A Review of
"Nutrition, Health and Agricultural Development"

by

Peter L. Pellett
for the Winrock Colloquium

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Nutrition, Health and Agricultural Development

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OVERVIEW

This paper starts from the premise that since nutrition is now recognized to be dependent on a whole range of economic variables, it would be desirable to incorporate nutritional objectives into general development projects. Whereas some view the interrelatedness of nutritional status and broader economic variables as reasons for abandoning the traditional methodology of nutrition specialists, with its narrow focus on measuring dietary intake and child growth against recognized standards, Pellett believes that such studies now actually have wider relevance because of what they can indicate about general agricultural development.

HIGHLIGHTS OF PAPER

The Extent and Causes of Malnutrition

Most of this paper is devoted to a review of the current state of our knowledge of the causes and prevalence of malnutrition in the Third World. Pellett discusses the various criteria by which people may be judged to be malnourished as well as providing estimates of the proportion of malnourished people in the developing world today. He also gives brief explanations of the major types of nutritional deficiencies, such as protein-energy malnutrition and hypovitaminosis A.

Pellett identifies five levels at which problems can arise that contribute to malnutrition. The first of these is the level of basic overall food availability, which is affected by national and international politico-economic conditions. The next determinant of nutritional status is family purchasing power, which is also dependent on many of the same factors as food availability, but on a more local level. The third level is that of food choice, which is a result of cultural and educational patterns. The question of food choice is also related to the distinct process of food distribution within the family. Both are highly influenced by culture and education. The last level identified by Pellett is that of individual health, since infection often prevents people from receiving the full benefit from the food they ingest.

Measuring the Extent of World Malnourishment

There are many inherent difficulties in deciding whether any given individual is malnourished or not. Pellett goes into some depth in describing the pros and cons of different indicators of nutritional status, such as weight-height, and age-weight ratios as well as the Basal Metabolic Rate (BMR) method. He points out the further methodological problems posed by the absence of any objective standards for minimum requirements of daily protein or caloric intake.

The Relationship Between Health and Agricultural Policies

The key (and most disappointing) part of this paper is its attempt to explore the interrelatedness of nutritional status and agricultural policies. However, instead of attempting to answer such fundamental and habitually unaddressed questions as what effects do higher crop prices have on the nutritional status of rural families, Pellett merely argues for the inclusion of nutrition components as desirable appendages to traditional agricultural and rural development projects.

According to Pellett, because of the broad pattern of correlations between nutritional status and other economic indicators, many rural projects would profit by giving greater attention to nutrition and health. Nutrition and health services provided through projects can have an especially large impact since many governments fail to provide rural areas with either of these services.

CONCLUSIONS

Pellett concludes his paper with a plea for a return to the "basic human needs" approach, which he believes is much more effective in alleviating poverty than the "trickle-down" policies which he says have characterized the approaches of the major donors for the past few years. He also makes the following specific recomendations:

- -Economists should collaborate with nutritionists to measure the true social cost of malnutrition.
- -Nutrition workers should regularly prepare "nutrition impact statements" for the government ministries involved in formulating economic policies.
- -Political authorities, both at the national and local levels, should pay more than lip service to equity goals.
- -Projects must become more aware of the impact that they have on children.

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INTRODUCTION

The view that malnutrition is caused by many interlinked social, political and social factors affecting food supply and health is now commonplace. This partially results from the fact that in science, heresy can become dogma within quite a short timespan. Until relatively recently, mainstream opinion in nutrition limited itself to nutrients and their utilization. The only answer that can now be given, if one is questioned as to what are the determinants of nutritional status, must be "almost everything". This answer is especially true because in practice nutritionists often use the term nutritional status to imply health or general well-being. A simple definition of nutritional status, as the condition of health as influenced by the utilization of nutrients, illustrates these close relationships. This definition itself can be seen as circular, since the utilization of nutrients, of nutrients is also influenced by health.

More recently the obvious basic links between nutrition and agricultural policy have become more formalized FAO 1982, Tripp 1982, Lunven and Sabry 1981, Miladi et al. 1983, Pinstrup-Andersen et al. 1984, Frankenberger 1985, Nygaard and Pellett 1988). Farming Systems Research is now widely applied to integrate agricultural development activities

(soil and irrigation improvements, new varieties and techniques) at the level of the small farmer. If nutrition information can be collected and analysed within this framework, then decisions can be made as to whether nutritional objectives can be effectively incorporated into development aims (Mokbel and Pellett 1987). Detailed dietary and nutrition surveys when available can supply important information for these purposes but frequently simpler, localized projects are more appropriate.

The involvement of health as a component of integrated development is a far from new concept. The phrase 'marriage of health and agriculture' dates from at least the 1930's. More recently Article I of the Declaration of Alma-Ata (WHO 1978) reaffirms that health -- "a state of complete physical mental and social well being and not merely the absence of disease and infirmity is a fundamental human right ..... but whose realization requires the action of many other social and economic sectors in addition to the health sector." The extension to other sectors is made much more explicit in article VII (WHO 1978) where the promotion of food supply and proper nutrition and development of the agriculture and food industry sectors are all identified as factors necessary for improved health. Primary Health Care (Mahler 1975) is thus now seen as a collaborating part of a multisectoral effort in agriculture education and community development. It therefore seems essential that agriculture

should also view its development activities as integrated with health; with extension workers cooperating closely with community health workers involved in primary health care.

The broadening of consideration as to what can determine nutritional status, from the original concentration on nutrients to the current inclusion of the basic political and socio-economic factors, has contributed to the present crisis of confidence seen by some in the nutrition community. The involvement of political issues into health and nutrition concerns is also not new (De Castro 1952) but has only recently come to the forefront since the issues of economic and political determinants of malnutrition managed to be simultaneously recognized and ignored for many decades. If nutritional status is, for example, determined by the terms of international trade or the prime interest rate, is there any relevance to the solution of the real problems of the world in measuring nutritional intake in dietary surveys or in comparing the growth of children to reference standards? The answer must still be "yes" but it is necessary to examine causation at both immediate and basic levels (Jonsson 1981) and also to accept that nutrition is one component only in the over-all aim of improving health in the process of development. Personally I view our recognition of these complex interrelationships not as weakness and a cause for despair but as a

source of strength and maturity. (Pellett 1987). Another important reason for monitoring child growth is for the evaluation of agricultural development.

