

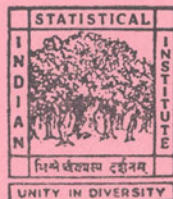
INDIAN STATISTICAL INSTITUTE

THIRTEENTH CONVOCATION ADDRESS

NUTRITION IN INDIA IN CURRENT FIVE YEAR PLANS

By

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Mr. President, Mrs. Mahalanobis, Dr. Maitra, distinguished guests and fellow statisticians,

1. I deem it a great honour to be invited to deliver the Convocation Address of the Indian Statistical Institute. I am especially conscious of the honour because persons who have preceded me include such illustrious names as Professors R. A. Fisher, Jerzy Neyman and Harald Cramér, who are known the world over for their pioneering contributions to the Foundations of Statistical Science. I hope I will be able to perform the task worthy of the great traditions set by them.

2. During most of my career I have worked as an applied statistician in the field of food and agriculture—first in Indian Council of Agricultural Research and later in Food and Agriculture Organisation of the United Nations. The part of my work which dealt with research and development of survey methods of sampling was both challenging and satisfying. I was well equipped to handle it. But the part which dealt with evaluation of data and assessment of programmes was not. I found this particularly true of the assessment of nutrition status and of feeding programs to combat malnutrition in the different countries of the world. I often wondered whether statistical method was being used by FAO to rubber stamp certain preconceived notions. As an example, I was not happy with the assessment by Lore Boyd Orr, the first Director-General of FAO that 2/3rds of the world was hungry and malnourished. The model of normal bivariate distribution for intake and requirement used by him was not convincing and yet I needed to know much more about the basic concepts of nutrient requirements and their relationship with health before I could suggest any improvement. On one hand, the policy implications of wrong evaluation were enormous; on the other hand, there was little that I could do to influence them unless I talked and argued in the language of the subject matter specialist. The late Professor Mahalanobis always stressed the need to understand the problem in depth before going in for experimentation to collect data and interpreting their results. Speaking in the Institute

founded by him, I feel encouraged to narrate my experience. I do so for two reasons — firstly, 30 years have passed since independence and yet the goal of raising the level of nutrition of our people mentioned in Article 47 of our Constitution continues to elude us despite planned efforts in successive plans to realise it. Secondly, I would like to illustrate the contribution which statistical methods can make to improving our understanding of the problem of malnutrition facing us, the reasons for past failure and the prospects for future. I do so in the belief that my experience will be useful to you in later life when you go out of this Institute after your graduation.

3. It will suffice my purpose if I take you to the years preceding the first United Nations Conference on Science and Technology of the last decade. Then, as now, people began to do some hard thinking on the problem of food and nutrition. There was particular reason to be optimistic at that time; man had just landed on the moon and this remarkable feat had given rise to a wave of optimism that given big science based technology and capital, we could conquer the problem of hunger and malnutrition facing the third world. Accordingly, a committee on the application of Science and Technology to Development was set up by the United Nations to study the problem. This Committee of distinguished food scientists and nutritionists brought out a report to say that protein deficiency lay at the heart of the problem of malnutrition, that food grain diets provide no more than 2/3rd of the protein needed by man, that if we continue taking it as it is, without enriching it with good quality protein, our 'economic, social and physical development will be completely arrested', that it will take a long time at current rate of development for us to produce good quality animal protein and that even if we produced the needed animal products, most people will not be able to afford it. The only feasible solution in the Committee's view was technological. Modern technology, the Committee observed, had fortunately made it possible to produce new protein products which can be had at little extra cost. All that was needed was capital from the developed countries to back the effort. Briefly, the Committee dismissed the problem of malnutrition as entirely technological in nature, requiring capital from the rich countries and cooperation of the poor countries to solve it.

