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Measurement of Undernutrition: Biological Considerations

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In recent years, there has been a sustained and vigorous debate on the level of calorie intake to be used as a measure of undernutrition. (Sukhatme, P V: *Econ. Pol. Weekly,* 1978, 13: 1373-84; Sukhatme, P V: *Proc. Nutr. Soc. India,* 1979, 23: 1-11; Sukhatme, P V: *Econ. Pol. Weekly,* 1981, 16: 1318-24; Dandekar, V M: *Econ. Pol. Weekly,* 1981, 16: 1241-50; Dandekar, V M: *Econ. Pol. Weekly,* 1982, 17: 203-12). Dandekar and Rath (Dandekar, V M: Rath N: "Poverty in India", *Econ. Pol. Weekly,* January 2 to 9, 1971.) had used household calorie intake as the yardstick for the measurement of poverty. In the debate touched off by this paper, unfortunately, the measurement of *undernutrition, rather than of poverty,* gained the main focus.

Since the participants in the debate have been mostly statisticians and economists (undoubtedly highly eminent), the debate has not done adequate justice to the various dimensions of the nutrition problem. The far-reaching postulates on 'physiological adaptation' boldly ventured in the course of this debate (Sukhatme, P V: *Proc. Nutr. Soc. India,* 1979, 23: 1-11; Sukhatme, P V: *Econ. Pol. Weekly,* 1981, 16: 1318-24) have generated the unfortunate impression among policy-makers that undernutrition is not a serious problem in the country any more.

Limitations of level of calorie intake as a yardstick for measurement of undernutrition: Poor communities subject to socio-economic deprivation, who suffer from undernutrition, do not suffer from deficiency of calories alone, although it is undoubtedly a major factor. Studies over the last four decades in this country have shown that other major nutrient deficiencies also contribute very significantly to undernutrition. It is misleading semantics to dismiss these major deficiencies which afflict vast sections of our people as representing 'malnutrition' and not 'undernutrition', as though such 'malnutrition' is a matter of minor concern. *All nutrient deficiencies represent* undernutrition.

Important among these are deficiencies of vitamin A, iron, and vitamins of the B group. There is undoubtedly considerable overlap between calorie deficiency and deficiencies of these other nutrients because all these deficiencies are the attributes of the same poverty syndrome, but the severity of all these different deficiencies need not run parallel.

Correlation

While a close positive correlation between calorie intake on the one hand and protein intake and iron intake on the other obtains in Indian dietaries, there is no reason to expect the same degree of correlation between calorie intake and intake of vitamin A (carotene), because the food sources of carotene and vitamin A are not generally the major sources of calories. The requirements of some vitamins of the B group are indeed known to be enhanced with increase in calorie intake. Several millions in the country are suffering from goitre (iodine deficiency) which is not related to the level of calories in the diet. The quantum of undernutrition in the community will thus exceed the quantum of calorie deficiency.

Recent field studies have in fact shown that some nutritional deficiency signs like those attributable to deficiencies of vitamins of the B complex group were actually higher in subjects on a relatively higher calorie intake. Thus, while the level of *household* calorie intake may be a useful yardstick to measure *poverty,* it will provide a significant underestimation of undernutrition even if mean requirement (and not mean — 2 SD as is now being proposed) is used as the yardstick.

Measurement

Measurement of poverty on the basis of calorie intake is an economic measurement. It considers the minimum needs, that is, capacity to afford enough food to meet just calorie needs.

It is *not* a measure of undernutrition as it does not take into consideration many other nutritional needs. For such a measurement one should perhaps consider the least-cost balanced diet which provides all the required nutrients besides calories.

Assuming that three-fourths of the family earnings are spent on food and an average least-cost balanced diet per day (without including fuel cost) may cost Rs. 2.50, the monthly per caput income, which will enable a family to afford such a diet would be at least Rs. 100. This would be about 1.5 times the income which will be considered minimum for fulfilling only the calorie needs. If ability to afford a balanced diet is used as the criterion, the extent of poverty will be much higher than the estimates based on Dandekar and Rath's criterion.

Limitations in the measurement of calorie intake of individuals and groups: If we depend on a *single* yardstick to measure undernutrition, then we must be sure that yardstick carries with it the attributes of specificity, and reliability and precision with regard to estimation. The calorie-intake yardstick certainly cannot claim to possess these attributes. Calorie-intake measurement at a given point of time as a yardstick for assessing even calorie adequacy of an individual or group (let alone measuring undernutrition) does not carry the same reliability as, say, haemoglobin level estimations for assessment of iron-deficiency anaemia. To place sole reliance for measurement of undernutrition on such a yardstick will be unjustified.