MALNUTRITION AND ITS CAUSATION

The ability to assign credit or blame to a dietary in the development of malnutrition is thus much less direct than many assume. Nutritional status and health status overlap; adaptation to high or low intakes may occur; nutritional requirements, while based on scientific facts, depend on informed judgements and are subject to a wide range of individual variability; and finally estimates of nutrient intakes are only approximate except under controlled metabolic conditions which are hardly normal.

It is now increasingly recognized that malnutrition may be caused less by nutrient deficiency as such and more by many interrelated social, political and economic factors; the widespread prevalence of malnutrition is claimed by Maletnlema (1980) as a symptom of a very sick society. Because of this multifactorial causation, solutions must also be multifaceted, even if concepts such as the elimination of poverty and improvement of living standards are basic. Malnutrition affects the growth, development and survival of children, and the health, activity

and well-being of adults. Conventional solutions in the form of specific programs are usually inadequate to tackle problems, and their effects are transitory since they do not reach causes. Nutrition can be improved through upgrading the level of living -- particularly of real income, food availability and health services. Long term solutions are, therefore, mostly outside the traditional field but will be through economic and social development.

While the term malnutrition strictly should include overnutrition and some of the diseases of affluence, it is often used to mean only the condition resulting from a deficient intake of energy or of a particular nutrient. Four especially important and broad causes of malnutrition are; an insufficient supply of the foods necessary for a balanced diet, often due to poor agricultural production; an uneven distribution of the available food (both between and within families); a lack of knowledge about food, nutrition and health; and infectious diseases which are synergistic to malnutrition (Latham, 1979). These must be recognized as being, not separate and distinct causes, but groups of causes which overlap with each other.

Major Problems of Malnutrition

In Table 1, the characteristics of hunger and some of the major world nutritional problems are listed. This has been reviewed in detail elsewhere (Pellett 1986). Problems other than these, such as scurvy, rickets, beri-beri, and pellagra still exist but are generally less prevalent than the conditions tabulated. Of hunger, there is no doubt that the problem is widespread; conditions that could be described as hunger range from the gross manifestation of prolonged starvation to mild and apparently reversible growth failure. Estimates of prevalence thus can differ widely (Poleman 1981 ab). Recent FAO (1985) estimates vary between 335 and 494 million 'undernourished' depending on the criteria used. The basis behind world-wide estimates of malnutrition will be discussed in a later section.

The conditions of protein energy malnutrition and the factors causing low birth weight in babies overlap to a considerable degree with hunger, so much so that they may be indistinguishable. The majority of infants with low birth weight (<2500 g) in developing countries are those of normal gestational age. The frequency of birth of such infants can be several times greater than in developed countries (UNICEF 1988). Such children are more prone to infections and also lag in their subsequent development. Maternal dietary supplements can increase birth weight

(Lechtig et al., 1979). But in an environment where health care is often lacking, maternal mortality is high. Furthermore, the desire by mothers for small babies (and easier birth) should be recognized, since this can negate programs for nutrition intervention until health care facilities are improved.

The world prevalence of protein-energy malnutrition has been estimated from data of some large-scale surveys (Bengoa 1973; Bengoa & Donoso, 1974; Puffer & Serrano, 1973. Using the proportions estimated by Bengoa & Donoso (1974) but later population estimates, it is probable that some 100 million cases of protein-energy malnutrition currently exist in the developing regions. These numbers represent a minimum, since many children are reported to have died from infectious diseases where malnutrition was a likely underlying, or major, simultaneous cause.

Another nutritional problem of considerable significance is hypovitaminosis A, considered to be the most common cause of blindness in developing areas of the world (WHO, 1976; Underwood, 1978). Estimates (Sommer et al., 1982) from studies in rural Indonesia indicate an incidence of 2.7 per thousand for corneal xerophthalmia amongst preschool children. Half of these children probably develop bilateral blindness. Extrapolation of this rate to the preschool children of Bangladesh, India, Indonesia and the Philippines would indicate a frequency of 500,000 cases per year for corneal xerophthalmia with up to ten times as many with less

severe deficiency.

It seems likely that hypovitaminosis A, as a public health problem, will only be eliminated when the society has access to a diet sufficient in vitamin A and also in the other nutrients that affect vitamin A metabolism. This requires a more equitable distribution of the benefits of national development. Serious hypovitaminosis A occurs most frequently in countries where protein-energy malnutrition of children and generalized poverty are also major problems (Underwood, 1978). It will be observed that poverty and health determinants of malnutrition are more frequently stated throughout Table 1 than are causes due to the mere absence of nutrients.

Causation of Hunger and Malnutrition:

The causes of malnutrition in individuals or communities can be grouped into levels which are summarized in Table 2. These levels relate to money-based societies. For other societies similar levels would exist, but would overlap in a different manner. The levels of causation of malnutrition start with overall food availability. This is affected by international and national politico-economic activities as well as agricultural policies both within and external to the country. The next determinant is family purchasing power. This also is dependent on

political and economic factors, but at more local level. Thus, what food is purchased is determined by food availability as well as economic status and money availability. At the next level comes food choice. Within any economic group, the pattern of food purchases is dependent on cultural pattern and individual preferences as well as relative prices of the various foods. Nutrition education can work at this level by improving the degree of selection of nutrient-rich foods over nutrient poor sources costing the same. However, nutritional education is far less effective than we would wish (Schurch, 1983).

The next level below the family food purchasing pattern and which overlaps with it to some degree, is the pattern of food distribution within the family. This is also dependent on culture and is frequently a major cause of malnutrition in the vulnerable groups. The greater need for protein and micronutrients by women and children, despite lower food energy needs, i.e. a higher concentration of nutrients, is often a complicated notion to impart since nutritional education will frequently conflict with cultural norms. Finally, because of the now well-known interrelationships between malnutrition and infection, (Scrimshaw et al., 1968, Chen, 1983) consumed food may not be fully utilized. This last level of causation can then be termed food utilization. An individual suffering from infection (or infestation) may not only have a reduced food intake, but may also have poorer utilization for a range of nutrients.

Sanitary environment and clean water availability thus profoundly affect nutritional status and re-inforce the view that health considerations must be integrated with agricultural development.