4. Examination of the report, however, showed that there was little or no support for the thesis advanced by the Committee. In particular, it was found that the concentration and quality of protein in the cereal-pulse diet that we eat is more than adequate to meet man's needs provided he eats

enough to meet his energy needs. For children, milk is a desirable addition, but not so much because the diet does not meet his protein needs but because it provides vitamins and minerals, especially calcium and further, milk helps transition from breast milk to solid food. Even mother's milk contains no more than 5 to 6% of its calories in the form of protein and yet it is an ideal food for infants. It is of course true that the food grain diet is not adequate for a satisfactory growth of laboratory animals like rat; but 'man is not a rat'. The relative rates of growth in man and rat are very different. As Mickleson puts it, 'if the results of bio-assays on rats reporting protein efficiency ratios were directly applicable to man, we would have never grown to adulthood'. There are no known benefits from excess consumption of protein either. On the contrary, at very high doses of *N*, the adult organism is found to be under stress, protein metabolism is altered, becoming more rapid in an effort to eliminate excess nitrogen as quickly as possible. If people in the rich countries eat more protein than what is needed for health, it must be because it is difficult to resist the temptation to eat more of tasty animal foods when one can afford to do so. Good nutrition is not only a matter of balance between intake and output; it is also a matter of the power with which balance is regulated. This power is reduced at high doses of intake. For us in the developing countries, the real problem with protein arises from the inadequacy of the calories in the diet. Protein synthesis is very expensive in terms of calories. Available data, critically examined, confirmed that protein malnutrition such as we see in the country is for the most part, the indirect result of inadequate energy in the diet and that acute forms of malnutrition such as Kwashiorkar are precipitated in the presence of infections.

5. At this stage, I ought to mention the reactions of press to this finding. I mention these reactions not with any sense of anger, but because it is instructive in considering options and alternatives open to us. As an example, a leading newspaper in its editorial called my finding the result of blind and perverse logic, distorted vision, etc. Evidently, the Editorial was inspired by entrepreneurs and enterprisers who feared that their interests in developing protein rich foods using modern technology would be jeopardised. However, it was not long before they reconciled themselves to the fact that the so called protein gap was a myth. How nearly India went off the track at that time can best be judged from the following extract from a report on Nutrition in Rural India in the Fifth Plan by Shri B. Sivraman, member, Planning Commission (1974).

“While all this was going on, the cry of protein malnutrition in the world was raised by the world health bodies and received a strong support of the Food and Agriculture Organisation of the United Nations. Well meaning world organisations tried to tackle the problem by supplying readymade protein supplements manufactured in the affluent countries as gifts to the poorer areas for such programs as feeding of children and expectant nursing mothers. Developing countries found this wave of new theory supported by prestigious world organisations too strong and there was quite a danger of a country like India going off the main track by their propaganda which was later on found to be an undue emphasis on the protein deficiency *per se* in the diet. Fortunately, a balance was reached with the contribution of Dr. Sukhatme, who showed ...”

However, we do not seem to have drawn sufficient lesson from this experience. A perusal of the current plans will show that our nutrition programs continue to use and emphasise protein rich foods to combat malnutrition. The growing interest of the food industry in feeding programs has its origin in the possibility of popularising protein rich foods. The development of the lysine fortified bread is the direct result of this interest. Likewise production of protein rich biscuits, chocolates, drinks and infant foods although mostly catering to the demands of the well-to-do, is carried out in the name of reducing malnutrition. It is likely that food technology in India will be extended in the years to come to cover even a larger variety of convenience and luxury protein rich foods articles as in the West. While all this is understandable it will be wrong to encourage the belief that these products and feeding programs based thereon are a solution to our food and nutrition problem. The use of colourless, odourless and tasteless amino acid powders to enrich the content of protein to prepare new food articles for use in nutrition programs, e.g., Sukhadhi has little to commend in practice. A glass of milk in their place will be far more beneficial for health. And here I cannot but congratulate the Government of Maharashtra for the bold measure it has taken this year in providing milk in place of Paushtik Ahar to school going children.

