The differential diagnosis of protein-energy malnutrition: implications for prevention

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Introduction

Malnutrition in the young child may be 'prevented' by identifying the individuals at risk, and, for the period when the risk is greatest, modifying their environment, or even removing them from it, in order to ensure that, as individuals, they are spared the sequelae of undernutrition. The only diagnostic base this intervention requires is the proper identification of the child 'at risk'. However, many would argue that this approach implies neither a complete diagnosis, nor true prevention, as nothing has been done to improve conditions which caused the problem. In any event the resources required to implement this approach on a global scale are not available.

Accepting that nutritional intervention aimed at the individual is often necessary, that the treatment of the overtly-malnourished has a place and that the 'nutrition problem' will not be solved by accurate diagnosis alone, in this paper we will suggest that the diagnosis of malnutrition arises from the examination of the household and the environment in which it operates, and that the diagnostic spotlight should be adjusted to include the household if the basis for effective preventive measures is to be established.

We will suggest, furthermore, that the household can be examined by methods which are no less rigorous than (and, in fact, are similar to) those which are used to identify pathology in the individual.

In order to satisfactorily 'diagnose' the causes of a nutrition problem the information we require should fulfil the following general criteria:

1. It should discriminate between groups of people whose needs are different, (i.e. whose 'pathology' is different) although the presenting syndrome, that is protein-energy malnutrition (PEM), is the same.

2. It should be sufficiently penetrating to decompose each problem into its constituent parts and identify the cause and effect relationships involved as precisely as possible.

3. It should be complete enough to suggest optimum strategies and flexible enough to allow for what is possible.

4. It should be sufficiently quantitative to enable a ranking of priorities in terms of target groups and to provide at least a first-order of magnitude estimate of resources required.

5. It should be cast in a way that will show clearly the contributions to be made by the economist, the agriculturalist and the nutritionist on the one hand, and by the central planner and the village worker on the other.

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6. It should indicate the way resources are distributed and not rely on aggregate estimates of supply.

7. It should allow for both the prediction of change and the retrospective assessment of the effect of intervention programmes.

In short the diagnosis of PEM should state where the problem exists and why, how serious it is, how many people are affected and what will happen if this course is followed or that, or if nothing is done at all.

To my knowledge the first systematic attempt at enunciating a general approach to the diagnosis of malnutrition in these terms came from Joy & Payne (1975). Payne's functional classification of the malnourished remains a sound basis for the analysis of factors which contribute to the genesis of PEM. At about the same time a number of other workers approached this problem of analysing what might be called the 'ecology of nutrition' (Duckham & Jones, 1976; Hay, 1978; Parrack, 1978). Although differences are apparent, similarities are more obvious. Each attempted to show linkages between food production and distribution and the availability of food at a household level on the one hand, and disease on the other in determining nutritional status. Each attempted to make classifications which would discriminate between population groups whose nutrition problem stemmed from different causes.

I do not intend to review these classifications in detail as they are well documented in the literature. Instead I should like to compare and contrast the method of diagnosis which evolved in Ethiopia and is now in use there, broadening its scope to include features from other systems of analysis which I have found personally helpful.

A conceptual framework for diagnosis

The individual stands at the centre of concentric circles of influence; which might be called, in a collective sense, his environment. Beginning with the individual and moving steadily outward, it is possible to identify defects at each step which together result in impaired nutritional welfare and therefore a risk of malnutrition. This contrasts with a number of quantitative methods which estimate aggregate or per caput measures of welfare and regard these as representative of the population at large.

1. *The individual*

Individual nutritional status is determined by the amount and quality of the food eaten, the efficiency with which it is absorbed and by the diseases to which the individual falls prey. Considerable work has been carried out in an attempt to elucidate this complex of synergistic relationships. The effect of nutritional status on the resistance to infection, the effect of disease on dietary intake, the effect of disease on nutritional status and the relationship between diet and nutritional status have all received a great deal of attention (Scrimshaw *et al.* 1968; Scrimshaw, 1977). Recent work from the MRC Unit in The Gambia (Roland *et al.* 1977), and elsewhere (Mata, 1975; Mata *et al.* 1977) has added further

evidence to support the notion that in some instances the control of childhood disease may be as important as the improvement of diet in the prevention of malnutrition. This work is also important as it attempts to quantify the relative effect of diet and disease on nutritional status.

At the individual level, then, we can identify two clear streams of influence. That which results in a diet of observed quantity and quality and that which results in a disease pattern of an observed nature and prevalence.

