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The nature of the nutrition problem

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This paper attempts to conceptualize malnutrition from an ecological point of view. One definition of malnutrition, a term that in Spanish can be rendered by either 'desnutricion' or 'malnutricion', is:

a pathologic state usually induced by an insufficient consumption of food, and, therefore, by a lower calorie intake than required durinS a prolonged period; it manifests itself by physical, psychologic and biochemical alterations, by lower weight for height increments and by a deficit in height as compared to well nourished children.1

This definition is unsatisfactory because it suggests that malnutrition is solely the result of lowered food consumption, wholly disregarding other components in the complex web of causation.

A more realistic definition might be the following: 'malnutrition is a pathologic state due to a deficient availability of essential nutrients at the cellular and tissue level during a prolonged period; it manifests itself by physical, psychologic and biochemical alterations', etc. This broader defmition allows for situations where an adequate amount of food is consumed, but the organism is still malnourished.

The classical - and still accepted - defmition of malnutrition illustrates just how firmly established is the concept that food is the main factor in the genesis of malnutrition, even to the extent that it has been customary to equate malnutrition with underalimentation and malaIimentation. This philosophical misconception has greatly affected the evolution of scientific nutrition, and has been detrimental to the orientation of teaching, research and nutrition planning in developing nations.

The cause and effect relationship between food and malnutrition has influenced programs of control and prevention. It has also misdirected research, leading scientists far afield from what now seems obvious: namely, that malnutrition is not a purely biochemical and biomedical problem, that its origins are rooted in the structure and organization of family and society, and that its control and prevention cannot be accomplished by the provision of food alone.

A wider study of the social sciences (particularly anthropology) and a better understanding of primate biology and animal behavior indicate that good nutrition is a natural occurrence resulting from the interaction of the host with its natural habitat. Malnutrition is brought about only as the result of a congenital defect, an acquired injury, or a drastic perturbation of the ecosystem such as drought, fire or climatic variation.2

There is reason to believe that such a situation must have prevailed during the time man was a tribal hunter and gatherer. He probably had a complete and varied diet. He was also quite free of microbial pathogens. In fact, human 'virgin' populations, free of tuberculosis, respiratory viruses and other debilitating agents, have been found. American Indians and South Pacific Islanders were free of measles and smallpox until they met with Europeans.

The beginning of endemic malnutrition in man occurred along with the organization of large, densely populated, sedentary societies which depended almost entirely on one or two foods, generally cereals. This mono-diet was highly susceptible to fluctuation by man-made and natural conditions and allowed increased opportunities for the persistence of pathogenic agents. Population density has been an important factor in determining endemicity of infection which flourishes in situations of crowding, poor housing, and deficient environmental sanitation.

At various times in history, weather fluctuations, plant diseases and depredation have affected the available food supply. Together with epidemic disease, natural disasters and warfare, these factors served as periodic checks on population growth, particularly up to the nineteenth century) Chronic malnutrition (which is often a consequence of infectious disease)and infection itself eliminated the weakest at any time of the year, but often seasonally. From the beginning of civilization, the interaction of malnutrition and infection has been the

most important check on population growth.

It is important to realize that a large proportion of people in the world today exist in insanitary environments, consume monotonous diets and live under systems based on social inequity_The situation has become more complex in recent times because there have been interventions to prevent some suffering and death. Broad-scale public health programs, the construction of roads, the rise of commerce, and increasing industrialization have brought about drastic control of debilitating disease. The resulting decrease in mortality boosted population growth, which became overt in rural Central America after the second world war.4 Often, the gains have not been accompanied by comparable social, economic and political actions to promote justice and welfare for all people. While a trend towards overall improvement in nutrition can be seen in most countries, rapid population growth may neutralize those gains or lead to situations from which it is difficult to expect further improvement. Ultimately, the concern of world planners is population growth. Some countries seem to have reached a 'state of no return', in which peaceful solutions are difficult, if not impossible, to achieve.