The errors in the computation of even household calorie intakes could vary from one team of investigators to the other; and with the same investigators, from one community to another. This is because in the collection of data, not only the training of the investigators but also the co-operation of the communities concerned are important. There are also seasonal fluctuations in dietary intake among the rural poor, and weekly fluctuations among the urban poor, with the result that an estimation of calorie intake at any given point of time could only reflect the current intake and no more. In a recent study, Narasinga Rao *et al,* taking note of daily variations in calorie intake, have emphasised the need for estimations on several occasions in order to arrive at conclusions regarding the true mean intake of an individual.

Limitation

Perhaps the most serious limitation is with respect to the computation of the actual calorie intake of children and women of the household, the most vulnerable segment from the point of view of undernutrition. In most diet surveys, the overall household calorie intake is surveyed, and the individual intakes are computed on the basis of 'coefficient' based on physiological requirements — the assumption being that the intra-familial distribution of the foods is strictly in accordance with physiological needs — which we now know is not the case. It has now been established that the actual intra-familial distribution of food, especially in the poorest families, is tilted against children, with the result that in many households where the overall calorie intake may be seemingly adequate, children may in fact be calorie deficient.

Thus a recent study at the National Institute of Nutrition showed that as against the calorie coefficient (adult equivalent consumption unit) of 0.5 for children between 1-3 years, the actual intake was only 0.33; and for the 4-6 years age group, as against the coefficient of 0.62, the actual intake was only 0.47. Household diet survey data will thus fail to bring into focus the age and the sex distribution of calorie inadequacy and preponderance of calorie inadequacy in children — nutritionally the most vulnerable group.

Underestimation

Much of the available data on calorie intakes of children of poor communities computed on the basis of application of 'coefficients, to overall household intakes are overestimates and as a result we already have an underestimation of the problem of undernutrition in children. Even when the questionable yardstick of m — 2 SD was used to assess the calorie intakes through individual diet surveys of children, more than 50 percent of the under-fives were found to suffer from calorie deficit and, in some parts of India, the figure was as high as 80 percent. This would have been masked to a considerable extent by energy-intake data at the household level. The household energy intake data do not also bring into focus the other vulnerable group, namely, pregnant women and nursing mothers. In the assessment of the adequacy of energy intake in a community, the use of m — 2 SD as the limit of adequacy will be unjustified even where intake of subjects in the community are individually measured; it will be even more so, where energy-intakes are measured at the household level.

It is because of overestimation of calorie intake of children through computations from overall household calorie intakes, that the true nature of the protein-calorie malnutrition (PCM) problem as being primarily one of calorie deficiency in children was not revealed till the actual intakes of individual children within the household were measured through painstaking research. It is one thing to do such elaborate studies with meticulous care in time-consuming research operations in selected population groups; it is quite a different thing to attempt a similar operation on a countrywide basis in the course of routine diet surveys, and expect the same degree of accuracy and reliability. In the poorest homes and among the tribals, food is shared from a common family pot; it is not as if each member of the family has a tidy plate and spoon laid out before him or her. Moreover, it is particularly in children of poor communities that wide fluctuation in calorie intakes occurs in the course of few weeks or months related to the onset of diarrhoea and other infective episodes. Even an accurate determination of calorie intake at a given point of time in an individual child may not therefore be considered applicable for the entire duration of a year or six months. Estimation of individual intakes in routine field operations have thus several limitations. In these circumstances, assessment of calorie intakes of individual children within households in the course of routine diet surveys is still mostly based on overall household calorie intakes, and the application of 'coefficients' to compute intakes of individuals in their families. For this reason available data generally represent overestimates of calorie intakes of children — and consequently underestimation of the problem of undernutrition in them. If these sources of errors in the computation of calorie intakes of individuals within households had been appreciated, there might have been less emphasis on calorie intake levels as the sole measure of undernutrition.

Procedure

It is in recognition of these limitations that over the last four decades, nutrition scientists have evolved a procedure for the assessment of nutritional status which does *not* place sole reliance on calorie intake alone. The assessment is based on: (1) diet survey data, (2) anthropometric data on children, (3) clinical signs of undernutrition — conjunctival xerosis, bitot spots, glossitis, etc., (4) socio-economic condition, environmental state and morbidity history, and (5) biochemical estimations — including especially haemoglobin estimations. It is only such a comprehensive battery of tests that can do adequate justice to the multi-dimensional nature and the multi-factorial causation of undernutrition. Such an approach will enable us not only to detect the nature of

undernutrition and its determinants but also provide a clue to its treatment and prevention. Sole reliance on calorie intake to measure undernutrition is a simplistic approach, with inherent fallacies.

The hypothesis of 'intra-individual variation' and physiological adaptation: The debate has largely centred around Sukhatme's hypothesis according to which calorie intakes falling below the recommended mean energy requirement minus 2 SD (m — 2 SD) alone and not the mean requirement (as is the case at present) need be considered inadequate. The statistical basis underlying the hypothesis has been subject to detailed examination by Dandekar (Dandekar, V M: *Econ. Pol. Weekly,* 1982, 17: 203-12) and several eminent statisticians. We will not attempt to cover that ground here. We will address ourselves to some biological questions.