EVALUATION OF NUTRITIONAL (HEALTH) STATUS

The evaluation of the nutritional status of populations comes from consideration of various levels of information. These can be separated into two major categories, the first pertaining to agriculture and food availability, the second pertaining to the health of the population. These are shown in Table 3. Agriculture and food production data have limitations, but they can indicate approximate availability of food supplies and nutrients to a population. Close examination of agricultural production data can also allow judgments on the success or failure of agricultural techniques. The next level of information concerning food derives from dietary surveys and food consumption patterns within the society and provide data upon socio-economic variables and the distribution of storage of foods. Dietary surveys are difficult to perform with accuracy, but can give the most detailed information on food and nutrient consumption at the family level. Conversion of food intake to nutrient intake is now performed rapidly using computers, but is still dependent on both judgement and accuracy of food-table data.

Once nutrient intake data are established, these must be compared with standards before decisions can be made concerning the nutritional value of the diet and thus the nutritional status of the consumer. In practice derivation of the appropriate requirement standards and comparison with intake values do not always allow clearcut conclusions concerning either a specific nutrient deficiency or the overall value of the dietary.

Protein requirement values have tended to vary considerably over the years. This unfortunately has seriously affected the credibility of nutritionists among the agricultural community. The perception grew that protein deficiency was the fundamental cause of most world malnutrition. Responses came *inter alia* from plant breeding programs in developing high protein and high lysine varieties of grains but by the time they were available protein and amino acids requirements had been reduced and thus the role of the new varieties was no longer of high priority. Additional reasons for the failures of these projects however included insufficient attention being given to the acceptability of the new grain varieties for making traditional foods such as tortilla and arepa.

The most recent FAO/WHO/UNU (1985) report on protein and energy requirements may well be continuing in the unfortunate tradition of proposing significant changes without awareness of their agricultural

development implications. Although published estimates of adult human amino acid requirements have not changed greatly over the years (NAS-NRC 1959, NAS-NRC 1974) the new committee was the first to use age-specific amino acid scoring patterns and thus to focus attention on the apparently extremely low values representing adult amino acid needs. In the previous international pattern (FAO/WHO 1973), although adult needs were considered and tabulated, the amino acid scoring pattern was in fact derived from consideration of only infant and young child needs. While the FAO/WHO/UNU (1985) report drew its conclusions from the best data available at the time the explicit tabulation of the low adult amino acid requirement values has policy implications for action which in the long term, could be extremely damaging to the nutritional health of many. The implications, which were apparently overlooked by the FAO/WHO/UNU (1985) committee, follow directly from the data as presented since it would appear that <u>any</u> diet even poor quality diets based on single cereal sources could provide indispensable amino acids well in excess (2 to 3 fold) of adult needs. Dietary and requirement data from FAO/WHO/UNU (1985) are shown in Table 4 together with the amino acid composition of wheat and some regional diets (Pellett and Young 1988a). It can be seen that not only can practical low cost and regional diets supply amino acids considerably in excess of the internationally recommended adult amino acid needs but that a single cereal staple such as wheat would also appear more than adequate. It is no wonder therefore that significant policy decisions could be made on the

basis of these amino acid requirement data which may affect priorities given to cereal development in International Agricultural Research Centers (IARC'S) and in emergency feeding programs.

It has been proposed by Pellett and Young (1988 abc) that the data presented by FAO/WHO/UNU (1985) of an adult scoring pattern for evaluation of foods and diets are not only seriously misleading but can now be challenged in their validity. Challenges can be made both on the grounds of potential errors in the interpretation of the original requirement values and also on the availability of new data (Young 1987, Young and Pellett 1987, Young, Bier and Pellett 1988). It was recommended that authoritative recommendations should be made by a new group under the auspices of U.N. agency. Such a group meeting is urgently required to discuss these issues and to produce a statement. A reassessment of diets (Pellett and Young abc) based on the new adult amino acid requirement estimates (Young, Bier and Pellett 1988) shown in the Table 4 leads to the recommendations that, for specific areas of the world eg Africa, the Near and Far East, dietary protein quality and quantity should remain an important consideration in the design and implementation of food, nutrition and agricultural programs and policies. In practice therefore the traditional view that a diet based heavily on cereals with little animal or legume protein is likely to be of poor nutritional value for both children and adults remains true. Such diets cannot be made acceptable by specifying low adult amino acid needs and it is recommended

that either a return to the FAO/WHO (1973) pattern or use of the young child pattern (FAO/WHO/UNU 1985) will more realistically assess the protein value of diets for adults.

WORLD ESTIMATES OF THE NUMBERS MALNOURISHED

The numbers of those estimated to be malnourished throughout the world are frequently derived from food balance sheet data. Depending on the assumptions made estimates can vary enormously (Poleman 1981 ab). It is thus no wonder that there is considerable confusion and skepticism concerning these estimates. In Table 5 data from Poleman (1981 ab) have been updated by including more recent estimates from the Fifth World Food Survey (FAO 1985). Many changes have occured over recent years as to how requirements of food energy and energy balance should be considered (Beaton 1983, FAO/WHO/UNU 1985) but in essence it is now realized that because of the interconnections between energy intake, energy expenditure and the energy content of body stores, individuals can adapt to smaller than desirable energy intakes. In addition it is now considered inappropriate to define requirements without bringing the question to a much more individual level by asking 'requirement for what'?

Adaptation as nutritional phenomenon has been recently re-examined in detail (Blaxter and Waterlow 1985). For all essential nutrients there is

a range of intakes within which physiological and biochemical mechanisms maintain long-term homeostasis without apparent adverse consequences. The actual limits of this range however remain controversial ie there is no firm agreement as to what variations can occur in dietary intakes of energy or of specific nutrients without causing pathological or behavioral changes. Adaptation has been defined as the process that permits the organism to respond to dietary change without adverse consequences (Waterlow 1985) but a successful adaptation does not require or imply that all body functions remain unaffected. Adaptation may require a selection among various body functions in order preserve those that are most important.

The word accomodation, has been introduced (Beaton 1985) to encompass both the biological and behavioral adjustments to changes in energy intake and utilization. The term has been used in the field or protein metabolism in a more restricted way to describe responses to dietary change that, while they favor survival of the individual, result simultaneously in significant losses in some important functions (Young et al. 1987). These may impair optimal adjustment to the individual's social, biological, or physical environment. Accomodation, therefore, is used to describe a response that is less than wholly successful even though the individual's survival has been ensured or at least prolonged. This concept is of fundamental relevance to any consideration of the numbers malnourished and of the quality of life that can be achieved under sub-optimal dietary and health conditions.

