshop on Micronutrient malnutrition control in India 26.3.2004.
- Inaugural address on 'Decentralised District-based Health Care in India' International Workshop on 'Decentralized Delivery of Health Care: Search for an Ideal Indian Model' at Observer Research Foundation on 9th February, 2004.
- 'Nutrition Intervention During the Tenth Plan period' Symposium on: Nutrition – Challenges Ahead organised by Institute of Home Economics on 5th February, 2004.
- 'Critical Stages in the Life Cycle for Combating Undernutrition' at the National Food Security Summit organised by World Food Program on 4th February, 2004
- 'Gender Issues in Population, Health and Nutrition' in MIMAP Gender Net work Conference on Impact of Macroeconomic policies on Gender at India Habitat Centre 2.2.2004
- 'Use of Data from DLHS for Decentralized Planning and Monitoring of RCH Programme' in National Dissemination Seminar on District Level Household Survey Phase I at Scope Complex 27.1.2004

LECTURES DELIVERED BY DR S. GOPALAN (DEPUTY DIRECTOR – NFI)

- "Parenteral Nutrition the Indian Scenario" VIth Annual Conference of ISPEN (Indian Society for Parenteral and Enteral Nutrition), New Delhi on March 13-14, 1998.
- 'Use of Fermented Foods to Combat Stunting and Failure to Thrive' – First World Congress of Paedi-

atric Gastroenterology, Hepatology and Nutrition , Boston, U.S.A. on August 5-9, 2000.

 'Dietary Modifications in Celiac Disease in Indian Patients' – Xth Annual Convention of the Indian Association Of Paediatric Gastroenterology, SGPGIMS, Lucknow on October 14-15, 2000.



- 'Immunonutrition' and 'Probiotics and Prebiotics in Diarrheal Diseases', Conference of the Indian Association of Paediatric Gastroenterology at Chandigarh from August 30-September 2, 2001
- Plenary speaker 'Probiotics and prebiotics in childhood diseases' – First SAARC Congress of Paediatrics at Kathmandu, Nepal on March 14-16, 2002.
- 'Recent advances in Nutrition in Children' First Pediatric Multispeciality Update at Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow on April 13-14, 2002.
- 'Enteral Nutrition in the Critically-ill Child' Annual Conference of Indian Academy of Paediatricians (Gastroenterology Subchapter), Kolkata on October 5-6, 2002.
- 'Role of Micronutrients in Infections and Convalescence' – Symposium on " Micronutrient Supplementation in Health and Disease" jointly organised

by National Institute of Nutrition, Hyderabad and Centre for Research on Nutrition Support Systems, New Delhi at New Delhi on December 15, 2002.

- 'Life Cycle Approach to Convergence of Food and Nutrition Programme in the Coming Millenium' in the consultation on 'Towards Hunger – Free India – Countdown from 2007' organised by World Food Programme on April 4-5, 2003.
- 'Nutritional Management in Short Bowel Syndrome – Current Strategies' – Annual Conference of Indian Academy of Paediatricians (Gastroenterology Subchapter), Pune on September 27-29, 2003.
- Plenary Presentation on 'Feasible strategies to combat low birth weight and intra-uterine growth retardation' – Second World Congress of Paediatric Gastroenterology, Hepatology and Nutrition (WCPGHAN) at Paris, France on July 3 -7, 2004.



Appendix V

LIST OF ARTICLES PUBLISHED IN NFI BULLETIN

1980 Green Power and Freedom for January Hunger: M.S. Swaminathan April Central Issues in Nutrition Policy and April Programmes: Saran Singh July Post Harvest Technology of Foodgrains and Oil Seeds in India: C. P. Natarajan and J. V. Shankar 1981 How Short are We of Edible Oil?: K. T. January July Achaya April Nutritional Consideration in Agricultural and Rural Development: M.S. Swaminathan Vitamin A Deficiency Programme: S. G. Srikantia October Malting as an Aid in Reduction of Viscosity of Cereal and Legume Diets: H.R.S. Desikachar Control of Anaemia by Fortification of Common Salt: B.S. Narasinga Rao July National Goitre Control Programme: C. Gopalan The Child-in-need Institute: S.N. Choudhury Nutrition and Contraception: Mehtab, S. Bamji October School Health Services: C. Gopalan