Malnutrition is not caused by a shortage of food, but by inequities within the society which seem to have resulted from man's scientific and technological achievements. Civilization brought about craftsmanship, professionalization and militarization, thereby establishing a caste system which breeds ignorance, poverty and exploitation, even in the twentieth century. In every nation, whether rich or poor, malnutrition occurs more frequently in the lower social classes. The same is true in the relations between nations themselves. The more 'advanced' and wealthier countries have practised discriminatory policies ranging from the crudity of military occupation and slavery to the more sophisticated forms of neocolonialism. In my view, however, the main problem concerns the SOCiopolitical and economic situations prevailing within nations. These factors require immediate attention if the nutrition, health and welfare of any given population is to be dealt with effectively.

The next section of this paper concerns the assessment of malnutrition. This is an issue which is fraught with disagreement. My emphasis is on energy-protein malnutrition.

Assessment of malnutrition in individuals

Historically, the clinical and epidemiological study of disease in individuals led to the discovery of nutritional deficiencies. More than forty years ago, Dr Cicely Williams described with great accuracy a syndrome new to the medical profession.5 Her account of kwashiorkor accurately described not only the features of energy-protein malnutrition (EPM), but also the various biological, cultural and social factors surrounding its occurrence. It must be stressed that there is no substitute for the clinical appraisal of the patient when diagnosing the severe forms of malnutrition. The study of parameters influenced by acute and chronic malnutrition - such as height, weight, bone maturation, hemoglobin, serum albumin and creatinine - is valuable, providing clinical and epidemiological criteria are collaterally included in interpretation.

While the assessment of severe malnutrition is not difficult, its chronic, moderate, subclinical and mild forms are not as easily identified. My limited experience indicates that many nutritionists find malnutrition where it does not exist, confusing it with poverty, filth and infectious disease. I have seen a qualified nutritionist label a child 'malnourished' who was underweight for its age, but otherwise healthy. In rural Costa Rica, nutritionists despaired because children did not improve their deficit in weight for age despite the provision of adequate nourishment, when actually the children showed a normal or excess weight for height. Moreover, a careful examination of all hospital records regarding children admitted with third-degree malnutrition in 1975 revealed that 9% had an adequate weight for height and a normal height for age.6Evidently, these problems emerge from the use of the weight-for-age criterion.

Any assessment of malnutrition in individual children must take into account the clinical signs and symptoms. When these are not present, a combination of two or more of the following parameters is required: general state of health; relationship of weight for height and height for age; hemoglobin concentration; serum albumin concentration; and intestinal absorption tests.

If a child shows a marked deficit in weight for height, suffers from acute, chronic or recurrent diarrhea or other infectious diseases, or manifests malabsorption, low blood hemoglobin or serum albumin, he should be classed as malnourished, even in the absence of the typical signs and symptoms of malnutrition.

Assessment of malnutrition in the population

This aspect of public health nutrition has been characterized by disagreement on the criteria to be used in assessing nutritional status. Much of the problem seems to stem from the use of knowledge derived from prevalence data, from a deficient manipulation and analysis of existing data, and from an oversimpllflcatlon of what is actually a complex body of information. There has also been biased intervention on the part of individuals with limited exposure to the field situation who subsequently make comparisons with better (or at least different) environments.

The assessment of malnutrition encompasses both the evaluation of biologic information (including general health status as reflected in morbidity and mortality indices) and the pattern of growth as reflected in stature and body weight. However, social and economic parameters, along with other indicators of development ought also to be included. Unfortunately, these are difficult to define and apply at present.

An easy way to assess the nutritional status of a pop-

ulation is to look at its health parameters, especially morbidity and mortality rates. While morbidity registration is faulty or non-existent in developing nations. death registration is sufficiently reliable to measure improvements over time. Mortality within the first and second years of life is an important parameter, since energy-protein malnutrition primarily affects children of those ages. If breast-feeding extends into the second, third or fourth year of life, the mortality within that age group is also extremely relevant? In Table I, an arbitrary scale has been devised to class population groups according to mortality figures.

Other ways to utilize mortality figures have been proposed. For instance, the ratio of infant mortality to one to four year old mortality is a valuable tool for judging nations in relation to each other and in terms of their economic developmentf Prospective field studies in India and Guatemala have identified the interaction between malnutrition and infectious disease.9Mortality in nearly all types of infectious disease is greater in nations with prevalent malnutrition. The accepted interpretation of this fact is that a debilitated or malnourished host is less capable of fighting off an infection.lO So, the comparative study of cause-specific death rates (in the case, for example, of diarrhea, whooping cough or measles) is important. However, little use of this resource has been made, except for the PAHO International Study of Childhood Mortality.ll

Special care should be taken in interpreting mortality figures when they are influenced by factors which are not dependent on nutritional status. Thus, tetanus neonatorum may account for 10-30% of neonatal deaths in certain regions, or hyperendemic malaria may cause premature death in a certain season of the year. On the other hand, the lack of health services and hydration for children in rural areas is responsible for deaths among well nourished children suffering from bacterial or viral diarrhea.