2. *The household*

The household is the biological, social and economic unit which protects, feeds and supports the young human animal. As such it is the pivotal structure in the array of influences which have a bearing on the problem of malnutrition. From the household we can look inwards to the individual to see how family resources are shared, and outward to the social, economic, political and physical environments over which the family has decreasing amounts of control.

The household, to me at least, represents the seat of the pathology which produces the PEM syndromes. The diagnosis of malnutrition is therefore essentially a diagnosis of the functional efficiency of the household to protect and to feed its young.

There are three main household characteristics the diagnostician will want to know about. The first is the size of the family's productive assets; the second is the productivity of those assets. Quite simply these two give a measure of the resources which may be used to provide for the young child. The third is the manner in which they are utilized; that is, the way in which the household resources are shared between members of the family.

3. *The community*

Communities are composed of households and communities have particular cultural and social attributes which influence food patterns and child care. Without attempting to summarize all the sociological features which are obviously relevant to the welfare of the family, I want to mention one idea which I have found to be illuminating. It is the notion of the 'dislocated society'. It is clear that a family performs most efficiently and happily in the context of a strong community of which it is part. L. Bondestam (personal communication) has suggested that when a community is subjected to changes over which it has no control it tends to become dislocated from its cultural environment. As a result there is a loss of structure, a loss of spirit and a loss of traditional values. The syndrome is seen in its most obvious form when families become separated from their communities and become refugees. It can occur in a more subtle form, however, when families move from the country to the city or when changes in the name of development occur at such a rate that families or even whole communities are left stranded by the tide of change. The effects are difficult to quantify although it is common knowledge that transitional communities tend to have a higher than usual prevalence of malnutrition.

Specifically the syndrome appears to affect two things. The first is the extent to which the family's resources are utilized, and the second is the way these resources are distributed amongst the family members.

There are compelling biological and social reasons for ensuring that the young of the family are well cared for even if family resources are scarce. When this does not happen we can suspect that an extent of social integrity has been lost.

4. *The economic environment*

As far as the household is concerned the economic environment can be summarized by two characteristics. The first is the supply of goods and services which are available to it and the second is the rate at which its own production can be exchanged for those goods and services. Recently Professor Amaryta Sen (1977) has coined the phrase 'exchange entitlements' to express this rate which is clearly of essence in determining the quality and quantity of food and the quality of services which a family can obtain.

The two economic features which will have a bearing on the diagnosis of malnutrition are first the supply of food and (particularly medical) services available, and second, the family's exchange entitlements.

5. *The political environment*

I do not wish to take sides in a controversial issue but merely to note three facts. The first is that the family's economic and political environment are inextricably linked. The second is that the control of factors of production, and therefore the size at least of a household's productive resources, is determined as much by political structures as by economic ones, and the third is that while the technical professional might provide the diagnosis of malnutrition the politican holds the power to offer the cure.

6. *The physical environment*

A vast number of people still derive all or a substantial part of their food directly from the land or from the sea. For these the productivity of the physical environment represents the productivity of their resources. Despite technological progress the means to control the stability and productivity of the physical environment is neither completely effective nor is available to everyone.

Thus, at least for subsistence groups, the diagnosis of malnutrition is not complete unless environmental productivity has been assessed.

This then is a framework for a differential diagnosis of malnutrition (Fig. 1). It provides for a method of decomposing the problem of malnutrition into its constituent parts. In this approach the analysis focuses on the household, moving inwards to the individual and then, step by step, outwards through concentric circles of influence. The defects are identified in sequence and are then reassembled to provide an analysis of cause and effect in the genesis of malnutrition.