6. The view that the principal limiting factor in our diet is energy and not protein now generally prevails. Analysis of data confirm that as income increases, the energy intake increases, rapidly to start with and gradually thereafter, indicating that an appreciable number of people remain undernourished and malnourished for want of adequate income. Our planners were quick to see in this analysis that poverty was the principal reason for the large and widespread incidence of malnutrition as also for its persistent nature over the years. It followed that the policies and plans to combat malnutrition,

which hitherto took as a first reference point of attack, the existing inequalities in protein consumption, must give way to policies and plans to eliminate inequalities in the income itself, at least to enable the poor and the malnourished to have income to afford a cereal-pulse diet adequate to meet their energy needs. The emphasis on providing employment to the needy, even guaranteeing it, was born out of this realisation.

7. While I have no doubt that we are on the right path in emphasising employment as the most essential element in combating malnutrition, I fear we have not done sufficient homework in understanding what minimum energy need means and how we should go about in defining minimum income to afford it. The view that inadequate income is the cause of widespread malnutrition, gained such a rapid acceptance that minimum energy requirement has now come to be used as the criterion for estimating the extent of poverty itself. A person who cannot afford a diet which meets his minimum energy needs is certainly both poor and malnourished. The oft quoted figures that some 40% of the rural population and 50% of the urban population of India are poor and malnourished are arrived at using this criterion. More recently, Reutlinger and Sellowsky of the World Bank have also used this criterion to estimate the dimensions of malnutrition and poverty in the developing world. However, in estimating the poverty in this way the authors have misused the meaning of energy requirement. They have used average energy requirement for the minimum and in the process, grossly overstated the dimensions of hunger and malnutrition. These studies remind me of the report made by the late Sir Arther Bowley for United Kingdom in the thirties. He found that 50% people in the U.K. ate below the average requirement for Great Britain and concluded (to the consternation of the Ministry concerned) that they must be undernourished and malnourished. I need hardly add that notwithstanding the eminence of Lord Bowley, the Government rejected the report. In our country, however, our planners are holding fast to the meaningless figures for the incidence of poverty and malnutrition arrived in this way. I call them meaningless because to call a person as undernourished when his intake is below the average is equivalent to considering a person as overnourished when his intake exceeds the average requirement. This would imply that the more serious problem with India today is overnutrition, not undernutrition. One is bound to reach such absurd conclusion when one uses statistical method without paying adequate regard to inter and intra-individual variation in intake and requirement.

8. How does one take into account the variation in estimating the incidence of undernutrition? A consideration of this question will take more time than would be desirable to devote on this occasion. To those interested, I will refer to my Lal Bahadur Shastri Memorial Lecture on 'Malnutrition and Poverty' 1977, and my paper on Assessment of Adequacy of Diets in the Economic and Political Weekly, 1978. It would suffice here to state that energy balance in man maintaining body weight is found to vary from day-to-day and week-to-week in a way that is far from random. In particular, the successive values are found to be correlated in an auto-regressive (AR) process showing that the balance is regulated. As a result intra-individual variation remains a fundamental source of variation even when intake and expenditure are averaged over a week. This means there is no absolute energy requirement for any day or period. It simply means that the individual is in homeostatis and that his requirement is controlled by a regulated system. This is also the explanation of why intakes of individuals belonging to the same age-sex groups and engaged in similar activities are found to vary over the entire range of intra-individual variation even when intakes are averaged over a week as pointed out by Widdowson (1947) long ago. In particular, she observed that one can be sure of finding at least one individual in every 40 who will have an intake twice as large as the smallest eater and yet all will be healthy and active, doing similar work. A part of this variation will undoubtedly be due to variation in body weight. However, the correlation between body weight and intake rarely exceeded .5. Even after standardising intake to reference body weight, it was observed that individuals differed in their weekly intakes with a coefficient of variation of 12 to 15%. If energy requirement in man was merely a sum total of the energy expended on basal metabolism and maintenance (as determined by his body weight) and energy expended on physical activity and a small increment due to specific dynamic action as postulated by FAO/WHO Committee of experts (1973) in its report on energy requirements, we would not be able to explain this variation. On the other hand, metabolic pathways which lead to variation in energy balance are known. In consequence we cannot regard an individual eating less than the average requirement as undernourished or one eating above the average as overnourished unless his intake is found to exceed the homeostatic limits governing the auto-regulatory mechanism of his energy balance. Apparently, the body regulates its energy balance by varying the efficiency of energy utilisation much in the same way as it regulates *N* balance. I ought to add that such a statement need not be taken to mean that the first law of