Physical anthropometry has been the most used and abused tool for assessing the nutritional status of a general population. Measurements have ranged from height and weight to skinfold thickness and bone maturation; in some studies,'as many as twenty variables have been included. Much of the data collected were never (and perhaps never will be) properly analyzed. With few exceptions, the contributions have done little to clarify our understanding of the value of anthropometry in assessing malnutrition.

Table 1. Mortality scale to assess malnutrition in the community.

Mortality per 1000 Infant	1-4 years	Mortality level	Nutritional status
< 20	<1	Very low	Very good
20-39	1-2	Low	Good
40-59	3-5	Fair	Fail
60-79	6-9	High	Deficient
80+	10+	Very high	Very deficient

My interest in the problem originates from the fact that I directed a long-term prospective study in a Guatemalan Indian village.1:{)ver a ten-year period, we were able to study the appearance of EPM in a population which numbered 1000 at the beginning of the study and 1500 at the end. The incidence of EPM was 13 per 100 in the first year of life, 27 per 100 in the second year, and 9 per 100 in the third. Most of the malnutrition was of the marasmic type.

According to the Gomez classification Phowever, 85% of the children were below the third percentile of the Denver standard by eighteen months of age - a finding which contrasts with the visitor's observation of children (admittedly small in size) running around with smiling faces. To classify most of these children as malnourished as a result of comparing their weights with those of their peers in developed societies (Boston, Iowa, Denver) is both unjust and impractical.

The Gomez classification was developed twenty years ago as a means of dealing with children admitted to the hospital for treatment of malnutrition (kwashiorkor was very prevalent in Mexico in those days) and was *not* intended to apply to the general population. Moreover; its use is limited by the high incidence of low birth weight in rural and lower-class urban populations. It is estimated that not less than twenty million low birth weight infants are born each year throughout the world.14 In deVf~loping nations, the frequency ranges from 15-30%,15 but the real magnitude is unknown since there are no adequate data for most countries. Studies in the Guatemalan village mentioned above revealed an incidence of 40%.16

What are the implications of low birth weight in the assessment of malnutrition by means of the G6mez scale? Figure 1 shows that children tend to remain in growth tracks defined by birth characteristics, even when they are adequately breast-fed.PTherefore, the weight-for-age criterion is too stringent when applied to children with low birth weight, particularly in the first two years of life. The inadequacy of the weight-for-age classification is further evidenced when one examines the growth curves of individual children (Figure 2). Malnutrition occurs during and immediately after episodes of infectious disease, but the child may have been in a state of adequate nutrition before or after, growing at a normal rate while still manifesting a deficit in weight for age. The greater the number of disease episodes, the larger the cumulative weight-by-age deficit. But the child may be generally healthy and well nourished between repeated disease episodes. In fact, most children surviving infancy and early preschool age are adapted to the environment; they exhibit adequate hemoglobin values, adequate weight for height and a low mortality.

A survey conducted in 1966 in thirty Costa Rican rural communities established that 57% of preschool children were malnourished;18 the data pertaining to weight for age and weight for height are combined in Table 2. While the rate of 'malnutrition' increased with age according to the first criterion, it decreased (and was always lower) in terms of the second. Obviously, a sys-