The theoretical basis behind the procedures used in assessing the number malnourished have been described in detail by FAO (1985) and draw upon the recent discussions involving balance, requirements and adaptation. A major change was made at the time of the fourth food survey (FAO 1977) in that an estimate of prevalence of malnutrition was considered to be Basal Metabolic Rate (BMR) x 1.2 rather than failure to meet a group mean food-energy requirement value.

The definition used for food energy requirement in the FAO/WHO/UNU (1985) report is "that level of energy intake which will balance energy expenditure when the individual has a body size and composition and level of physical activity consistent with long-term good health, and which will allow for the maintenance of economically necessary and socially desirable physical activity". This definition while conceptually very satisfactory, is hard to use for defining cut-off points in relation to undernutrition. In the Fifth World Food Survey (FAO 1985) therefore both 1.2 and 1.4 x BMR were used to estimate a level below which it was considered that individuals were constrained in their ability to work or enjoy leisure as a result of insufficient food. The new indicators are far more stringent than the older procedures as can be seen from Table 5 where the numbers defined as malnourished are generally below 20% of the popoulation of the poorer countries rather than in excess of 50% in the earlier estimates.

An additional set of factors involving health must also be considered; diseases increase dietary requirements by raising the body temperature and the rate of catabolic nutrient losses and in addition depress appetite, thus lowering food intakes. Diarrhoeas also reduce food absorption efficiency. Such interactions make it difficult to distinguish between undernutrition caused in the first place by food deprivation and that initiated by infection. Defined requirement values must assume optimum or at aleast favourable environmental and health conditions. Since these conditions are adverse in most developing countries, actual minimum requirements are likely to be higher than specified. Thus, the assessment of the extent of undernutrition is liable to exclude some of those who are undernourished primarily because of advese environmental and health factors (FAO 1985). Estimates of the number malnourished in the world based upon food availability data have nevertheless been reduced considerably over recent years at least in part related to the concept of adaptation.

This concept has also considerable relevance when indicators involving the growth of children are used to estimate malnutrition. Observations on the health of populations are also used to indicate nutritional status

although impairment of health can usually be directly ascribed to faulty nutrition only when corresponding food and nutrient intake data are available to correlate with the health data (Table 3). These data start at the regional or country level by using vital and health statistics which can identify the extent of risk to the community. At the individual level, nutritional assessment includes anthropometric, biochemical and clinical studies. Consideration of the results of such surveys can give information on the effects of nutrition on physical development, on the impairment of biochemical function and on the deviation from health due to malnutrition.

Poor apparent nutritional status, as measured by inadequate growth and development of children may however be more related to infectious disease, inadequate water supply and poor sanitation than directly to food availability and/or food selection. This is further complicated by a synergistic relationships between nutrition and health. Even the procedure used in anthropometric assessment will often allow varying conclusions to be drawn, (Table 6). Weight for age in children will give higher estimates for the prevalence of malnutrition than weight for height measurements. Children from poor environments may weigh less than well-nourished children of the same age but have, however, become adapted to the situation and may be apparently healthy. Are these children suffering from malnutrition or not? The answer is dependent on the

definition used. Smaller overall size but balanced weight for height, may therefore be a reflection of adaptation to a lower level of total food energy intake. The best indicator to use to evaluate agricultural or economic development thus remains controversial. My own view is that weight for age, while a less accurate indicator of nutritional status may be preferable for use in attempting to evaluate long-term progress involving both nutrition and health.

RELATIONSHIPS BETWEEN INDICATORS

Estimates of the incidence of undernutrition and malnutrition serve mainly to draw attention to the magnitude of the problem and to indicate changes that have occurred. In order to determine appropriate policies and measures for nutritional improvement, it is necessary to go much further and to identify more precisely who are the malnourished and why they are malnourished (FAO 1985). Food deprivation often results from inadequate control over food resources as well as over factors that govern overall health. These conditions, in turn, are affected by both environmental and politico-economic factors operating in a synergistic manner so that the ability to cope is diminished. As food deprivation becomes more intense it is the poor who must ultimately revert to the most irreversible responses, such as selling productive assets. Thus food deprivation not only exposes the poor to greater risk but frequently

transforms their potential to adjust to future encounters into an even more vulnerable state (Brooke-Thomas, Paine and Brenton 1988). The poorest people, such as the unemployed and landless, therefore suffer worst because of their lack of resources for obtaining an adequate diet. Within the poorest groups, the young children and pregnant and lactating women are the most vulnerable because of their higher nutritional requirements. Preschool children are the most seriously affected, and their risk of malnutrition is often increased by other factors such as large family size, high birth order, illiteracy of parents, single parentage, maternal age, short stature of the mother, low per capita land availability, and poor access to social services (Morley 1973, FAO 1985).

The Fifth World Food Survey (FAO 1985) thus emphasizes that the causes of malnutrition are multidimensional and include both food and non-food factors. These factors combine to form a "web of biological socio-economic cultural, and environmental deprivations leading to malnutrition." As wealth increases not only is more food consumed but also there are major changes in the pattern of the foods selected. These changes were tabulated in a classic report by Perissé, Sizaret and François in 1969 (using Food Balance Sheet data) where they demonstrated that the proportion of dietary energy intake from fats fell steeply as income (GNP) declined while that from total carbohydrates increased. Simultaneously proportion of the total protein intake from animal sources

decreased with a fall in income. In Table 7 some health, wealth, and dietary data from 130 countries are summarized. Amongst the broad relationships in will be seen that as wealth (indicated by GNP) increases both the infant mortality rate and the under five mortality rate decline, as also does the prevalence of births of low birth weight infants. At the same time both percentages of births attended by health personnel and access to a clean water supply both increase. The dietary changes that accompany these health changes are increases in the dietary energy (Kcal) availability in relation to requirement, in total protein per day, animal protein per day, the percentage of animal protein in relation to total protein and in the total fat and retinol (vitamin A) intakes.