The arguments advanced in favour of the hypothesis are two-fold: that energy requirement of normal individuals is not static and intra-individual variation is closely similar to the inter-individual variation in a group; and that all individuals with energy intakes at the level of m—2 SD can successfully 'adapt' to these low intakes (representing the lower limit of 'requirement distribution' considering their intra-individual variations), even if such intakes become a permanent feature of their dietaries.

Calorie intake

It is claimed that the body can "adapt requirement to intake". We need not dispute the postulate that the calorie intake of individuals not subject to socio-economic constraints is not the same day after day. Intra-individual variation in calorie intake is to be expected, depending on the level of activity, presence or absence of infection, etc. The 'pendulum' of daily calorie intake in an individual may thus oscillate between points on either side of the mean.

It is the second postulate, that subjects permanently obliged to subsist on calorie intakes representing the lower limits of their normal intra-individual variation, can *permanently* adapt their requirement to this low intake without any functional impairment that is unacceptable. This second postulate suggests that the 'pendulum' can be safely arrested to a halt at the lowest end of its oscillation! It would mean that individuals permanently subsisting on the proposed low calorie levels involving such 'adaptation' can, thereafter, not afford intra-individual variation any more.

Variation

If intra-individual variation is a physiological attribute, such 'adapted' individuals are then no longer in the physiological state. In a healthy individual, not subject to dietary constraints, and living in a normal physiological state, it is to be expected that it will be the intake which will adapt to requirement, and not the other way about. Further, a healthy subject responds to alterations in energy intake by burning body fat when dietary energy is deficient, or by storing body fat when dietary energy is in excess, resulting in a continuous process of breakdown and synthesis of body energy reserves. However, individuals subsisting permanently on low energy intakes have no scope for this and lose the advantage of an important regulatory or adaptive mechanism.

Terms such as 'adaptation' and 'threshold' have been freely used to buttress statistical conclusions. Adaptation has been referred to approvingly as something always consistent with normal physiology (like increase in heart-rate on exercise). As Lincoln Chen (Chen, Lincoln C: *Bull. Nutr. Found. of India,* 1982 October, p-4) has pointed out, the possible 'cost' involved in so-called 'adaptation' should not be lost sight of. The fact that so-called 'adaptation' may represent a pathological rather than a physiological equilibrium (cardiac hypertrophy in hypertension) has not been recognised.

An adult subsisting on low energy intakes may 'adapt' by cutting down his energy expenditure; this may result in a reduction in work capacity but may not pose serious health hazards, if the inadequacy can be totally compensated by reduction in activity. A child, subjected to such inadequacy, may also adapt by cutting down his activity but such curtailment in activity, even if it serves to achieve energy balance, will hamper the child's physical growth and development. (Parizkova, J: "Body Fat and Physical Fitness", The Hague. Martinus Nijhoff, 1977. Torun B, Schultz Y, Bradfield R, Viteri, Fe: *Proc. Tenth Int. Cong. Nutrition,* Kyoto (Japan), 1975).

In support of the hypothesis of adaptation', it has been suggested that enzymic mechanisms may be invoked to improve efficiency of energy utilisation in subjects on the proposed low-calorie diets. The contribution of enzymic mechanisms to adaptation to low-calorie intake, if any, must be relatively small in comparison to that of reduction in activity. The extent of contribution of enzymatic mechanism in the increased efficiency of energy utilisation needs to be yet established scientifically. Even if such enzymic mechanisms operate to any significant degree, their possible 'functional cost' should not be discounted. For instance, how would such individuals respond to stress situations — like exposure to cold or to conditions calling for physical endurance and stamina?

Adaptation

The 'new hypothesis' which proposes a substantial lowering of the limit of calorie adequacy, relies heavily for its justification on so-called 'adaptation'. Adaptation, in the current context, represents not a stage of normalcy but one of "strategic metabolic and functional retreat" in response to stress, a device which may help the victim to ward off the catastrophe of death but which unfortunately will not help him to 'live' a normal life of activity and productivity. Indeed a child which is 'marasmic' and is emaciated, is also 'adapted' to undernutrition unlike the child with 'kwashiorkor'. In the former case, unlike in the latter, the 'Wisdom of the Body' has operated to enable the child to discard and waste its muscles which are less important, for sheer survival, in order to protect the more important liver, pancreas and intestines.

The marasmic wasted child has a relatively normal function of the liver, pancreas and intestines, unlike the child with kwashiorkor in which these organs are damaged. Yet no physician would pronounce a marasmic child as functionally normal, and accept marasmus as a state of good health. The stunted children are, again, those who are so 'adapted' that their growth is limited to a size commensurate to their low calorie intakes and poor environment.