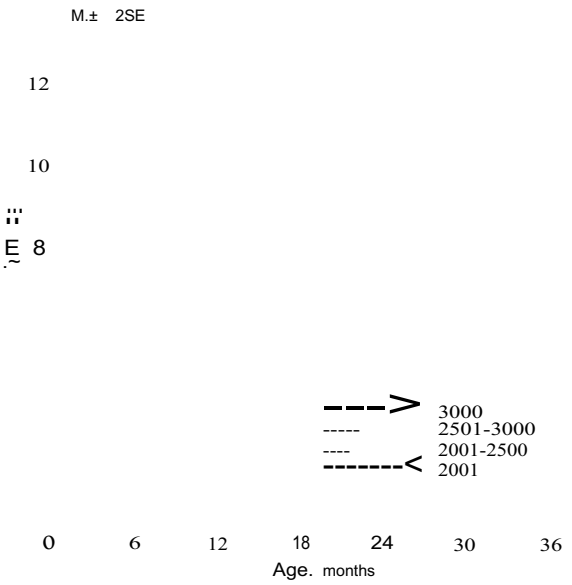

Figure 1. Mean growth curves.
Cohorts of children defined by birth weight, from birth to three yean of age. Two standard errors are shown. The numbers in the CUf\let indicate the number of cohort children m_ured at each point. The upper curw i, the IOWA ltandard of JIilCQon and Kelly.

tern is inadequate which indicates that malnutrition increases with age and which shows malnutrition and mortality to be inversely correlated.

Nine years later a new survey was conducted in the same communities. Data examined by the Gomez classification led to the conclusion that there had been only an 8% improvement in nutritional status during that interval (Table 3). This rmding was incompatible with an observed 51% reduction in infant mortality, and a 7Cl'lo decline in the one to four year group.

Interestingly, the relationship of weight for height did not improve. In general, there was an increase in the prevalence of 'wasting', ie a deficit of 20% or more in weight for height,19 meaning that children were more slender in 1975 than in 1966. This apparent deterioration in nutritional state during the nine-year interval can be accounted for by a marked increase in the height of preschool children of all ages (Table 4). The prevalence of stunting among preschool children decreased from 17 to 7%. The greatest difference was noted in infants; since no marked changes have been recorded in birth length,Ilthe trend actually reflects better nutrition and health care for infants in recent years. Changes in height correlate better with the reduction in childhood mortality noted above (Table 3).

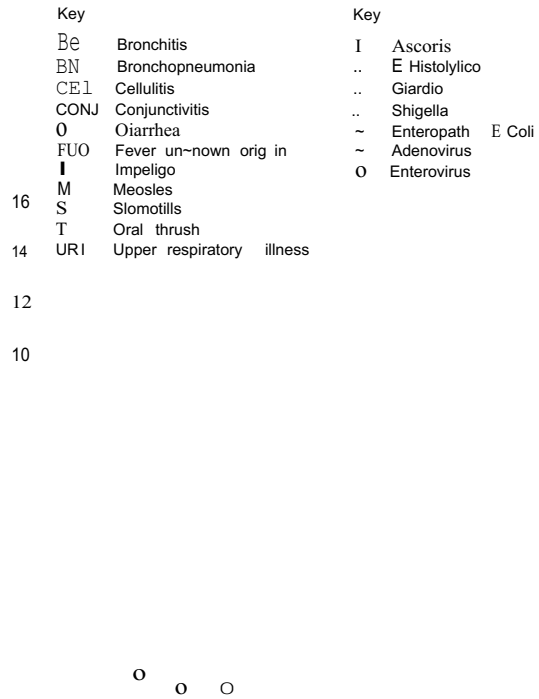

Figure 2. Growth curve of an individual child.
Observed from birth to age three. The child had deficient birth weight but the growth rate was adequate during the first seven to eight months. Thereafter, the combined effect of poor food supplements and multiple Infections resulted in deterioration of the nutritional state. It should be kept In mind that the child was lilCutely malnourished each time he had a severe Infectious disease, particularly diarmea, measles and respiratory Infections.

Table 2. Nutritional status by two criteria, Costa Rica, 1966.

Ase, years	Number of c:hidnm	Unclerweigll t'l WeirJ;t.t/ Age	Weiaht/Height	Overweight b WeirJ:t.tlAge	Weisht/Heip.t
1	132	41 c	29	11	13
1	142	6S	22	3	7
2	172	58	22	2	8
3	165	55	17	2	7
4	180	64	21	3	6
5-9	796	67	16	3	8
10-14	661	72	10	4	22

aLess than 91% weight/age or weight/height
bMore than 110% weight/age or weight/height
CPercentage of children

Table 3. Malnutrition and cbildJIood mortality, Costa Rica, 1966 and 1975.