A further elaboration of these relationships is shown in Table 8 where a cross-country correlation matrix between selected health, economic and dietary data is presented. These results are derived from consideration of data from the same 130 countries. As per caput GNP increases, child and infant mortality rates decline, the percentage of low birth weight infants also declines and life expectancy increases. The dietary changes that correlate with increases in economic status are significant increases in availability of total dietary energy, protein, animal protein and fat. Since all of these variables are highly correlated with wealth there are also significant correlations between infant and child mortality rates with protein, animal protein and fat consumption. These dietary factors

are also significantly correlated with life expectancy since the largest component weighting life expectancy values is infant mortality. However, such significant statistical relationships between dietary factors and measures of the health of a population must not be considered causal since all have direct or indirect relationships with indicators representing poverty.

Further relationships between health, economic status and dietary data with the percentages in the population of children under five years of age (Pellett 1987) emphasize the fundamental importance of population growth as a determinant of nutritional status. The broad correlations that occur between the wide range of indicators used gives general credence to the view that even though the values are collected by different agencies for different purposes they do reflect basic truths concerning development progress. Skeptics however might reply that the general agreement between indicators merely indicate that that the data are, if we did but know the truth, merely plucked from the air on the basis of general impressions. My own native optimum makes me reject this skeptical view and leads me to believe that our various indicators do approximate reality and in fact demonstrate considerable success in our ability to be able to evaluate progress.

THE NEED FOR INTEGRATED HEALTH AND AGRICULTURAL POLICIES

Broad food based national indicators (eg FAO 1985) allow us to conclude that there has been a turn in the tide. Accelerating growth in per capita food supplies in the developing market economics has reduced the proportion of the population suffering from undernutrition. Nevertheless although the proportion is reduced, as a result of population growth, the absolute numbers of these undernourished has increased. Recognition is now much more widespread that policies can no longer be limited to one sector at a time. As stated by FAO (1985) "policies to attack malnutrition should be multidimensional. Accelerated agricultural and economic development and more equitable income distribution will provide the only long-term solution. But much more needs to be done for those who for a long time will be bypassed by general growth and development. Appropriate nutrition intervention programmes, targeted as closely as possible on the most deprived rural households, should be mounted on a large scale. Because of the complex interactions between malnutrition and infectious diseases, programmes for providing primary health care, sanitation and safe drinking water should go hand in hand with nutrition intervention programmes. Because of the many roles that women play in the food system of developing countries - not only as mothers but also as farmers, labourers, traders and teachers - the status

of women should be raised and their education improved. This would have a telling influence on nutritional improvement."

The World Bank (Reutlinger and Selowsky 1976, Berg 1987) has also emphasized this multidimensional approach. The Bank has been involved in projects concerned with nutrition since the mid 1970's. Questions were raised at the time concerning the appropriateness of such a role for the Bank. Was malnutrition a development problem and, therefore, one the Bank should address? If so, were there feasible things that could be done about it particularly things that the Bank was suited to do? The answer to the first question was considered positive. Malnutrition was recognized to be wide-spread and the effectiveness of nutrition measures in reducing the number of deaths and decreasing the side effects of malnutrition was considered reasonably well established. This was then regarded as sufficient justification for investment in better nutrition. The answer to the second question was, however, less clear-cut. It was agreed that while there was little doubt that nutrition could be improved through increases in the per capita income of the poor yet for most countries such change was likely to be painfully slow. Later research indeed showed that in many places per capita income was not likely to increase enough within a generation to solve the problems of the currently malnourished (Berg 1987).

Malnutrition has traditionally been viewed as a problem related to food availability and, therefore, able to be answered by increased production. It has become much more accepted over the last decade that increased production should not be the only goal but greater emphasis should be given to improve distribution so as to involve those most deprived. More than half of those in need in most countries are families of landless agricultural laborers, farmers with land holdings too small to be reached by rural development programs, small scale fishermen, and unemployed urban workers (Berg 1987). In addition malnutrition continues to be widespread in many countries that are now considered to be self-sufficient in food grains (eg. India) and also those which have shown considerable economic development such as Brazil. Although it is acknowledged that malnutrition is closely linked to basic economic development, Berg (1987) strongly advocates the concept that improvements in nutrition need not wait the achievement of high economic growth. Improvements can come in particular from careful targeting of food subsidies, from food supplementation programs and from nutrition education to those groups most at risk, especially poor women and children. This closely echoes, the advice proposed by FAO (1985).

The involvement of nutrition as a components of other activities is now a well-known aspect of development projects. Such nutrition components have been implemented by United Nations agencies (FAO and WHO) as well as some of the International Agricultural Research Centers (IARC's) and the Agency for International Development (AID). The problems with these components as found in World Bank projects (Berg 1987) parallel those found by other agencies. My own experience fully supports these conclusions. When projects are add-ons they are generally small in size and therefore receive little attention both from National governments and from the implementing agency staff. Berg (1987) considers quite correctly, that this problem also reflects the fact that nutrition as a discipline cuts across sectors and thus 'nutrition' as he puts it "can slip through the organizational cracks". One recent AID funded activity in Sierre Leone - The Adaptive Crop Research and Extension (ACRE) project which included an 'add-on' nutrition component was broadly successful both in involving women and in alleviating some of the hardships of the hungry season by the introduction of improved varieties of sweet potatoes. With hindsight some provision of medical services by the female nutrition extension workers could have improved their rapport with mothers and women farmers. No health services were apparently provided in the region by the Ministry of Health and while ACRE and the Ministry of Agriculture could go as far as giving health advice and using oral rehydration (ORT) they were unable to provide medical treatment, medicines and drugs. A good case

could be made in such circumstances for integration between agricultural extension and primary health care in any successor activity to the ACRE project. No successor project was however funded and the relative success of ACRE appears to have been celebrated by AID by its complete withdrawal from Sierre Leone!

Decision making for nutrition programs is now being undertaken in an environment that has changed markedly over the last decade. Both conservative politics in several major donor countries combined with a much more difficult international economic environment have reduced the ability to address basic human needs. Possibly as a consequence, it was been found from an analysis of data from thirty countries during the first during the first half of the 1980's that all but three experienced declines in per capita dietary energy supply accompanied by an increased infant mortality (Berg 1987). A somewhat earlier analysis (FAO 1985) was much more optimistic and showed only 26 from the 112 countries and territorities examined where per capita dietary energy supply declined between 1970 and 1980. It is possible to be optimistic also that progress has occurred world-wide when recent UNICEF (1988) health data are examined. Under five year mortality rates in the 33 countries with the highest rates worldwide have declined from median values of 308 per 1000 live births in 1960 to 211 in 1986. For the 31 countries in the next highest group, median values declined even more significantly over the same period from 251 to 135 per thousand. Parallel improvements were also reported in adult literacy and primary school enrollment rates.