thermodynamics is violated. The laws of thermodynamics do not impose any obligation that intake must equal expenditure every day or after fixed periods of 3, 5, or 7 days. There can be a time lag in balancing intakes with expenditure over a period of stress or strain which in fact motivates a movement towards a balance. Even in purely mechanical systems, attainment of this balance is not necessarily instantaneous but may be preceded by a stress or strain generating time-lag. Living biological systems tend to reach this balance through their in-built auto-regulatory mechanism. The fact that the distribution of energy balance is stochastic stationary ensures that the expected value of balance is zero and the standard deviation is independent of time.

9. I have referred to these overestimations in my Address because policies and programs based on cut-off points for income corresponding to the average energy requirement can be self-defeating. When correct meaning is put on requirement and allowance is made for intra-individual variation, it will be found that at best 15 to 20% of the population can be considered as malnourished for want of adequate income. The NSS data do not lend themselves to a more precise statement of incidence by age and sex. Clinical evidence shows that the incidence is smaller. But even a figure of 15% means that some 100 million individuals in the country are malnourished. By including twice or thrice as many individuals as poor and malnourished when only the lower half or third among them are so, we are only helping the relatively better offs among the poor with an opportunity of capturing the benefits of official programs, leaving those who are really poor as they were or even to become worse. I am aware that there is a tendency to blame this on unsatisfactory implementation; the flaw in my view lies with the strategy developed by the Planning Commission. It needs to be remembered that politicians and officials love to pick and choose beneficiaries when planners give them such latitudes and funds are in short supply !

10. The finding that energy and N balance in man are regulated have aroused wide interest among the scientists. Much as I like to believe that new ground is broken, our research will need to be reinforced by further metabolic studies. Thanks to the Indian Council of Agricultural Research, I have been able to build at M.A.C.S., Pune facilities for experimentation on rats and monkeys. Further, the Department of Science and Technology has encouraged me to enter into collaborative arrangements with the Department of Nutritional Sciences, University of California, Berkeley for metabolic studies on

man. In the ultimate analysis, however, it will be necessary to establish such facilities in India itself. It is important that this facility should be a part of the Indian Statistical Institute because essentially we are concerned here with control and regulation of errors and their interpretation. I would like to take the opportunity of this Address to express the hope that the project will be given high priority in the next plan.

11. The implications of the finding that dimensions of malnutrition linked with poverty are much smaller than they have been made out are enormous for future prospects. It was believed all along that as gross national product increased, the gains of development will find their way to the poor. This expectation has not come true. This is the reason why nutrition programs were instituted to help the poor in the intervening period. But in doing so adequate attention to public health aspects was not paid. Thus, water is the most important of all nutrients, but majority of villages do not have an easy access to protected supply of drinking water. Water supply for washing and maintenance of hygiene, particularly during summer is known to be inadequate. There is also absence of community latrines and sanitation. Housing is inadequate and hygiene and health consciousness hardly developed. Conditions in the slum areas of the cities are no better. Most of the incidence of morbidity in children has its origin in these factors. Much of the energy of children is in fact spent in combating infections and in the process they are forced to lower their energy balance and lose body weight. Periodical deworming and feeding is like pouring water in a leaky bucket. The result is that feeding programs rarely make an impact on their nutritional status. By contrast experience of children of Indian origin brought up in USA or UK suggests that they grow well even though they continue to take much the same diet as in India. Conversely, whenever these children return to India, they suffer set back to their health and to their rate of growth because of the high incidence of gastro-intestinal and other infections.