Year	% 'mllnourilhed' a D+m	I+D+W	'-'"stunted'	Mortality per 1000 Infant	1-4 years old
1966b *n= 791*	13·5	57·5	16·9	65-1	6·3
1975 *n= 1910*	IN	52.5	7-2	37-1	1·9
% Reduction	8	9	57	51	70

a GOmez classification
b The same 30 villages

Table 4. Heiaht deC-leitby age ('stunting,),· Costa Rica.

Age, years	1966 *n= 791*	1975 *n= 1910*	% Reduction in '.tunting'
<1	4·6	1·3	72
14	19-4	8·7	S5
Total	16·9	7-2	57

a 90% height for age

Table 5. Nutritional status by degree of 'wating' and ',tunting',' children O-Syears old, Costa Rica.

SUJ'Vey year	Number of children	% Height/Age	% Weqht/Height 81+	<81
1966	791	91+	80·9b	2·2
		<91	16·1	0·9
1975	1910	91+	85·7	H
		<91	6'5	0·7

a Wasting = deficit in weight/height; stunting = deficit in height/age
b Percentage of children

Table 6. Recommended calories and protein and NDpCal%.

	Calories	Protein, I	NDpCAL%
6 months	880	12	5·3
1-3 years	1360	16	4-6
4-6 years	1830	20	4·3

Source: Food Fortification, Protetn-Calorie Malnutrition, FAO Nutrition Meetings Reports Series, No 49, WHO Technical Report Series, No 477, Food and Agriculture Organization and World Health Organization. 1971.

It seems that height for age is the best single indicator of nutritional changes among population groups in countries undergoing transition. The major advantage of this criterion is that its application requires little equipment. The disadvantage is that the age of children must be known with some accuracy; however, this is feasible in most developing nations.

Ten years ago, a system was developed to assess the nutritional status of children taking height and weight into account.21 More recently, a similar system introduced the concepts of 'wasting' and 'stunting,22 thus allowing populations to be classed in groups with different priorities for intervention planning. For instance, the children examined in the Costa Rican surveys of 1966 and 1975 were grouped as shown in Table 5. Eighty one percent of preschool children in 1966 and 86% in 1975 were well nourished, figures which contrast sharply with those obtained with the Gomez classlflcation.

About 1% of the children were actually suffering from malnutrition, and required immediate nutritional rehabilitation. While there were 16% stunted children in 1966, only 6'5% were found in 1975. Stunted children seem normal in every respect.23The rate of wasted children increased from 2 to 7% in nine years, but this figure should be interpreted not as a deterioration of nutritional status within the population, but as the effect on weight for height brought about by an increase in body length.

Finally, a word should be said about two other indicators of nutritional state: food balance sheets and dietary surveys. Food balance sheets have only limited value because they utilize averages which may mask differences in consumption within a given population. The magnitude of this limitation is proportional to the range of class differentiations within the society. In Costa Rica, for example, this type of study showed an ex-cessof calories and protein when imports were added and exports subtracted from the total food production. This excess availability was greater for protein than for calories; the 'availability/need' ratios were 2'3 and 1·2 respectively:24 The food available would be enough to maintain an adequate level of calorie and protein consumption throughout the population - an important fact in relation to Costa Rica's potential self-sufficiency. like most developing countries, Costa Rica exports high-calorie density food (such as sugar) and excellent protein (meat and fish) to maintain a great part of its balance of payments.

While dietary studies appear to be useful, they are also cumbersome, particularly when dealing with small children for whom the information is both limited and more important. Changes have occurred in the interpretation of dietary information in recent ~ears. According to the FAO/WHO recommendations, 5 5% of the total calories derived from biological utilizable protein in the diet (NDpCal%) is adequate for the organism (Table 6), provided that the caloric needs are satisfied.26 For children in tropical regions, the NDpCal%could be slightly higher.27

A study in Costa Rica (Table 7) showed that diets of rural oampesino children have NDpCal% in excess of these acceptable levels,28 a similar situation holds for

the diets of Mayan Indian children living under extreme poverty.29 However, calories are deficient in the diet of Costa Rica (Table 8), and in the Guatemalan Indian village, where no protein deficiency was noted30 after the data were treated by the Sukhatme approach (Table 9).31

The assessment of malnutrition through dietary surveys provides valuable information, but is limited by the fact that other results are incongruent with those obtained by the use of anthropometry. Localities where 80% of the diets are deficient may have only 60% of children 'malnourished' by the Gomez classification, and only 10-30% by weight for height. If the more realistic height for age relationship is applied, the disagreement is even greater. A probable explanation is the apparent overestimation of nutrient requirement recommendations, causing exaggerated 'deficiencies'.