CONCLUSIONS

The numbers estimated as malnourished in the world are now based on far more stringent criteria than in the past (BMR x 1.2 or 1.4 and often wt/ht rather than wt age). While the validity of all estimates can be criticized it is now believed that they are not as much in error as the earlier surveys. "In a significant way however the conclusions of each have been identical to those of the first survey .... there is much starvation and malnutrition in the world" FAO (1985). In addition the diets that are consumed by the disadvantaged are heavily based on cereals and thus monotonous and generally poorer in nutritional quality (Perisse et al. 1969, Pellett and Young 1988 a). The distribution of diets within countries is also likely to show a skew distribution (Scrimshaw and Lockwood 1980, Mellor and Gavian 1987) with the lowest strata receiving diets significantly poorer in both quality and quantity than the perhaps already marginal country mean values.

Not withstanding these problems it however now seems evident that while there has been world wide progression in improving per capita food availability (FAO 1985), reducing child mortality and improving opportunities for women (UNICEF 1988) there are still many, not only in the very poorest countries, who are by-passed by the fruits of development. To reach these there is the need for political commitment at

the highest level as well as some new ideas. Nutrition projects have not always been fully successful, food subsidies have been abused and have had adverse effects and in addition economic adjustment issues have often removed nutrition activities from the agenda. Nevertheless there is now increasing recognition that in economic development "trickle-down" does not always reach the lowest layers. Conversely, however, economic crises and subsequent austerity programs can have severe adverse effects on the very poor. Some targeted nutrition programs such as the Tamil Nadu Integrated Nutrition Project (TINP) can claim considerable success (Berg 1987). According to the monitoring data for the 9000 villages in the program, 17 to 24% of the children weighed less than 70% median weight/age (Indian standards) at the beginning of the project. By early 1987 only between 7 and 10% were below that level. This represent a decline of about 58%. Berg (1987) claims, from these and other data from the project, that a well-managed and targeted program is able to reduce serious and severe malnutrition more than a less-focused program and at a significantly lower cost.

The need for greater integration of agriculture and health policies now appears to be a widely accepted concept. The background document on Intersectoral Action for Health (WHO 1986) goes further and contains much important information relevant to implementation. In addition a recent statement following a UNU workshop on the impact of agricultural and food

supply policies on nutrition and health status (Wallerstein 1986) concluded that "the international nutrition community, both life scientists and social scientists, needs to devote more adequate attention to developing or identifying real linkages with agricultural and food policies that can have a positive impact on the circumstances of poor people." It was however acknowledged that the decision-making arena for nutrition and health issues is very different from that for agriculture and food policy. Officials from the two areas approach problems, or policy-making, from very different viewpoints. Recommendation for linkages have not always taken this into account. More recently almost a complete issue of the FAO publication Food and Nutrition (FAO 1987) was devoted to consideration of health, agriculture and rural development. Here again political commitment was emphasized and a series of detailed recommendations were tabulated to enhance interaction among the health, nutrition, agriculture and rural development sectors. Since the author (Atienza-Salvana 1987) is the Director of the National Nutrition Council, Ministry of Agriculture and Food in the Philippines, at least one developing country appears to explicitly support these interactions at a high political level.

My own experience from viewing a number of agriculture and health projects in the Middle East and Africa is that so far close cooperation across the whole spectrum of health, agriculture and rural development is very rare mainly because of the vertical structure derived from separate

Ministries. As one examines the situation at the village level however the type of activities undertaken by community health workers, and nutrition--agricultural extension agents can have a considerable degree of overlap and could become the focus for shared community development activities. It is important that such workers should all be local people selected for training and supported by their communities. No suggestion is made that a single person should be responsible for both health and agricultural roles except perhaps in nomadic populations where agricultural extension may center on animal health and the same person could also be responsible for Primary Health Care. In this area in Somalia there is already some cooperation between the separate Ministries of Health and Livestock. In many countries shared cold - chain facilities for both human and vetinary use could be very cost-effective and the beginning of other cooperative activities. No attempt should be made to assign rigid priorities; whichever activity arrives first in a community (health or agriculture) successive activities should then begin to develop cross-sectoral cooperation. In such a way concepts of horizonal community based cooperative activities may become functional without the traditional ministerial barriers. Such cooperation will not be easy -- the mechanisms outlined by Atienza-Salvana (1987) are reasonable and could well be applied to other areas of the world since they are based on political experience and are of sufficiently broad focus. From my own experience the following suggestions may also be relevant to both implementation and evaluation of projects concerned with improvement of health of the disadvantaged.

* In cooperation with economists, activities should be extended in attempting to quantify the true social costs of malnutrition. In the competition for scarce resources those with the power to allocate priorities should be informed of the future costs to society of continued poor health and malnutrition especially in children.

* Within the ministerial heirachy, especially planning and finance, it would be helpful if qualified health - nutrition personnel could be in a position to prepare 'nutrition impact statements' so that Ministers could be informed of the potential effects on the health and nutrition of the population of the various fiscal and planning actions that they might take.

* Commitment, support and continuity are essential at the highest political level. Lip service is not enough, those in power must truly believe that health of the very poor is important enough for policies to be directed to its improvement. They must further believe that this will not happen automatically by the 'magic of the marketplace' within a sufficiently short time-span to be relevant for those in need.

* Leadership and commitment are also essential at the local level. Programs of equal merit will thrive or fail dependent on local leadership.

* No single grand agriculture- nutrition - health plan can ever exist. All plans must be tailored to local needs and priorities again emphasizing the essential nature of local leadership and community involvement.

* The bottom line of any development project lies in the removal of impairments to the growth of children. Improvements in production - economic indicators while important are often irrelevant to the most disadvantaged. Growth of children (even the much abused weight for age) is a composite indicator which will only change significantly when both nutrition and health are simultaneously satisfactory.