Is being 'small' this way 'beautiful'? And if so, to whom — certainly not to the parents of these children.

The assumption that these stunted children are perfectly healthy and functionally as effective and productive as children with normal growth and development, is a sweeping one.

If these limitations in the interpretation of the word 'adaptation' had been understood, the word would not have been used as loosely as it has been done in the debate. The new low levels proposed as the limits of calorie adequacy (mean requirement — 2 SD) may be a good prescription for a 'survival ration' which will permit mere existence. Those interested in building a strong vigorous nation, of healthy productive adults, and of active children who can run, play and bounce about, grow and develop into healthy adults, may however *not* be prepared to buy such a prescription.

If we understand aright, the operative thrust in the new hypothesis is not that we reduce the currently accepted figures for mean requirement of calories, but that we consider only such population groups with levels of intake below mean — 2 SD as proposed in the hypothesis to be undernourished and address our programmes only to this group leaving alone population groups subsisting on calorie intake between m and m—2 SD as *'adapted'*. This in effect is the policy of brinkmanship which we had earlier pointed out to be a dangerous and poor practical strategy of "repair and rehabilitation", after the damage has been done (Gopalan, C: *Bull. Nutr. Found. of India*, 1982 Oct: p 5).

Other nutrient deficiencies at m—2 SD levels: In subjects surviving on m—2 SD calorie levels, not only is their calorie adequacy in question, but they can almost certainly also be expected to suffer from other nutrient deficiencies as well.

Cereals

In poor Indian dietaries, there is a close positive correlation between calorie levels and protein levels because the major source of calories and proteins is the same food item, namely, cereals. In the controversy regarding pathogenesis of protein-calorie malnutrition (PCM), on the basis of recommended figures for protein requirement and calorie requirement, we had taken the position that if the habitual, predominantly cereal-based poor Indian dietaries are taken in quantities adequate to fulfil the calorie needs (as per the generally accepted mean requirement figures) then the protein needs will also be met.

It was on this ground that we had categorically asserted that the problem of PCM was primarily a problem of calorie deficiency and that it can be prevented and controlled through the use of inexpensive local diets in common use, and that there was no need for expensive protein-rich formulations, which, in any case, the poor can hardly afford. This view has now found wide acceptance all over the world and it is because of this situation that we can look forward to the eventual control of PCM even with our current dietary base.

Work output

However, if the hypothesis now proferred is accepted, the position would be different. Adult males in 'moderate activity' with a mean energy requirement of 2700 K Cal a day, when forced to subsist on 1900 K Cal (m—2 SD) may still manage to meet their protein requirement with the usual cereal-based diet, though their work output may suffer. On the other hand, among under-fives subsisting on 600 to 800 K Cal (m—2SD) daily, it was found that only 65 percent could meet their protein requirement (Swaminathan, M C: *Demographic and Socio-Economic Aspects of the Child in India, Bombay:* Himalaya Publishing House, 1979: 371-82). So the acceptance of this hypothesis will imply that predominantly cereal-based diets to which the poor are used may *not* meet the young child's protein needs, even when fed in quantities sufficient to meet the child's lower (newly proposed m—2 SD) levels of calorie 'requirement'.

Since in Indian dietaries, the food sources of calories and proteins are the same, reduction in calorie intake, as pointed out above, will have the effect of a corresponding reduction in protein intake. There is also the other equally important consideration of the 'protein-sparing' effect of calories. Within limits, a decrease in calorie intake could increase protein requirement. This has been recently shown by studies at National Institute both in adults (Rao, Nageswara *et al: Am. Jour. Clin. Nutr.,* 1975, 28. 1116. Iyengar, Ashok *et al: Brit. Jour. Nutr.,* 1975 41. 19.) and children (Iyengar, Ashok *et al: Brit. Jour. Nutr.,* 1979, 42. 417). Thus, reduced calorie intake in Indian dietaries will on the one hand involve reduced actual protein intake, and on the other hand, increased protein requirement.

It may be argued that with our current dietaries providing nearly 10 percent of calories from protein, the child may still be able to obtain his protein requirement even with the reduced calorie intake. This 10 percent estimate will be justified only if the diets include besides rice, significant amounts of pulses as well — a tall assumption indeed with regard to dietaries of the poor (and especially of those so poor as to be able to afford diets only at the newly proposed m—2 SD levels of calories), in the current context of prices of pulses. But even if this be true in some cases, this will be cutting things very fine indeed, and there will be no margin for the inevitable bouts of diarrhoeas and infections which serve to increase requirements. Also, this level of calorie intake will not provide energy for activity, an essential requirement for growth and development of a child. In fact when calorie intake becomes the limiting factor, even increasing protein intake may not be of much avail in promoting growth and development as evidenced in several field trials by the ineffectiveness of protein concentrates in promoting growth of children in the absence of a calorie supplement.