Table 7. Nutrient intake by COIta Rican children, 1966.

		Age,yean		
		1	3	*4-S*
Calories	981	947	1030	1003
Protein, g	32	98	29	27
% Animal protein	77	58	60	*4S*
NDpCal%	10'4	9·5	9'3	8'8

Source: V. Valverde, G. Arroyave, and M. Flores, 'Revision del aporte calorico *y* proteinico de las dietas de poblaciones de baio nivel sociceconcmico en Centroamerica. Existe un problema de proteinas?' *Arch Latinoamer Nutr.* Vol 25; p 327.
P 327.

Table 8. Nutrient value of dieta of pllldtool children, Costa Ric:a.

	1966 *n= 7S*	1974 *n*= 144
Calorie deficient	86a	76
Protein deficient	44	32
Calorie adequate	14	24
Protein adequate	56	68

a Percentage of children.
Source: V. Valverde, G. Arroyave, and M. Flores, 'Revision del aporte calorico y proteinico de las dietas de poblaciones de bajo nivel socioeconomico en Centroamerica. Existe un problema de proteinas?' *Arch LatinoamerNutr,* Vol2S, p 327.

Table 9. Adequacy of the diet of weaned children by we.. t, Santa Maria C4uque, 1964-1970.

Aje, months	Numbm of chUdren	Protein	Calories Adequate	Inadequate
24	14	Adequate	3a	9b
		Inadequate	0	2
36	30	Adequate	15	*IS*
		Inadequate	0	0

aThree children had diets adequate in proteins and calories at bage 24 months.
Nine children had diets adequate in proteins but inadequate in calories at age 24 months.

Also, caution is advisable when comparing surveys conducted in different eras because the calculations may have been based on different sets of recommendations. The FAO/WHO recently lowered its recommended protein levels,32 although the matter seems unsettled)3 It appears plausible that children could grow well with fewer calories than is now universally accepted,34 and changes in this parameter might well be observed in the future.

Other indicators of a nutritional state are the rate of literacy, the level of hygiene, income and other socioeconomic characteristics. Socioeconomic conditions and the level of sanitation have been found to be related at the regional or local level with a prevalence of malnutrition.35 Although the indicators may be sensitive, they have not been extensively used: additional research might weDbe undertaken in this area.

Extent of malnutrition in the world

No generalization can be made on this subject because the nature of malnutrition varies from region to region. In the past, we thought that unavailability of food at the national level was the common denominator. But since any limitation in food availability primarily affects the lower social strata, nations typically believed to suffer from chronic food shortages may actually have enough food to satisfy the needs of the population. In fact, during the recent food and energy crisis, increased per capita food consumption was shown in India.36 However, this did not ameliorate the nutrition problem because inflation and other phenomena prevented the neediest segment of the population from increasing its food intake.

Furthermore, an understanding of malnutrition-infection interactions demonstrates that infection is probably one of the most important components in the causation of malnutrition. Figure 3 shows the diet chart of a typical child whose level of calorie consumption was decidedly deficient, but began to improve after weaning. An episode of diarrhea resulted in a drastic reduction of caloric intake.

During convalescence, the caloric intake may remain low. The high exposure of weaning infants to respiratory and intestinal tract infections afflicts most children with successivebouts of infectious disease, each one actually representing an episode of acute malnutrition because of the profound dietary and biochemical alterations involved.37 Thus if the rates of infectious disease (part icularly diarrhea) were reduced, food would become more available and utilizable, resulting in the elimination of much of the malnutrition.