Finally to move from the local and national levels to the international arena, the problems of food aid and the well-being of children in the developing world were examined in a recent UNICEF - WFP workshop (UNICEF-WFP 1986). The inconsistency between food aid and the long run objectives of self-reliance in food and nutrition were recognized. "This basic inconsistency is at the heart of the well known problems associated with food aid -- problems of lack of incentives to local agriculture, of taste changes away from local products, and of weak (often negligible)

positive effects on nutritional levels, because a target group is rarely covered consistently over a sufficient period of time to raise nutritional levels." In consequence the question was asked whether the basic inconsistency could be circumvented and ways devised of using food aid so that it meets short-run needs, while supporting and not undermining the achievement of long-run goals of self-reliance at the level of the household and of the nation. (UNICEF-WFP 1986). It was generally agreed that, providing the problem was recognised, a balance could be acheived.

For long term development even more fundamental issues of international cooperation (or its lack) must be considered. While the 'right' to food and health care is often contained in documents prepared by world congresses established by U.N. agencies (eg United Nations 1975, WHO 1978) in practice 'human rights abuses' generally mean the behaviour of our political adversaries of which we publicly wish to disapprove. I do not believe that a true commitment to the alleviation of hunger and malnutrition on a world-wide basis will be apparent until our political leaders start using the term, and are committed to the concept that, 'human rights' should include the 'right' to an income or circumstances that allow access to adequate food and provision of health care. Towards that end in 1977 an Independent Commission on International Development Issues (Brandt Commission) was launched. Commissioners were from the highest rank of public life in both developed and developing nations and

were invited to serve in a private capacity, not under governmental instructions. Terms of reference were:

"... to study the grave global issues arising from the economic and social disparities of the world community and to suggest ways of promoting adequate solutions to the problems involved in development and in attacking absolute poverty. As an independent commission it is free to raise any aspects of the world situation which the Commission considers pertinent and to recommend any measures it finds in the interest of the world economy.

The Commission should pay careful attention to the UN resolutions on development problems and other issues explored in international fora in recent years. It should seek to identify desirable and realistic directions for international development policy in the next decade, giving attention to what in their mutual interest both the developed and the developing countries should go."

The report (Brandt 1980) was published in 1980 but hardly created a ripple on the world scene. Many of its conclusions are however as true now as they were then and as difficult to implement. A quotation indicates its scope.

"Mankind has never before had such ample technical and financial resources for coping with hunger and poverty. The immense task can be tackled once the necessary collective will is mobilized. What is necessary can be done, and must be done, in order to provide the conditions by which the poor can be saved from starvation as well as destructive confrontation.

Solidarity among men must go beyond national boundaries; we cannot allow it to be reduced to a meaningless pharase. International solidarity must stem both from strong mutal interests in cooperation and from compassion for the hungry.

The elimination of hunger is the most basic of human needs. There we attach great importance to the increase of international food production and to the promotion of agriculture in many parts of the world which have become precariously dependent on imports.

The quality of life is almost meaningless without health, which depends on proper nutrition and a healthy environment. This also demands more research and operational funds devoted to combating the diseases of people in poor countries. Health care, social development and economic progress must advance interdependently if we are to attain our objectives for the year 2000."

I not believe that the publication of the report would be met with such resounding disinterest today since the climate of opinion and the recognition of our world-wide interdependence appears to have changed for the better over the last decade. On re-reading sections of the report I am impressed by its collective wisdom and would recommend those concerned with policies for food aid in the 1990's to re-examine the document. It was unfortunately published ahead of its time. A final quotation I believe correctly describes what should be our aims for the future. These "must be to diminish the distance between rich and poor nations, to do away with discrimination, to approach equality of opportunities step by step. This is not only a matter of striving for justice, which in itself would be important, but it is also sound self-interest not only for the poor and very poor nations, but for the better off as well." (Brandt 1980).

List of Tables

Table 1. Characteristics of hunger and major nutritional disorders. There is considerable degree of overlap in infants between protein-energy malnutrition and low body weight. Protein-energy malnutrition (e.g. body mass as a function of age or height) when early or of mild-moderate severity is usually subclinical and can only be diagnosed by anthropometric criteria. Low birth weight is defined as below 2500 g. In developing countries, the majority of low birth weights are due to foetal growth retardation.

	Hunger	Protein-energy malnutrition		Xeropthalmia	Goitre	Iron deficiency anaemia	Low birth weight
		Nutritional Marasmus	Kwashiorkor				
Causation/ precipitation long-term	Poverty, poor agriculture		Low-protein diet	Low intakes of carotene or retinol	Low intakes of iodine	Low intake or absorption of iron	Poor dietary intake since conception. Infections of mother
Causation/ precipitation immediate	Poverty crop failure war	Early weaning; infections	Infections	Early weaning; infections		Blood loss from infections	Low weight gain in pregnancy
Vulnerable groups and main age of incidence	All ages	Children less than one year	Children between 1-2 years	Preschool children	Older children; women	Children 3 years and women of childbearing age	Mothers of poor socio-economic status
Major features	Growth failure, wasting lethargy	Wasting	Oedema, fatty liver, reduced serum albumin	Night blindness, xerosis of conjunctiva and corea, keratomalacia, low serum retinol	Enlarged thyroid	Low hemoglobin (mitrocytic hypochromic anaemia, if severe)	Hypoglycaemia, hypothermia, poor resistance infection (low immunoglobin Ig G)
Consequences	Reduced growth reduced work capacity, high	High mortality, impaired mental development	High mortality, impaired mental development	High mortality especially when associated with protein-energy malnutrition, blindness	Cretinism	Pallor, reduced work and learning efficiency	High mortality, sub-optimal development, high incidence of infection

Table 2

Schematic overview of some major factors affecting nutritional status

Sequence*	Some causes and/or solutions
Food availability	International and national politics and economics, agricultural policy, production and distribution.
↓	
Family purchasing power	Political and economic factors at a local level. Targeted economic assistance: → Improved purchasing power.
↓	
Family food purchasing pattern	Poor nutrition knowledge. Nutrition education. → Improved food selection.
↓	
Within family food distribution	Poor nutrition knowledge. Nutrition education, targeted food assistance: → Improved food distribution.
↓	
Utilization of foods by consumer	Infection, infestation, poor sanitation. Health advice and services: Improved food utilization
↓	
Individual nutritional status	

Source: Pellett (1983); sequence adapted from Finstrup-Andersen (1982).