Iron deficiency

In view of the close correlation between calorie intake and iron intake in Indian dietaries, and the fact that even with calorie intakes at mean requirement levels, available iron is only marginally adequate, we may expect that subjects at m — 2 SD levels of calorie intake will invariably suffer from iron deficiency as well.

Thus it can be concluded that in subjects subsisting on m—2 SD levels of calorie intake: (a) calorie intake will not be adequate for a healthy, active, productive life, (b) protein intake could be deficient or dangerously low, and (c) iron intake will certainly be deficient. Further, it is also likely that subjects so poor that they can only afford m—2 SD rations may not afford vegetables and other sources of carotene either. Because of these multiple possibilities we may safely conclude that subjects on m—2 SD levels of calorie intake will be undernourished, and that in fact they will be suffering from multiple nutritional deficiencies. On the other hand, subjects on calorie intakes at mean requirement levels will not only obtain calories adequate for normal activity and productivity but will also have far less chances of suffering from other nutrient deficiencies.

Concluding Comments: In view of the considerations discussed above,

we consider that (a) in the assessment of adequacy of calorie intakes in a community, it will be justifiable and prudent for us to continue to use the recommended mean calorie requirement and not the m — 2 SD as the yardstick of calorie adequacy, and (b) it will be prudent not to place sole reliance on calorie intake figures for measurement of undernutrition but to continue to use the approaches hitherto in vogue for the assessment of nutritional status of individuals and population groups — namely, a combination of diet surveys, anthropometric measurements, clinical assessments, socio-economic and environmental status assessments and selective biochemical estimations — especially estimations of haemoglobin levels. There is indeed a need for developing a composite yardstick for the estimation of undernutrition taking all these factors into consideration. In advancing the hypothesis, emphasis is being often laid on control of infections and safe water supply, implying that those who do not accept the hypothesis deny the importance of these steps for the elimination of undernutrition. It is nobody's case that the problem of undernutrition among our poor should be tackled only, or even largely, through providing more food and through supplementary feeding programmes. Everyone recognises that factors inhibiting the absorption, assimilation and metabolic utilisation of food, and those increasing nutrient requirement must be simultaneously tackled, especially in a poverty situation where food is scarce and where every effort must be effective. In fact, even the mean requirement level will be valid as a yardstick only if leaks caused by infection are plugged.

The authors of the hypothesis have been careful to point out in their latest publication that what they are proposing is just a *hypothesis and not a proven theory* (Sukhatme, P V, Margen, S: *A Jour. Clin. Nutr.,* 1982, 35. 355). We quote: "Obviously this (hypothesis) will need further testing in human metabolic experiments on energy and N balance. The implications of the hypothesis are so enormous for formulation of nutritional policy that experiments designed to test it must be carried out under strictly controlled but differing ecological conditions." This was a perfectly scientific position to take; a hypothesis as yet unproven, according to the authors' own admission, cannot obviously be presented as a basis for national policy.

Even according to the hypothesis, which in our opinion grossly underestimates undernutrition in the country, the total number of undernourished subjects in the country would exceed 150 million, most of them being children. There can be no doubt, even on this score, that undernutrition is a massive problem. The debate should not, unfortunately, obscure the central fact that undernutrition in the country, by whatever reckoning, is a massive, pervasive problem.

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Food Production and Consumption Trends

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In most discussions of our food situation, major attention has been focused on overall food production and food availability at the national level. In a vast country, beset with formidable hurdles in the way of equitable distribution of food between different regions, between different income groups within regions and different members within a given family, such overall figures may provide a misleading picture of the actual situation. This paper is an attempt to briefly highlight some major differences between and within different regions of the country.

The Overall Situation: While our population growth continues to be high, our food production has not always kept pace with it, at times causing considerable anxiety due to failure of monsoons. In the period 1961-81, while the population increased at the rate of 2.82 percent per annum, food production, no doubt, increased at the rate of 3.04 percent per annum; but there was considerable instability in food production. For example, production of foodgrains dipped from 121 million tonnes in 1975-76 to 111.2 million in 1976-77 and again increased to 126.4 million tonnes in 1976-77.

In the period 1961-81, the *net* per capita availability of foodgrains declined from about 469 gms to 460 gms and (even more unfortunately from the nutritional point of view) that of pulses from 69 gms to 39 gms. However, what should cause concern is the fact that the performance with regard to food production has been very uneven in different parts of the country, the seemingly satisfactory overall growth rate is mainly due to the striking increase in food production in the Punjab — Haryana belt.

The Regional Picture: We give below changes in per capita output of foodgrains in different states (from production within the states).