1982

January Health Management by the People: David. P. Haxton

Nutritional Consequences of Devel-

opmental	Programmes:	C.	Gopalan
		~	

Marine Food Resources:Present Status and Problems: V.V.R. Varadachari et al

Nutrition in the New 20-point Programme: C. Gopalan Exclusive Breast-feeding for Six Months Old – An Attainable Goal for Poor Communities: Deepali Das et al

A Revisit to Rewa: C. Gopalan

Nutrition in Relation to Health for all by the Year 2000 A.D: U. Ko Ko

Expansion of ICDS : M.S Dayal

Minimum Wages for Agricultural Labour: C. Gopalan

October Malnutrition and Mortality: Lincoln C. Chen

Integrated Rural Development: C. Gopalan

The Narayanapuram Experience: P.V. Indersen

January	Nutritious Meal Programme for Children of Tamil Nadu: Rajamal. P. Devadas
	The New Technology for Production of Pulses: H.K. Jain
	Why Soya Bean?: K.T. Achaya
April	Human Milk and Childhood Diar- rhoea: D.B. Jellife and E.P. F. Jellife
	Breast Feeding: Beyond the Codes: Indira Narayanan
	Mobile Crèches: Indu Balagopal



July	Measurement of Undernutrition: Biological Considerations : C. Gopalan		Nutrition Programmes in Rural Communities – A Nepal Experience:	
October	"Small is Healthy"? For the poor not the rich: C. Gopalan		Increasing Agricultural Productivity through Improved Photosynthesis:	
	trends : H. Lakshminarayan	0	Infant Nutrition from West Pongal	
	Nutrition in Medical Education: Tara Gopaldas and Subadra Seshadri	Арги	Insights from Recent Studies: C. Gopalan	
	1984		The Nutrition Component of Primary Health Care: S. G. Srikantia	
January	Child Survival and Undernutrition: Biological Considerations: C. Gopalan		Clonol Propogation in-vitro from Coconut Leaves: S. Bhaskaran	
	Body size, Health and Fitness: Janna Parizkova	July	Food Production and Nutrition Trends in India and China: C. Gopalan	
	Home Science and Vocational Train- ing for Rural Girls: C. Gopalan		Human Milk for Low Birth Weight babies: Indira Narayanan	
April	Classification of Undernutrition - their Limitations and Fallacies: C. Gopalan		Use of Biotechnology for Increasing Food Production: Challenge and Opportunities, Eves Demarly	
	Endemic Flurosis in A.P.: S.G. Srikantia	October	Child Health and Nutrition in Tamil Nadu : C. Gopalan, Urban Nutrition	
	Epidemiology and Control of Flurosis in India: A.K. Susheela		In India-I, Kamala J. S. Jaya Rao	
July Concerns Over Vegetable Oils: K.T.			C. Gopalan	
		1986		
	Males: Kamala S. Jaya Rao	January	Urban nutrition in India-II : Kamala J. S. Jaya Rao	
	Smallness- a Symptom of Deprivation: Micheal C. Latham		Nutritional status of Indian children, Has it improved in recent years: C.	
October	Protein Energy Requirements- In- sights from Long Term Studies: W.M. Rand and N.S. Schrimshaw	April	Gopalan Delivery of health care : Role of	
	Choosing Beneficiaries for Long Term		medical colleges : B. Cowan and H.N.S . Grewal	
	1985		Use of growth charts for promoting child nutrition : V.L. Srilatha	
January	Maternal Health, Fertility and Child nutrition: C. Gopalan		Fat intakes in India : K.T.Achaya	



July Participation of medical colleges in National health programme: An experiment in India : B.N. Tandon ICDS:Seventh plan and beyond : M.S.Dayal

Vitamin A deficiency and child mortality : C. Gopalan

Wholesomeness of Irradiated wheat : S.G Srikantia

October Iodised injections in Goitre prophylaxis : N Kochupillai and M M Godbole

> The Tamil Nadu Integrated Nutrition Programme : J.P Kevamy

Fats in breast milk : K.T Acharya

1987

Food Consumption In Rural Indian Janurary Households: Has It Increased In The Years? : K. Ramachandran The challanges of global malnutrition and response of international agencies: Lincoln C.Chen Reviews and comments: Irradiation of wheat : C. Gopalan April Growth monitoring : C. Gopalan Health care in U. P. and Bihar : K. N. Agarwal July Heights of population-an index of their nutrition and socio-economic developments: C. Gopalan Radionucleotides in foods due to radio active fallout and their biological hazards : B. S. Narasingha Rao The Chernobyl disaster: Potential hazards of the third world: C. Gopalan October The female child in India : Dr. Shanti ghosh