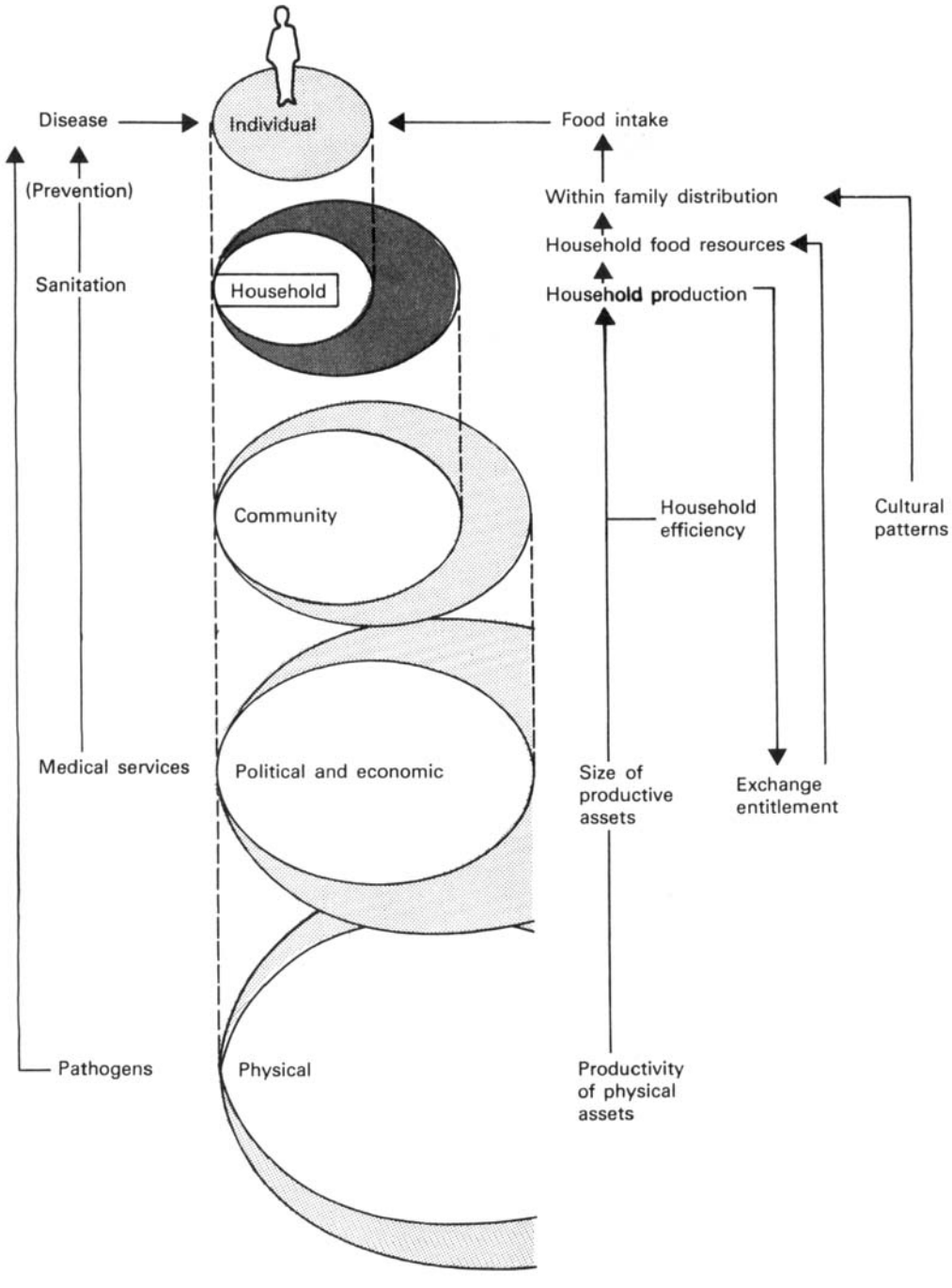

Fig. 1. The individual and his environment—some factors which affect nutritional status.

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A practical approach to the differential diagnosis of malnutrition

How may this approach be put into practice?

(1) *Classification of households.* Here I differ from most of the other schemes proposed in that I first classify households according to the way they obtain food (do they grow it, herd it, fish for it, or buy it?) and according to the staple food consumed. This seems to me to offer the advantage that from the beginning a certain homogeneity of food economy can be established. We have called these food economies 'food supply systems' (Hay, 1978).

A spatial classification can now be introduced which might be similar to Payne's functional classification (Joy & Payne, 1975). To me, however, the essential point is to make this classification on the basis of a household productivity measurement. For subsistence groups, land productivity will serve as a proxy so that an agro-climatic or ecological classification becomes an important element in the scheme. For market-dependent groups, an indicator of economic productivity is more appropriate. Occupation might be used as a proxy as Joy & Payne (1975) suggest, although this may generate too many classes. Employed, partly-employed and unemployed might be simpler, or an ethnic classification might be more appropriate. In any event the result will be a matrix of households such as shown in Table 1.

(2) *The food supply system flow chart.* It is helpful, as a second step, to trace the flow of food from production to consumption for each group of households; that is

Table 1. *Sample household classification by food supply system and agro-ecological–economic zone*

	Agro-ecological zone				Economic zone			
Food supply system	1	2	3	4	I	II	III	IV
Subsistence food supply system: 1 (livestock dependent)	Nomadic pastoral-ists (1·2 m)							
2 (crop dependent)	Freehold farmers (0·7 m)	Tenant farmers (15·6 m)	Tenant farmers (20·7 m)					
Mixed subsistence–market–dependent food supply system		Freehold farmers (cash crop coffee) (1·7 m)	Freehold farmers (cash crop cotton) (0·7 m)	Tenant (1·7 m) and freehold (13·8 m) farmers (cereal producers)				
Market–dependent food supply system			Commer-cial cotton farmers (0·1 m)	Commer-cial cereal farmers (0·05 m)	Non-Farm rural (0·5 m)	Villages and towns (2·4 m)	Pro-vincial capitals (4·6 m)	National capital (1·4 m)