It will be seen that the situation has

Table No. 1 : Changes in Per Capita Output (From Internal Production) of Foodgrains (in tonnes)

STATES	1961	1971	1981
Andhra Pradesh	0.17	0.16	0.19
Bihar	0.16	0.14	0.15
Haryana	—	0.47	0.47
Kerala	0.07	0.06	0.05
Madhya Pradesh	0.30	0.26	0.23
Maharashtra	0.19	0.11	0.16
Orissa	0.23	0.23	0.23
Punjab	0.31	0.52	0.72
Rajasthan	0.22	0.34	0.19
Tamilnadu	0.16	0.17	0.11
Uttar Pradesh	0.20	0.22	0.23
West Bengal	0.17	0.17	0.23
All India	0.18	0.20	0.19

deteriorated in Madhya Pradesh, Maharashtra, Rajasthan, Tamilnadu and Kerala with the last two states showing the lowest per capita output of the states which have shown increase in per capita output. Punjab's progress is spectacular with Haryana taking the second position.

For states with low per capita output (Bihar, Kerala, Maharashtra and Tamilnadu), the problem is not only one of low output but also one of low purchasing power of the peasant population. In states such as Orissa, (eastern) Uttar Pradesh and Rajasthan, the problem is often one of failure of crops due to failure of monsoons.

Thus the "green revolution" appears to have virtually by-passed vast areas of the country; and the 'revolution' has been largely confined to just two food items— wheat and rice.

The present trends in per capita availability are not likely to change in a positive direction, unless there are some new major innovative initiatives. There are three reasons for this assessment. Firstly, wheat yields in the Punjab, Haryana and (western) Uttar Pradesh have reached a plateau. All-India wheat yield which increased from 738 kg per hectare in the period 1956-61, to 1272 kg in 1969-74, remained around 1400 kg in the period 1975-80. Similarly, rice yield which increased from 817 kg in 1956-61 to 1112 kg in 1969-74 did not show any significant increase later on. Secondly, in the case of coarse grains there has been no breakthrough in productivity. Thirdly vast areas of the country lie outside the "green revolution belt", partly because most of these are unirrigated areas and partly because of the prevailing land tenure system. Indeed it is only through a breakthrough, in these hitherto relatively "dormant" areas of the country, that we can hope to achieve national self-sufficiency in food, in the decades ahead.

Inter-State Variations in Consumer Expenditure: We have analysed the consumer expenditure data obtained in the National Sample Consumer Expenditure Survey for rural areas in 1966-67 and 1973-74. In order to ensure comparability of data in the two periods we have 'deflated' the 1973-74 data with the help of the All India Consumer Price Index numbers (general index). In the tables presented we have deflated the state data also with the help of the All India Consumer Price Index. Before using the All India Index numbers for states we prepared an alternative set of data by using the state index numbers as the base. This was done by dividing the index numbers corresponding to the old base of each state by the index numbers of the new base year and multiplying by 100. When we compared the results given by both the methods we found that they gave broadly the same trends. In view of this we preferred using the same All India Consumer Price Index as the deflator for the states also so that the state figures become comparable. Thus 1973-74 consumer expenditure has been deflated with the help of the 1966-67 consumer price. Our analysis is based on five consumer expenditure items (cereals, pulses, milk, sugar, edible oil). These items may not reflect the Kerala situation completely as Kerala is dependent on sea food to a large extent and non-vege-

Table No. 2 : Classification of States on the basis of level of consumption (All Expenditure Classes— 1973-74)

Commodity	States with low consumption level	States with moderate consumption level	States with reasonably higher consumption
Cereals	Punjab, Kerala, Haryana, J & K, Maharashtra, Gujarat, A.P., U.P.	H.P., Rajasthan, M.P., Karnataka, West Bengal, Assam.	Tamilnadu, Bihar
Pulses	Kerala, Orissa, West Bengal, A.P., Assam.	U.P., Bihar, Gujarat, M.P., Punjab, Maharashtra, Karnataka, Tamilnadu, J & K, Rajasthan, Haryana.	H.P.
Sugar	Orissa, A.P., Tamilnadu, Bihar, West Bengal, Assam, J & K, Kerala.	Maharashtra, U.P., M.P., Karnataka.	Punjab, Haryana, Gujarat, Rajasthan, H.P.
Edible Oil	Haryana, Kerala, Orissa, West Bengal, Tamilnadu, Bihar, M.P., A.P., Assam.	Maharashtra, Rajasthan, U.P.	Gujarat, J & K, H.P., Punjab.
Milk	Orissa, Tamilnadu, West Bengal, Karnataka, Assam, Kerala, A.P., Maharashtra, Bihar, Karnataka.	U.P., M.P.	Haryana, Punjab, Rajasthan, H.P., Gujarat and J & K.
All Commodities	Orissa, Tamilnadu, West Bengal.	Bihar, Kerala, Punjab, Karnataka, Maharashtra, Assam, J & K, U.P., M.P., A.P.	Punjab, Haryana, H.P., Rajasthan.

tarianism is strong.

We do recognise that there are limitations to the comparability of the data obtained in the two surveys, arising from increase in the list of consumer items in the latter survey and differences in the weightage accorded to the different consumer items in the two surveys.