Gender bias in Health and Nutrition Care: C. Gopalan

January	Nutrition and Immunity in Old Age : R. K. Chandra
	Community Organisation for Health Care : C. Gopalan
	Reducing the Bulk of Cereals Gruels : Tara Gopaldas et al.
April	The National Nutrition Monitoring Bureau : S.G. Srikantia
	NNMB: The importance to Nutriton Reserch and Planning: C. Gopalan
	Consumption of Edible Oils in India- The Present Picture : C. Gopalan
July	Dietary Guidelines for Affluent Indians: C. Gopalan
	National Goitre Control Programme- Current Status : P. Subramanium
	October Dietary Fibre in Indian Diets and its Nutritional Significance : B. S. Narasingha Rao
	Diabetes in India : M. Viswanathan et
	al.
	al. 1989
January	al. 1989 Metabolic Response to Chronic Energy Deficiency: P.S. Shetty
January	al. 1989 Metabolic Response to Chronic Energy Deficiency: P.S. Shetty Reaching the 'Under -threes' in ICDS: Shanti Ghosh
January April	al. 1989 Metabolic Response to Chronic Energy Deficiency: P.S. Shetty Reaching the 'Under -threes' in ICDS: Shanti Ghosh Fats in Indian Diets: Ghafoorunissa
January April	al. 1989 Metabolic Response to Chronic Energy Deficiency: P.S. Shetty Reaching the 'Under -threes' in ICDS: Shanti Ghosh Fats in Indian Diets: Ghafoorunissa Adaptation to Chronic Energy Defi- ciency: C. Gopalan
January April	al. 1989 Metabolic Response to Chronic Energy Deficiency: P.S. Shetty Reaching the 'Under -threes' in ICDS: Shanti Ghosh Fats in Indian Diets: Ghafoorunissa Adaptation to Chronic Energy Defi- ciency: C. Gopalan Flurosis-early Warning Signs and Diagnostic Test: A.K. Susheela



	Recent Indian Studies in Food Toxins: R. V. Bhatt	July	Use of Carotene Rich Foods for Combating Vitamin A Deficiencies:
October	Women and Nutrition in India – Some practical consideration: C.		B.S. Narasinga Rao
	Gopalan		Nutrition and AIDS: Prema Ramachandran
	Adolescent girls in ICDS programme- A proposed scheme: K.R Venugopal	October	Prevention and Control of Goitre -
	1990		Kochupillai
January	Nutrition and Drug Metabolism – A Review of Recent Indian Studies: Kamala Krishnaswamy		Studies on Colostrum – Nutrients and Immunological Factors : Kunal Saha & Meenakshi Garg
	Pattern of Fatty Acid Intake in Tradi-		1992
April	tional Indian Dietaries: K.T. Achaya Is Satisfactory Energy Balance Pos-	January	Nutrition and Environmental Degra- dation: C. Gopalan
	A. Durnin Nutritional Aspect of Palm Oil: W.H.		Vitamin A Supplementation and Child Mortality – The Nepal Study: S. Rajagopalan
	Chug	April	The Urban Challenge - Health.
July	Vitamin A and Child Mortality : C. Gopalan	April	Nutrition Implication: C. Gopalan
	Metabolic Efficiencies In Chronic Energy Deficiencies : P. S. Shetty		Maternal and Child Health in Slums of Delhi – A Summary Report: R.K. Puri and H.P. S. Sachdeva
October	Nutrition in Leprosy: Kunal Saha & K. N. Rao		The Slums of Ludhiana City (Punjab): A Case Study: A. Zachariah & Prema Zachariah
	Vitamin A Supplementation and Child Mortality-examination of a Chain: J. Cravioto	July	Growth Chart in Primary Child Health Care: Time for Reassessment: C.
	Age of Girls at Marriage – Public		Gopalan
	Health Significance: Suminder Kaur 1991		Defluridation of Drinking Water: Merits of Alternative Technology: A.K. Susheela
January	The Changing Profile of Undernutri- tion in India: C. Gopalan	October	Ensuring Food Safety and Quality: The Present Picture in India: Ramesh. V. Bhat
	The Efficacy of BCG Vaccination in Undernutrition: P. Bhaskaram		Variations in Food Consumption
April	Dietary Management of Indian Diabetics: M. Viswanathan & V. Mohan		1993
	Prevention and Control of Anaemia in	January	ICDS: An Assessment: B.N. Tandon
	India: Theory and Practices: B.S Narasinga Rao	April	Nutrition and Cataract : K. Seetharam
		-	