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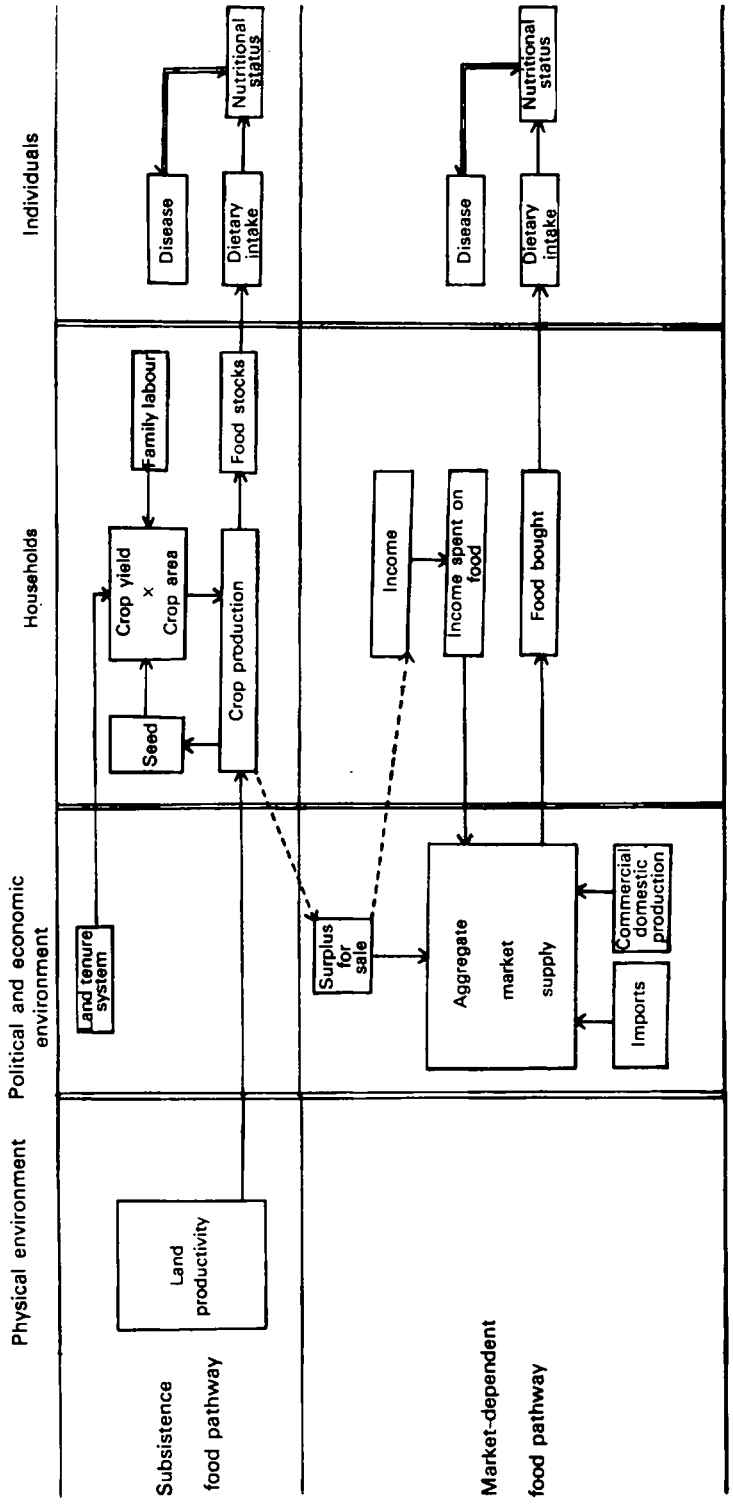

Fig. 2 Simplified food supply system flow chart showing subsistence and market-dependent 'food supply system'; 'mixed' food supply systems include elements of both pathways.

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for each food-supply system. The analysis should begin with the household and proceed in retrograde fashion to production.

Unless this analysis is required for a technical exercise such as the design of a monitoring system it need not be elaborate. We know that for households which buy food, the main elements of their food supply system are market supply, household demand, intra-family distribution and dietary intake. For subsistence food supply systems the array depends on the household productive activity but essentially it is made up of household production, possibly an element of market exchange, a method of food storage, intra-family food distribution and individual dietary intake.