Differences in the food habits and growing practices are important, particularly in regions of Africa and Latin America where the main food sources are tuberous crops which are low in protein in relation to caloric density. Social, economic, cultural and biologic factors are also important variables which account for differences in the nature of malnutrition; they may vary according to

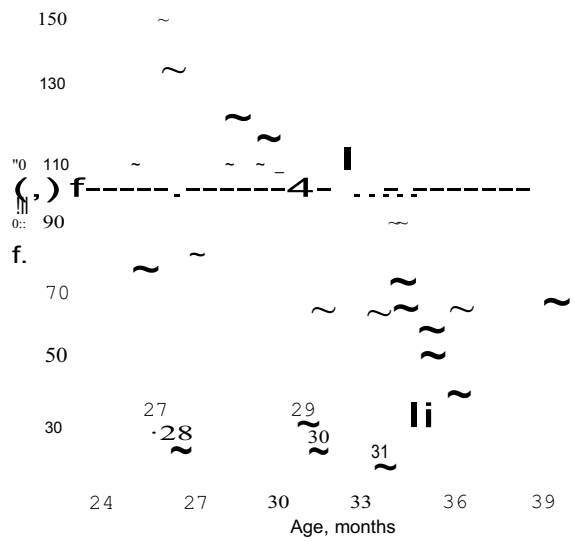

Figura 3. Diet history of a particular child.
The calories consomed per week lire expressed as ıı percentllg8 of the FAOfWHO requirement. *(Energy end Protei" Requirements,* WHO Technical Report Series, NO 522, Food and Agriculture Organization and World Health Organization, 19731. Little deficit is observed after weaning. which in this child was at twenty-foor months of ega; soon after there were several calorie restrictions, always associated with the occurrence of infectioos diseases. Each dot is a dietary study in this particular child.

country and region and must be taken into account in nutritional planning and national development.

The magnitude of the nutritional problem has been distorted by the emphatic use of the Gomez classification and dietary surveys in the past. My own feeling is that the problem is less severe than originally believed.38 If accepted, this notion should inspire some optimism in planners and politicians. Instead of finding that half the population of the developing nations is malnourished, the figure drops to 25·35% by weight for height and to not more than 15% if the stunted are excluded from the group of malnourished children. What is badly needed is careful reexamination of available data, and the use of such novel classification schemes as that proposed by Waterlow and Rutishauser.39 Continuous evaluation of nutritional state should be given a high priority in developing nations, particularly those where interventions are being planned or practised.

Misconceptions in nutrition planning

Mymessage is that the overemphasison food and general disregard of other factors has Jed to an exaggeration of global malnutrition, This faulty outlook has negatively influenced nutritional planning, and was in part responsible for the earlier belief that protein was the main deficiency in the diet of poor people,40 a view which initiated the chain of mistakes in nutrition intervention programs.

Case studies inevitably point up the meagre accomplishments of existing food programs. These failures have resulted from misconceptions concerning etiology, recommendations of inadequate food supplements, and the inability to recognize the importance of infection, social inequity and other factors. Not infrequently, politicans utilized equivocal information which was then used in ineffective food programs to mobilize voters.

Nutritional planning was usually directed towards an increase in food production, with no consideration for land tenure, wages or food prices. Increases in food production brought about through the Green Revolution generally favoured the large producers, with few real benefits for the people most in need.

High-yield, high-nutrient cereals produce a 'mirage of nutrition well being', since the children who are in greatest need benefit little from the greater availability of such cereals until adequate education and technology become available to the rural areas. The adaptation of plant varieties often requires a prolonged period of adaption to the new terrain and its microbiota.41

A rise in income - whether through industrialization, mechanization of agriculture or international efforts - does not necessarily solve the problem either. When such a goal was set for Latin America, through an international pact, the excess income generated in most countries clearly ended up in the hands of elite groups and multinational enterprises. In Costa Rica, the lowest-income group has continued to share less of the gross income during the past decade, while the middle classes have recorded a favorable increase,42 the lag persists after more than fifteen years of the Alliance for Progress.

For some time, nutrition planners have been obsessed with food distribution programs. Although their systems analysis approach is excellent (along with their good will), the programs are almost always set in motion without any real consideration of the basic logistical questions which must be answered if the food is actually to reach the target populations. Such basic factors as the geography of the region, its communication systems, the availability of electricity and scattering of the houses are the main obstacles to success, even at the lowest levels.

For instance, Table 10 shows the distribution of the population in our small country. Twelve percent live in

Table 10. Population distribution in Costa Rica, 1973.

Size of community	Number of communities	% Population	%Cumuladve
<50	837	1·1	
50 -	1712	10·6	11·7
200 -	1 135	18·9	30·6
500 -	375	13·6	44·2
1000 -	164	16·2	60·4
5000 -	16	6·5	66·9
20000 -	5	8·3	75·2
SO 000 +	1	24·8	100·0

Population = 1 871 780
Source: AITEC· DINADECO- AID

Table 11. Scatteringaof runl population in Costa Rka. 1973.