	Molecular Epidemiology of Cataract: D. Balasubramanium	April	Coronary Heart Diseases in Indians- Possible Role of Nutritional Factors: W. Phillip et al.
	Etiology of Malnutrition in Punjab: Poverty or Ignorance?: E. Booth et al.		Nutritional Status of Quarery Workers and Growth Profile of their Offspring: Sushma Sharma et al.
July	Child Care in India: Emerging Challenges: C. Gopalan	July	Diabetis and Insulin Resistance
	Turmeric: A Potential Anticancer agent: Kamala Krishnaswamy		The Childhood Origin of Atheroscle-
October	Osteoporotic Fracture: An Emerging Public Health Problem in Asia: C. Gopalan		Coronary Heart Disease in Delhi: The Possible Role of Air Pollution: C. Gopalan
	Low Birth Weights: The Indian Experience: Prema Ramachandran		Fluid Therapy in Childhood Diar-
	1994		rhoeas: Recent Developments: M. K. Bhan et al.
January	Nutrition and Degenerative Diseases in India: C. Gopalan	October	Assessing Child Malnutrition: Some Basic Issues: H. P. S. Sachdeva
	Diet in Renal Disease: M.K. Mani		Vitamin A and Vaccination : C. Gopalan
	Acute Toxicity of Vitamin A in Infancy: C. Gopalan		1996
April	Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir	January	1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al.
April	Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh	January	1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie
April July	Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh Micronutrient Deficiencies: Public Health Implications: C. Gopalan	January April	1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie Persisting Diarrhoea and Associated Malnutrition in Children: M.K. Bhan
April July October	 Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh Micronutrient Deficiencies: Public Health Implications: C. Gopalan Late Effects of Fetal Undernutrition : C. Gopalan 	January April	1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie Persisting Diarrhoea and Associated Malnutrition in Children: M.K. Bhan et al.
April July October	 Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh Micronutrient Deficiencies: Public Health Implications: C. Gopalan Late Effects of Fetal Undernutrition : C. Gopalan Dairy Development in India: A.P. Maha 	January April	 1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie Persisting Diarrhoea and Associated Malnutrition in Children: M.K. Bhan et al. Ensuring Food Quality and Food Safety- Emerging Challenges: Raj. K. Malik
April July October	Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh Micronutrient Deficiencies: Public Health Implications: C. Gopalan Late Effects of Fetal Undernutrition : C. Gopalan Dairy Development in India: A.P. Maha	January April July	 1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie Persisting Diarrhoea and Associated Malnutrition in Children: M.K. Bhan et al. Ensuring Food Quality and Food Safety- Emerging Challenges: Raj. K. Malik Diet Related Chronic Diseases in India – Changing Trends: C. Gopalan
April July October January	Acute Toxicity of Vitamin A in Infancy: C. Gopalan Control of Iodine Deficiency: The National Programme – Current status: Sheila Vir Child Survival and Safe Motherhood – The Hard Road Ahead: Shanti Ghosh Micronutrient Deficiencies: Public Health Implications: C. Gopalan Late Effects of Fetal Undernutrition : C. Gopalan Dairy Development in India: A.P. Maha 1995 Bioactive Phytochemicals in Indian foods: B. S. Narasinga Rao	January April July	 1996 The National Nutrition Science- An Analysis of Results of two National Surveys: M. K. Rai et al. Child Nutrition in India: Findings from the National Family Health Survey : S. Gillespie Persisting Diarrhoea and Associated Malnutrition in Children: M.K. Bhan et al. Ensuring Food Quality and Food Safety- Emerging Challenges: Raj. K. Malik Diet Related Chronic Diseases in India – Changing Trends: C. Gopalan Energy Requirements of Adolescents : P. S. Shetty