Subject to these limitations, on the basis of the level of consumption of various commodities (measured in terms of consumer expenditure) the states can be classified as mentioned below:

An analysis of consumer expenditure data shows that Orissa, Tamilnadu, West Bengal, Assam and Kerala are the states where levels of consumption are low. The position in Bihar is also not satisfactory. As compared to other states the levels of consumption are high in Punjab, Haryana, H.P., and Rajasthan which are located in the North Western part of India. As compared to 1966-67 Rajasthan has improved its position considerably.

Profile of deprivation

A commentary on the growing enormity of deprivation of the poor, is the observation of Horowitz and Madhu Kishwar ("Family life — the unequal deal", *Manushi* Nov. 11, 1982 pp 7) that even agricultural labourer-families even in the Punjab (which has benefitted from the green revolution) buy their rations not monthly or weekly but before every meal, as they do not have resources to buy even one week's rations in advance.

Table No. 3: Average Age, Height and daily Calorie intake of Jat Land Holders and Harijan Agricultural Labourers

	Mean Age		Height Cms		Weight Kgs.		Calories per day	
	M	F	M	F	M	F	M	F
Jat land owners	41.5	36.5	172.0	159.0	62.3	52.5	3.102	2.165
Harijan agricultural labourers	38.8	37.9	167.8	158.1	52.4	45.9	3.122	2.173

Effect on Body Size: The extent to which variations in food consumption standards have influenced physical growth can be seen from a study conducted by Horowitz and Madhu Kishwar in a Punjab village (loc. cit p 9). These authors studied samples of adult Jat land owners and Harijan agricultural labourers in the same village and their results are indicated in table 3 above.

The results may be summarised as follows:

- Jat women land owners weigh as much as male Harijan agricultural labourers.
- Though Jat women weighed nearly 6 kgs more then Harijan agricultural women labourers, their heights were only marginally greater.
- Jat male land owners weigh approximately 10 kgs more than Harijan agricultural male labourers.
- Though Harijan agricultural labourers expend greater energy than the Jat land lords, because of hard manual labour, their calorie intakes are similar to those of the Jat land-owners.
- The study confirmed the impression that in most Indian families, women eat the least and the last.
- During periods of heavy field labour (besides domestic work) Harijan women labourers work for 15 hours a day, and yet their average calorie consuption in less than two thirds of that of the men in the family.

Further studies to elucidate the inter-regional, intra-regional and intra-familial factors that underlie inadequate food consumption are necessary for a better understanding of the profile of undernutrition in the country.

The author, H. Lakshminarayan, is the Director, Agricultural Economics Research Centre, at the University of Delhi. This is an abridged version of a paper, by the author, on poverty, food and nutrition, to be published later.

NUTRITION NEWS

Nutrition Society of India — Annual Meeting: Dates: October 7 to 8 1983.

Venue: Viswa Yuva Kendra, New Delhi : *Programme :* Symposia 1. Infant Feeding — Beyond the Codes 2. New Thrusts on the Food Front. 3. Review of Current Major National Nutrition Programmes. Free papers session.

Prof. M.S. Gore : We congratulate Prof. M.S. Gore on his well-deserved appointment as Vice-Chancellor, Bombay University. Prof. Gore, former Director, Tata Institute of Social Sciences, Bombay, is the Chairman of the Nutrition Foundation's task force on infant feeding practices.

REVIEWS AND COMMENTS

The Rich and the Poor

In the context of the ongoing debate on the world food crisis, the following quotation may interest readers:

"...I think we're putting blinders on if we put all the (blame for the current world food crisis) on the Third and Fourth World countries. I would like to explore the notion that the world food crisis is perhaps partly the fault of the affluent countries. Look, for example at the selling policies of the United States: Kissinger was willing to sell 1.2 million bushels of wheat to the Russians, while limiting India (which wanted to buy an equal amount) to only 500,000 bushels. Consider also California farmers drowning chickens and farmers in the Midwest shooting 100,000 calves. Per capita grain consumption in the United States is 1900 lb per annum, most of it in the form of beef; India, on the other hand, consumes only 400 lb per capita.

At present, we are sending only one-sixth the amount of food abroad as we did ten years ago. Of the billion dollars spent on food aid by the United States, over 70 percent went to our allies and satellites (such as Korea, Indonesia, Syria and Vietnam). Over half of our agricultural lands are being used to produce stock feed. Cattle in the United States are fed twice as much grain per annum as all of India consumes. We use three million tons of fertiliser a year for lawns and golf courses, which is more than India uses to grow crops. We spend four

times as much money to pay U.S. farmers to keep 20 percent of the agricultural land out of production as we do in food aid for the rest of the world. Clearly, then, supply is not the sum total of the food problem — there is also a problem of distribution through the world.