Diatance,m	% Households
500	36
500-999	24
1000-1999	21
2000+	19

a With reference to nearest school
Source: AIDI AITEC

communities comprised of sparse households and numbering less than a hundred persons. An additional 19% have populations between 200 and 500, but live under the same conditions of deprivation. The rural population comprises 31% of the national figure, and includes all villages and communities with Jess than five hundred people.

One serious problem is a lack of or deficient means of communication. Table 11 indicates that 40% of all children live in households located one kilometer or more from the nearest school, a place where a food distribution center is likely to be set up. There is evidence that less than 15% of the food currently distributed in Costa Rica actually reaches the target group. The fact that ~ village must have electricity, piped water and a road in order to establish a food distribution center has limited the effectiveness of the program.

The difficulties in deciding between alternatives for action (particularly when cost-effectiveness is considered) present an obstacle to nutrition planning. Studies of cost-effectiveness of various programs have revealed un~xpected results. For instance, a greater availability of Jobs leads to an increase in income which inevitably results in a sharp drop in breast-feeding. The resources needed to feed children with whole or powdered milk are often greater than the increased income produced by the jobs. Similarly, policies designed to stimulate food production may actually induce Significant increases in the price of food.

Some authorities believed that nutritional policies should be directed towards target groups through some sort of food stamp program which would provide the food needed to eliminate dietary deficiencies. Table 12 shows that 60% of a sample of campesinos in Costa Rica had monthly incomes of less than ~70, which is not

Table 12. Level of income by occupation, Costa Rica, 1912.

Monthly income US,	Pen:entage of worken with income		
	Agriculture	Industry	Urban employees
-35	21 (lOO}a	0	0
36-70	*S9 (79)*	32 (100)	21 (lOO)
71-105	16 (20)	38 (68)	46 (79)
106-140	2 (4)	22 (30)	21 (33)
> 140	2	8	12

a Cumulative percentage

en~ugh to purchase local food to feed a family of six. :nus co?trasts sharply with $800 average per capita Income In the country at present, and argues eloquently for the use of a holistic approach in the planning and execution of such programs.

If one is to reach sparse populations like those of Costa Rica, programs must be extremely aggressive. Planning should incorporate the skills of scientists specialists, lawyers and politicians. The emphasis should be towards an overall improvement of the environment beginning with community organization which Will allow the people to participate in both planning and execution, and eventually to finance part of the intervention. Sanitation should be given a high priority particularly in the areas of housing, safe water supply and the protection of children against common comrnunicable diseases.

The food program itself is as important as the issue of sanitation. The aim is to increase local food production in order to provide a surplus for intervillage commerce. ~ood d~tribution at the local level cannot be accomplished With the present infrastructure in most countries of the world, and requires innovative research both in food technology and in operational procedures. Food supplements must be based on local foods (or similar ones) prepared in known or hitherto unknown forms (probably precooked), with specific instructions as to how they should be handled written in the vernacular. Target populations should be the nursing and the newly weaned child, along with the pregnant and lactating mother.

In Costa Rica, an ambitious program started two years ago, called 'The Program of Social Development and Family Allowances'. It is supported by high taxes on consumers which are then invested to improve poor rural areas. At present, the program has forty million dollars - one hundred million dollars is projected by 1980. The approach is holistic, with an emphasis on nutrition and the prevention of infectious disease. It includes betterment of environmental sanitation, education and family planning. Most important is the fact that community participation has received special attention and is already yielding good results.

I would like to close by saying that we should look at the malnutrition problem from a point of view quite different from that of the past. We should begin with the village, the sparsely populated community. Those interested in city slums must focus their attention in a similar way. We must examine the prevailing nutritional status as well as other needs of the people, employing novel criteria and maintaining en ecological attitude. We must determine what needs to be done to improve nutrition, health and welfare. Then we must discover the best way to apply present knowledge to ameliorate and eventually solve the problem; we must continue research into different approaches. In the meantime, we must evaluate the nutritional status of developing populations at frequent intervals, characterize target groups, and be able to defme or modify interventions in an unbiased and wise manner.

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