Vitamin A Supplementation in Pregnancy and Lactation: Prema Ramachandran

1997

January	Plant Food and Cancer Risk- Science and Tradition: J. D. Potter	lanus
	Food Safety Evaluation – National and International Perspectives: Ramesh Bhat et al.	Janua
April	Obesity and Physical Activity: P. S. Shetty	April
	Nutrition Related Chronic Diseases in Asia: Florentino S. Solan	
July	Nutritional Status of Children and Women in India – Recent Trends: H. P. S. Sachdeva	
	Universal Salt Iodization Programme in India – Progress and achievements: Shiela Vir	July
October	Nutrition and Cancer : Kamala Krishnaswamy	
	Antioxidants in Palm Oil : Narasinga Rao	Octol
	1998	
January	Obesity in the Indian Urban Middle Class: C. Gopalan	
	Fruits and Vegetables Production in India : G.L. Kaul	
April	Calcium Requirement in Pregnancy and Lactation: Ann Prentice	Janua
	Less Recognised Micronutrient Deficiencies in India: Mehtab S. Bamji and A.K. Lakxmi	April
July	Micronutrient Malnutrition in SAARC- The Need for a Food-based Approach:	

Recent Trends in Immunonutrition: Gill Hardy

C. Gopalan

October Arsenic in Drinking Water: A Public Health Hazard: A.K Susheela

> Folic Acid for Prevention of Neural Tube Defects: S.S. Agarwal

1999

anuary The Changing Epidemiology of Malnutrition in a Developing Society: C. Gopalan

Genetic Variation and Nutritional Requirements: Artemis P. Simopoulos

Childhood Obesity in Developing Societies: P.S. Shetty

> Control of Iron Deficiency Anaemia-New Approaches: Fernando E. Viteri

> Reviews and Comments: Anaemia in Adolescence and Pregnancy: Anshu Sharma and Bani Tamber

Nutrition in High Altitudes: S. Singh, K. Sridharan and W. Selvamurthy

> Genetically Modified Plants for Food Use: R.S.Paroda

October Nutrition and Developmental Transition- Lessons from Asian experience : C.Gopalan

> Reviews and Comments: New Challenges to Nutrition Security in the Third World: Michael C. Latham and Micheline Beaudry

January	India's Milk Revolution : V. Kurien
	Reviews and Comments: Malnutrition and Obesity :P.S. Shetty
April	Towards an Evergreen Revolution in Agriculture: M. S. Swaminathan
	Multiple Micronutrient Supplementa- tion in Pregnancy: C. Gopalan
July	lodation of Common Salt for Control of IDD- Not the Time to Backtrack: C. Gopalan



India's Horticultural Revolution: G.L. Kaul

Reviews and Comments: Pregnancy in Adoloscence – "Child Labour" at its Worst!: C. Gopalan

October Towards Population stabilisation: Ashish Bose

Nutritive Value of Rice Bran: B. S. Narasinga Rao

2001

January Prevalence of Vitamin D Deficiency in North India : N. Kochupillai Nutritional Status of Children in the State of Uttar Pradesh – Programme Implications: Sheila C. Vir and A. K. Nigam **Reviews and Comments: Combatting** Vitamin A deficiency – A Rationale Public Health Approach: Shanti Ghosh April Polyunsaturated Fatty Acids in Health and Nutrition: Ghafoorunissa Early Childhood Malnutrition in India: Inter-state Differences: C. Gopalan Combating Malnutrition with Scientific Intervention and Community Participation: Mahtab S. Bamji, P.V.V.S Murthy July Census of India 2001: Some Glimpses: Ashish Bose **Genetically Modified Foods: Potential** Benefits and Possible Hazards: Kamala Krishnaswamy, S. Vasanthi October Prevention of "Micronutrient Malnutrition": C. Gopalan 2002 Pulses and Legumes as Functional January

Foods: B.S. Narasinga Rao

The Vitamin A Fiasco: C. Gopalan

April Towards Women's Empowerment: C. Gopalan

Role of Dietary Fat in Meeting Energy Needs on Predominantly Cerealbased Diets: B.S. Narasinga Rao

Nutritional Status of Women in an Urban Slum of Delhi : A Profile: S. Saran

July Ensuring Nutritive Quality of Breast Milk: C. Gopalan, Rita Patnaik

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