I think the United States is using food as a weapon, and it seems to be no accident that the ultimate control of food has now been transferred to the National Security Council. I think we could also look at protein imperialism. In the United States, for example, we import large quantities of fish meal from Peru which we then feed to livestock. The blame, of course, does not rest entirely with the United States; the Netherlands imports most of the peanuts from Africa to feed its livestock.

To put all of our attention on increasing the food supply in the Third and Fourth Worlds is, in a sense, to ignore the consequences of colonial and neocolonial history. There are sobering facts to recall, such as the fact that food aid increases to those countries in 1975 were completely wiped out by increases in the price of oil....."

Margaret Mackenzie: Progress in Human Nutrition, Avi Publishing Co. 1978 p. 282-283.

We applaud the scientific integrity, objectivity and moral courage of enlightened American scientists who do not hesitate to speak out critically against the policies of their own Government, when they consider them wrong.

Indian scientists, exhibiting similar moral courage, should turn the searchlight inwards (instead of blaming our ills on others), and expose the current glaring incongruities in our own National Food and Development policies. We are confident that our Government would welcome such genuine, scientifically-based criticisms.

Bitter "Success" in Sugar

In an earlier issue (Gopalan C.: *Bull. Nutr. Found. India,* Jan. 1983, pp 6,7), we had warned against the creeping aberrations in our pattern of food production, not in consonance with national nutrition interests and needs. We had referred to the large-scale displacement of coarse grains (the poor man's food) by soyabean (meant for export of cattle fodder to EEC) in Madhya Pradesh (Achaya K.T.:*Bull. Nutr. Found,* Jan. 1983, p 8).

In this context, the following quotation from an article by Karan Sawhny in *The Statesman* of May 28, 1983, may be interesting :

"The irrelevance of the existing food policy frame is highlighted by the mismanagement of sugar whose output increased after one very lean and two lean years to a record level in 1981-82. However, in 1982-83 when the area under cane ought to have been reduced, U.P. and Bihar increased procurement prices to satisfy politically powerful interests. This further increased land under sugarcane. The supply glut has bankrupted most mills and is likely to cause extreme hardship to many growers. It is ironic that it is in the name of growers that these artificially high procurement prices were imposed, for it is inevitable that prices will crash in the face of the glut turned sugar mountain.

The average yield of potatoes is 13 tons per hectare (the highest is 45). The cultivated area under potatoes is 7.7 lakh hectares, about a quarter of the acreage under sugarcane and only half of one percent of the net cropped area.

The area under sugarcane increased by about six lakh hectares between 1980-81 and 1981-82 mainly in U.P. and Bihar on land more or less ideal for potatoes. It requires simple arithmetic to see that eight million tons of potatoes more could be produced on the six lakh acres now under sugarcane. In the absence of a potato lobby as strong as the sugar lobby, the Union and State Government will themselves have to shift relative procurement and support prices betbeen these two products.

Potato cultivation is labour intensive and not only produces many more calories per unit of land than most other crops but also absorbs much more labour per unit of land. Sugarcane cultivation requires much less labour and the increased acreage under it reflects irrational agricultural pricing as well as preference for more leisure than more work."

Perhaps even more disturbing is the following news item, (*PTI,* June 8):

"Advance to sugar industry due to a production glut in 1982-83 claimed the highest amount of Rs. 824.93 crore in the first nine months of the functioning of the National Bank for Agricultural and Rural Development till March 31."

This press report provides the alarming indication that an institution ostensibly set up for "agricultural and rural development" actually provided (perhaps unwittingly) incentives to tilt the pattern of agricultural production in a manner not in consonance with nutritional needs and interests.

All this would make us wonder whether we have a coherent National Food Policy at all. What we urgently need is a National Food Policy which is "consumption and nutrition oriented" and is "national need-based". We earnestly hope that the committee of eminent economists recently set up by the Prime Minister will take a close look at the incongruities in the national food scene, and arrest the present drift. It will be unfortunate if we continue to allow our food production to be distorted by greedy vested interests, to the detriment of our real national needs and interests.

FOUNDATION NEWS

Meetings of two Task Forces of the Foundation were held in New Delhi on July 2 to 3 under the Chairmanship of Dr. S.G. Srikantia. Dr. P.S. Sundar Rao, Dr. Vijay Kumar, Dr. C.S. Reddy, Dr. K.K. Kaul, Dr. S.N. Chaudhury, Mr. Prabhakar and Dr. C. Gopalan attended.

Scientific Reports: We are gratified at the response evoked by Scientific Report-1: "National Goitre Control Programme" in scientific and official circles. We appreciate the prompt action instituted by the Prime Minister and her secretariat, on the report. We understand that a high level inter-sectoral meeting was convened by the Health Secretary to review and intensify the programme. We hope that some concrete action will follow. Scientific Report - 2 "The Lathyrism Problem — Current Status and New Dimensions" is now in press.

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