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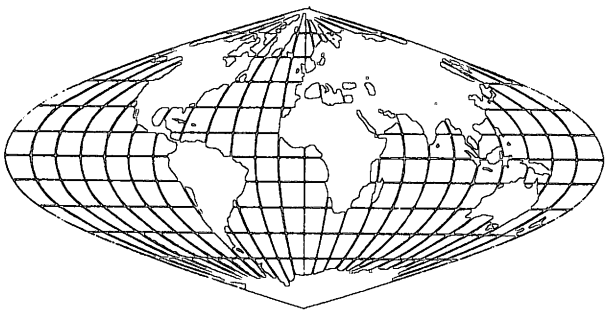
SOCIOECONOMIC DETERMINANTS OF CHILD MALNUTRITION IN SRI LANKA:

THE EVIDENCE FROM GALLE AND KALUTARA DISTRICTS

Seneka Abeyratne and Thomas T. Poleman



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July 1983

I have for many years been interested in the food and nutrition situation in Sri Lanka and have, with my students, studied it at length. The results have frequently been frustrating. Although Sri Lanka is, by the standards of the developing world, relatively amenable to quantification, the numbers as often as not have defied interpretation.

I was, for instance, privileged to be associated with the 1969/70 Socio-Economic Survey, through which uncommonly detailed information on apparent food consumption was collected for 10,000 households. But depending on which criteria you chose to judge the findings against, they could be used to prove either that 43 percent of the population suffered protein-energy malnutrition or that none did. Similarly, the 1975/76 Nutrition Survey seemed to suggest that 42 percent of the island's children were suffering from second and third degree PEM. But how could one reconcile so high a figure with an infant mortality rate of less than 50 per 1,000 and a life expectancy of 66 years?

Part of the problem, it seemed to me, was that the various surveys measured different things among different people at different times. Might not a truly comprehensive inquiry cut through some of the confusion? Such was the thinking behind Seneka Abeyratne's pilot study of Galle and Kalutara Districts, and although he concludes that the extent of child malnutrition still defies precise measurement, his study puts a number of misconceptions to rest.

Specifically, he concludes that rigid interpretation of the rather arbitrary criteria employed in nutritional anthropometry has led to an exaggeration of PEM in the past; and that means are at hand--chiefly in the form of the Thriposha weaning food program and oral rehydration therapy--for immediate rectification. As neither measure is costly and the infrastructure for them is already in place, they are wholly compatible with the strategy for development being followed by the current government. With minimal expense--but maximal determination--child malnutrition in Sri Lanka could be eliminated within the decade.

Mr. Abeyratne's study was a joint undertaking by Cornell University, the U.S. Department of Agriculture, Marga Institute, and the Food and Nutrition Policy Planning Division of the Government of Sri Lanka, and we wish to acknowledge our indebtedness to the many who helped us.

The study was funded by the U.S. Agency for International Development through the Department of Agriculture. Dr. Roberta van Haeften and Dr. Charlotte Miller, of the USDA's Nutrition Economics Group, guided us unerringly through the bureaucratic labyrinth and graciously tolerated our missing deadline after deadline. Emmy Simmons, of AID's Policy Planning Unit and one of the true experts on consumer surveys, spent many hours helping us improve our questionnaires.

At Marga, Godfrey Gunatilleke, M. M. Mohideen, and L. Wijemanne, made possible our collaboration with their uniquely flexible research group. Especially gratifying was the wise counsel and patient guidance provided by Henry Abeykoon. Mr. Abeykoon began conducting socioeconomic surveys before most of the rest of us were born and that Sri Lanka is as advanced as it is in this regard is a tribute to his labors.

Dr. Raja Ameresekere, Director of Food and Nutrition Policy Planning Division, together with his Deputy, Nimal Hettiaratchy, were kindness personified; they arranged for their Development Officers to double as our enumerators and helped us overcome the numerous logistical problems involved in doing field work in another country.

At Cornell, the contribution of Professor Daniel G. Sisler, who shared with me the satisfaction of guiding Mr. Abeyratne's work, was invaluable. Lillian Thomas prepared the tables, charts and maps. Jill Warner and her computer did the typescript. Thank you all.