Table 3

Outline of information needed for the Assessment of Nutritional Status

Food Related Data		Health Related Data	
Country	Individual	Country	Individual
Food Balance Sheets	Dietary surveys	Vital & Health Statistics	Anthropometric Biochemical Clinical
Approximate availability of Food Supplies per caput.	Approximate nutrient intakes of individuals and comparison with nutritional requirements	Morbidity and mortality data and degree of risk to the community	Effect of nutrition on physical development, biochemical function and development of clinical abnormalities

Table 4. Comparison of levels of four selected amino acids in some regional and low cost diets compared to some requirement patterns.[a]

DIETARY PATTERNS[b]	Amino-acids mg/g N			
	Lysine	Total Sulfur Amino Acids	Threonine	Tryptophan
Developed Countries	65	36	40	12
Africa	47	34	35	12
Near East	41	36	34	12
Far East	46	40	39	12
Latin America	56	34	39	11
Low-Cost Diets	45	31	34	10
Whole Wheat	28	40	29	11
REQUIREMENT PATTERNS				
FAO/WHO (1973)	55	35	40	10
FAO/WHO/UNU (1985)				
Young Child <1 year	66	42	43	17
Preschool Child 1-5 years	58	25	34	11
School Age Child 6-12 years	44	22	28	9
Adolescent/Adult >13 years	16	17	9	5
PROPOSED PATTERN[c] All ages>1 year	30	25	25	10

a. The four amino acids listed are the only ones of the nine indispensable (essential) amino acids likely to be deficient in practical diets.

b. Calculated by Pellett and Young (1988c) from FAO (1985) dietary data. Low cost diets are mean values from nineteen diets tabulated by FAO/WHO/UNU (1985).

c. Young, Bier and Pellett (1988).

Table 5: Estimates of numbers identified as nutritionally deficient in major world food surveys. Adapted from Poleman (1981ab); data for 1985 from the Fifth World Food Survey.

Year	Population size assessed (millions)	Nutritionally deficient (millions)	Proportion affected (%)	Basis for Estimate	Reference
1946	2000	1000	50	Availability	FAO(1946)
1952	1900	1100	60	Requirement	FAO(1952)
1961	2800	1900	68	Ratio	USDA(1961)
		[a]			
1963	2500	1000	40	"	FAO(1963)
1964	2900	1900	66	"	USDA(1964)
	[b]				
1976	1500	1100	73	"	Reutlinger & Selowsky (1976)
1977	2900	400	14	BMR x 1.2	FAO(1977)
	[c]				
1985	2200	335	15	BMR x 1.2	FAO(1985)
	[c]				
1985	2200	494	23	BMR x 1.4	FAO(1985)

a. Estimated on the basis of protein deficiency; number would fall to 400 million (16%) for food energy deficiency.

b. Major developing countries only

c. Developing Market Economies

Table 6.

National Nutrition Survey of Egypt
(anthropometric criteria used for assessment)

Diagnosis	Weight for Height	Height for Age	Weight for Age
Normal	95%	78%	53%
Moderately Malnourished	2%	17%	38%
Severely malnourished	less than 1%	5%	9%

Note: There were 8016 (4240 males and 3776 females) children below the age of 6 years. Normal was defined as above 85% of the reference standard population for Wt/Ht and above 90% for Ht/Age and Wt/Age. Moderately malnourished was between 80.0-84.9% Wt/Ht, 85-89.9 Ht/Age and 75-89.9 Wt/Age. Severely malnourished was defined as less than 80% Wt/Ht, less than 85% Ht/Age and less than 75% Wt/Age. The latter category thus includes Gomez 2nd degree and 3rd degree malnutrition.

Source: Nutrition Institute Egypt (1978).

Table 7. Health, Wealth and Dietary Data for 130 Countries

Group	No. of Countries	Population Millions	GNP[a] US $	IMR[b]	Under Five[c] M.R.	Life Expectancy Yrs	Children Under 5 yrs	LBW[d] %	Births Attended by Health Personnel %	Drinking Water Access	Kcal/ Kcal Req.	Protein(TP) per day g	Animal Protein(AP) g	AP/TP[e] %	Fat per day	Retinol per day ug
1	32	462	295	137	227	46	18	16	22	31	91	53	11	21	36	140
2	32	1498	1623	87	130	56	17	13	50	52	101	62	15	25	51	190
3	30	1692	2207	43	58	66	14	11	82	68	111	70	27	37	63	260
4	36	1165	7817	13	15	74	8	6	99	95	129	94	54	57	125	620
All	130	4817	2509	67	102	61	14	10	64	62	109	71	28	36	71	313

Source of Data: Nutrient information mainly FAO 1984, 1986; supplemented from FAO 1980: all other data UNICEF 1987.

a. Gross National Product per caput U.S. $

b. Infant Mortality Rate: annual number of deaths under 1 year of age per 1000 live births.

c. Under-five mortality rate: annual number of deaths under 5 years of age per 1000 live births.

d. Low Birth Weight: percentage of births with birth weight less than 2.5 kg.

e. Animal protein as a percentage of total protein.

Table 8: Cross Country Correlation Matrix Between Health and Dietary Data: 130 Countries.

	No. of Countries	GNP[a] US	IMR[b]	Protein (TP) g/day	Animal Protein (AP) g/day	AP/TP[c]	Fat g/day
Child Mortality Rate[d]	121-129	-.59	.79	-.68	-.73	-.72	-.67
Life Expectancy yrs	121-130	.63	-.97	.72	.76	.75	.72
Low Birth Weight[e]	113-120	-.49	.55	-.64	-.61	-.58	-.61
Children Under 5 yrs as Total	121-130	-.59	.73	-.67	-.74	-.69	-.74
GNP US	120-121		-.61	.68	.78	.73	.78
IMR	121-129			-.70	-.75	-.75	-.70
Protein g/day	120-129				.88	.74	.85
Animal Protein g/day	120-129					.95	.91
AP/TP %	120-129						.83

Note: All correlation coefficients P<0.001.

Sources of Data: Protein, Animal protein and Fat mainly FAO 1984, 1986 but supplemented by FAO 1980. All other data UNICEF 1987.

a. Gross National Product per caput U.S.

b. Infant Mortality Rate: deaths <1 year per 1000 live births.

c. Animal protein as percentage of total protein.

d. Number of deaths less than 5 years per 1000 live births.

e. Birth weight less than 2.5 kg.

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