12. That supplementary feeding programs are not the deciding factor in improving the health of children in the present environmental set up can also be seen from the numerous studies of regression of body weight on intake and morbidity reported in recent years. Thus in one extensive study, intake and morbidity were found to account for a third of the total variation in body weight, but whereas the regression coefficient of intake on body weight was .04 per k cal, that of days lost in morbidity from gastro-intestinal and other disorders on body weight was negative and .03. Most of the gains from

improved energy and protein intake were thus lost due to morbidity. The experience of Kerala is very instructive. As is well known, the level of energy and nutrient intake in Kerala is lower than that of most other States and yet Kerala enjoys better health. It has a much lower infant mortality, lower overall death rate and greater life expectation than others. The high rate of utilisation of hospital facilities for deliveries and infant care, their easy accessibility, and above all greater health consciousness created by education, are some of the factors explaining this improvement. Measurement of poverty using energy norm and household income presupposes the provision of these services from the Public Sector.

13. As for the present scale of operation of the nutrition programs, it is woefully inadequate. It has been estimated that there are some 50 million children below the age of 6 who are malnourished and require to be covered under the nutrition program. In actual practice, the Government has not been able to cover more than 10% of these children and even of those who are covered, the number of days on which they were given supplementary diet rarely exceeded 250 days a year. However, humanitarian the task of organising special nutrition programs little good can come out of such approach, the state of hygiene and public health being what it is today. I am aware that in addition to special nutrition programs we have offer of funds and resources from philanthropic organisations like CARE. But the picture remains essentially the same relative to the size of the problem. It is for this reason that we must be all the more careful to ensure that we derive the maximum benefit in any effort that we may make in improving the nutrition status of the poor. Fortunately, as we saw, the size of the problem is much smaller than was previously assessed. If the cost-benefit ratio is kept in mind in developing future programs, there is every hope that we would succeed in reducing materially the incidence of malnutrition during the next plan period.

14. Classification by occupation of the households in the bottom two deciles of the income range shows that they are mostly landless workers and the small farmers in the rural area and the temporary wage earners in the urban area. People in the tribal area and in slums and those belonging to scheduled castes fall almost entirely in the lower quartile. If the majority or most of them are malnourished, it is primarily because they do not have income adequate to meet their food needs. It is, therefore, only right that our main strategy should be directed to generating employment for raising their income

supplemented by feeding programs and public health measures, especially protected supply of drinking water. Food for work using the surpluses in food grains that we have accumulated over the last 3 years should materially help in implementing the strategy.

15. To two further considerations I would like to refer in the context of considering future prospects. The first is the need for community type organisations in generating employment and the second is the need for involving the mothers themselves and their children in this effort. For the surest way of combating malnutrition is to reach a child through mother by providing employment in the preparation of traditional foods that you and I prepare and eat at home.

16. Indira Community Kitchen at Pune provides a good example. Our employees are drawn from backward classes in need of employment. It is a cooperative. The food articles prepared are what we eat at home—poli, bhat, bhakri, varan, vegetables and sweets. The tools used in preparing them are the same that we use at home and yet the productivity of our workers is sufficiently high to convert the input of Rs. 20 into Rs. 30 a day, thus leaving up to Rs. 10 with which to pay to a worker and provide for the health and other services. We are able to sell our products at prices which are 50% lower than the market price. For example, chapaties are sold at Rs. 4 per kilo though the market price for comparable quality is two times as high. As for nutritional content, I would refer you to the tables in the Annual Report of the Kitchen. You will find that the Kitchen is able to give meal of some 1200 calories at Rs. 1.50. This means that the Kitchen is able to meet the daily needs of an adult man at Rs. 3.