To this simple flow chart we can relate the influence of the 'environmental hierarchy' we have constructed in order to show how the efficiency of each part of the food supply system is affected by the exogenous forces which play on it (Fig. 2).

There are two general questions we should have in our minds. First, how well is the food-supply system performing? (for example, what is the level of household productivity, household income, exchange entitlements, food availability to the household, prevalence of disease). And second, how stable is it? (for example, do seasonal variations occur, do climatic conditions vary from year to year, are wage rates and food prices stable, do disease rates vary widely?).

(3) *The collection of information.* If more precise information is required each element of the food supply system can be measured with greater or less precision. A list of the main indicators of food-supply-system performance is shown in Fig. 3.

	Subsistence food supply systems	Market-dependent food supply systems
Individual level	• Nutritional status–individual Dietary intake–individual Disease rates–individual	
Household (HH) level	• Food stocks–HH Production–HH	Food bought–HH Income–HH
Economic level		Market supply–commodity Retail price–commodity
Physical level	Productivity–region	

Fig. 3. Some major indicators of food supply system performance. •Difficult to obtain accurate information on a large scale.

However, we may not require and may not be able to obtain information in every category listed here. Our choice will be determined by the points along the food chain where the problems seem to exist, by the resources at our disposal and by the apparent seriousness of the situation. More detailed studies of the segments of the food chain may be required to put, in a manner of speaking, a particular part of the problem under a microscope but generally the array shown here will be enough to identify the points within the food supply system which contribute to the nutritional problem for a particular group of households.

This analysis should give the following results: (a) a list of the causes which are contributing to the nutrition problem of an area; (b) their relative importance; (c) their position in the cause and effect sequence; (d) the identity of the households which are affected; (e) the severity of the problem.

A number of methodological problems remain. They are all related to the interpretation and are all amenable to solution as a result of research.

The first is the problem of cause and association. The diagnostic process implies that the syndrome of PEM is not only associated with a series of factors which have been identified and measured but also caused by them. While it may be possible to show an associative relationship this does not necessarily imply a causal one.

The second problem is concerned with ranking the set of 'causative factors' in terms of their importance. To do this we must know something about the functional relationships between the elements of the food supply system and the environmental factors which influence it. Furthermore, we must know how households themselves respond to changes in the factors which are likely to influence their nutritional welfare.

There are two final points: The first is that where food supply and nutritional welfare are in peril, or where they are unstable, some of us would recommend that the diagnostic process becomes a continuous activity. This is called variously food and nutrition surveillance or nutritional surveillance. It is intended to be no more than a diagnostic tool for planning, management and the evaluation of the results of intervention. However, it has a preventive use in that it provides a predictive, as well as a documentary, output. The second is this. In contrast to the usual clinical situation, the prevention of malnutrition is frequently not in the hands of the man who makes the diagnosis. Indeed, such is the anatomy of power that it is often in the hands of the policy-makers who must balance conflicting interests in their administration of scarce resources and who may have to rely on technical advice from a number of sources when formulating policies and plans.

Thus an element of persuasion is inherent in the diagnosis of malnutrition which I suspect is more important in the prevention of a problem than in its cure. It is relatively easy to elicit a response to famine when the problem is obvious and gross; it is more difficult to persuade administrators, either national or international, of the importance of a problem which is covert or only 'probable'. In addition, the conceptual gap between technical professionals and administrators is often considerable and sometimes results in a loss of confidence on both sides. Hopefully as diagnostic reliability improves this problem will diminish.

Meantime, if we accept the role of 'persuader' which I believe we should, then we must also accept the responsibility of representing our findings clearly and persuasively, which is in itself, a challenging exercise in communication.

Conclusion

We have argued that a diagnosis of PEM, which is useful for prevention, is incomplete unless it specifies and ranks causes (Whitehead, 1977). We have

suggested that the household is the site of the pathology which is exhibited as malnutrition in its children so that an analysis of the household's functional competence (its productivity and the disposal of its resources) is the key to the diagnosis of PEM.

We have further suggested that the analysis of the factors which influence household productivity both exogenous and endogenous can be approached just as systematically as the diagnosis of any disease.

An accurate and sufficient diagnosis does not mean an end to the problem of malnutrition. However, it should provide a precise basis for policies, management and intervention to prevent malnutrition even if the design of programmes has to be tempered by the 'art of the possible'.

A great deal of work remains to be done, both practically, and in the field of research. At the end of the day the diagnostician may not be the healer but he will be, and should be, an advocate for poor people in the political arena. We have a duty, therefore, to present our diagnosis lucidly and imaginatively.

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