17. As for quality and taste of food we offer, I would refer to the opinions of the people who have visited us. I myself occasionally take meals from the Kitchen and find my guests complimenting my wife for the foods served when in fact the meals have been prepared by the Kitchen and served hot at home.

18. How is it you may ask that the Community Kitchen is able to offer the articles so cheaply ? In the beginning our employees were not able to prepare more than 5 or 6 bhakries an hour. By improving the supervision and management and by developing human skills of the employees, the rate of productivity is increased to 30 bhakries an hour. I would rather invite you to visit us to see for yourself what we have been able to achieve by dividing the total operation into sub-operations—sieving, cleaning, preparing dough, rolling,

baking on the gas range until one layer is formed, baking on coal-hearth for the formation of the other layer, drying, packing, etc. The whole operation has a human touch and yet it is carried out with efficiency of the assembly line in a factory. Our Kitchen illustrates how labour intensive technology can be used in offering guaranteed employment at market wage rate by keeping the marginal productivity sufficiently positive. Since our activities are primarily labour intensive, investment of capital is small. We are able to employ a worker by investing Rs. 1500 per worker only.

19. We serve about 7000 people a day and the demand for our foods continues to be heavy. We plan to increase the services to cover more people and simultaneously increase employment to women folk who are primarily drawn from the weaker sections of the community. As we expand, we are sure we would be making a decisive impact on the economy. Although food is the dominant need, of equal importance are other aspects of the lives of these people, e.g., housing, hygiene, education and nutrition of children. To provide employment disregarding these aspects is to lose the opportunity we have of bringing about social transformation in the lives of the poor. As soon as we shift the Kitchen to the new land, we shall set up Anganwadi within the compound of the Kitchen to collect the children of those who work with us and arrange for their feeding and schooling. This will ensure the link between mothers and children that is lacking today in the government sponsored nutrition programs which aim at delivering packets of food in the hands of children standing in a queue. The psychological impact we expect will be a great asset in improving nutrition status of the child.

20. In cities, there is a ready market for prepared foods, but not in villages. We are, therefore, experimenting on different lines in villages. Our work in villages is centred around schools and is divided in three stages. The first stage is directed to the improvement of the campus. This we have found relatively an easy task once the cooperation of the school authorities and the Zilla Parishad is secured. Simultaneously we have concentrated on imparting health and hygiene education and fostering of community action. The second stage is directed to the construction of bore well, community latrines adequate for use by all students and bio-gas plant connected with latrines. The aim here is to motivate children into using community latrines as the first thing in the morning, taking bath and daily washing of clothes as a matter of habit before entering the class. These habits, we hypothesise, will materially help in reducing the incidence of gastro-intestinal diseases. In the last stage,

supplementary nutrition program will be started for breakfast and lunch. Our hope is that once the children come to recognise the value and benefit of hygiene and sanitary measures for their well-being, and particularly the value of recycling waste, they are likely to carry forward the habits so formed in later life, thereby serving as a catalytic agent to bring about social transformation of the community.

21. Ours is by no means the first project of its kind. A number of similar village studies have been completed and reported in the nutrition literature. However, the conclusions reported from these studies are of limited values owing to certain flaws that have entered into their organisation and design. Thus in almost all studies, there is a difficulty in getting participation of different population groups of inhabitants. But even more difficult is to ensure that those who participate are not self-selected groups, thereby confounding the very effects which we seek to evaluate. Thus in the studies conducted in Guatemala, it has been found on further analysis that those who availed of the nutritious food mostly came from relatively well off households. And finally, there is no provision in the design to evaluate interaction of nutrition programs with environment, hygiene, public health and water. The conclusion that improvement in the intake of protein rich food will help eradicate malnutrition had its origin largely in such faulty studies reported in the past. I am sure that these aspects of design and inference will be of particular interest to you as statisticians. The knowledge of statistics and the practical experience you have acquired in this Institute in planning and carrying out inter-disciplinary studies make you eminently suited to accept the challenge of malnutrition and poverty and opportunities to serve the nation. I wish you good luck !