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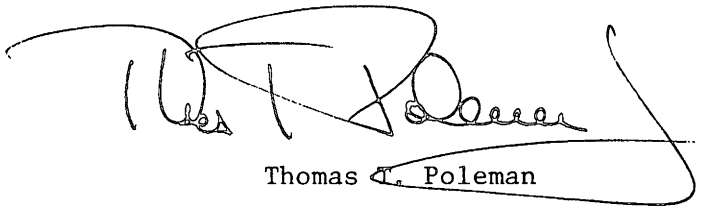

Thomas T. Poleman

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Table of Contents

Chapter I

INTRODUCTION

This study is the outcome of a collaborative effort by Cornell University, the U.S. Department of Agriculture, Marga Institute, and the Food and Nutrition Policy Planning Division of the Government of Sri Lanka to better understand the extent and causes of child malnutrition in Sri Lanka. It draws on a comprehensive, cross-sectional survey conducted over a period of six weeks among 1000 rural households in Galle and Kalutara Districts during the summer of 1980.

An analysis of nutritional deprivation in its socioeconomic context is the theme. It is not an inquiry into the social etiology of malnutrition. Such insights cannot ensue from a six-week survey, since, by definition, social etiology is a dynamic concept. Such a survey can, however, identify linkages between socioeconomic factors and nutritional status. To the policy maker these linkages are of critical importance: they apprise him of his options. Upon learning, say, that poor sanitation can be related statistically to malnutrition, he cannot conclude that it is the cause -- but he can predict with confidence that improving sanitation will have a salutary effect on nutrition.

The last decade has seen an impressive array of nutrition planning models prescribed by international experts for Sri Lanka and other developing countries. Virtually all, because of their bewildering complexity and the social tinkering they would entail, have fallen on deaf ears. Few have offered down-to-earth, practical measures for alleviating malnutrition, and few have been based on country-specific empirical evidence. We hope this study is a modest step in a different direction.

Quantifying Nutritional Deprivation in Developing Countries[1/]

A statistical methodology has yet to be developed that can quantify malnutrition[2/] in the less-developed countries (LDCs) with an acceptable

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[1/] This section draws heavily on the work of T.T. Poleman -- specifically 25, 26, and 27.

[2/] Rigorously defined, the term malnutrition means any disorder of nutrition caused by inappropriate dietary intake, be it inadequate or excessive. Under this definition, any nutrient deficiency (undernutrition) or excess (overnutrition) may be called malnutrition. The term protein-energy malnutrition (PEM) refers to a spectrum of disease caused by dietary

degree of accuracy. This is because of the difficulties of measuring the food needs of a population, the food available to it, and the impact income has on a person's ability to consume. Historically, food availabilities have been underestimated and food requirements overstated, so that the extent of malnutrition has been exaggerated. This has been a failing of most of the world food studies conducted during the past 30 or 40 years.

The findings of these surveys are summarized graphically in Figure 1. No more than a cursory glance is needed to note the extent to which they disagree. For instance, the most recent of these studies, the Food and Agriculture Organization's (FAO's) Fourth World Food Survey (15) concluded that about 450 million people were suffering from protein-energy malnutrition (PEM), while in the World Bank's Malnutrition and Poverty (29), the corresponding figure was an awesome 1.2 billion. Such widely differing conclusions leave the reader in considerable doubt regarding the credibility of these surveys.

In the early surveys -- the FAO's first two World Food Surveys (12, 13) and the United States Department of Agriculture's (USDA's) two World Food Budgets (32, 33) -- the analytical approach was to set apparent per capita food availabilities minus handling, storage and transporation losses, against estimated per capita nutrient needs. When and where the outcome was positive, the country's or region's entire population was deemed adequately fed, whereas in the reverse situation it was considered to be inadequately nourished. The conceptual errors inherent in this sort of exercise are numerous, and when probed, obvious.

Food availabilities are obtained from a food balance sheet calculation in which the annual food supplies (reflecting production, trade and stock changes) are adjusted for wastage and utilization (in seed and feed use). Because agricultural reporting systems in most LDC's are poorly developed, production -- the principal item on the balance sheet's supply side -- tends to be understated. Output which is not seen or which does not pass through regular commercial channels (where it might be monitored) is not counted. Moreover, farmers tend to underreport production because of lingering fears that statistical officers are not really statistical officers but only tax collectors masquerading as such (25, p. 241).

In contrast to food availabilities, which are generally underestimated, the estimation of food needs has tended to err in the opposite direction (27, p. 5). Several important variables determine an individual's nutritional requirements. Once these factors are known, it is theoretically possible to set minimum intake levels for nutrients such as energy, protein, vitamins and minerals; in practice it is very difficult to

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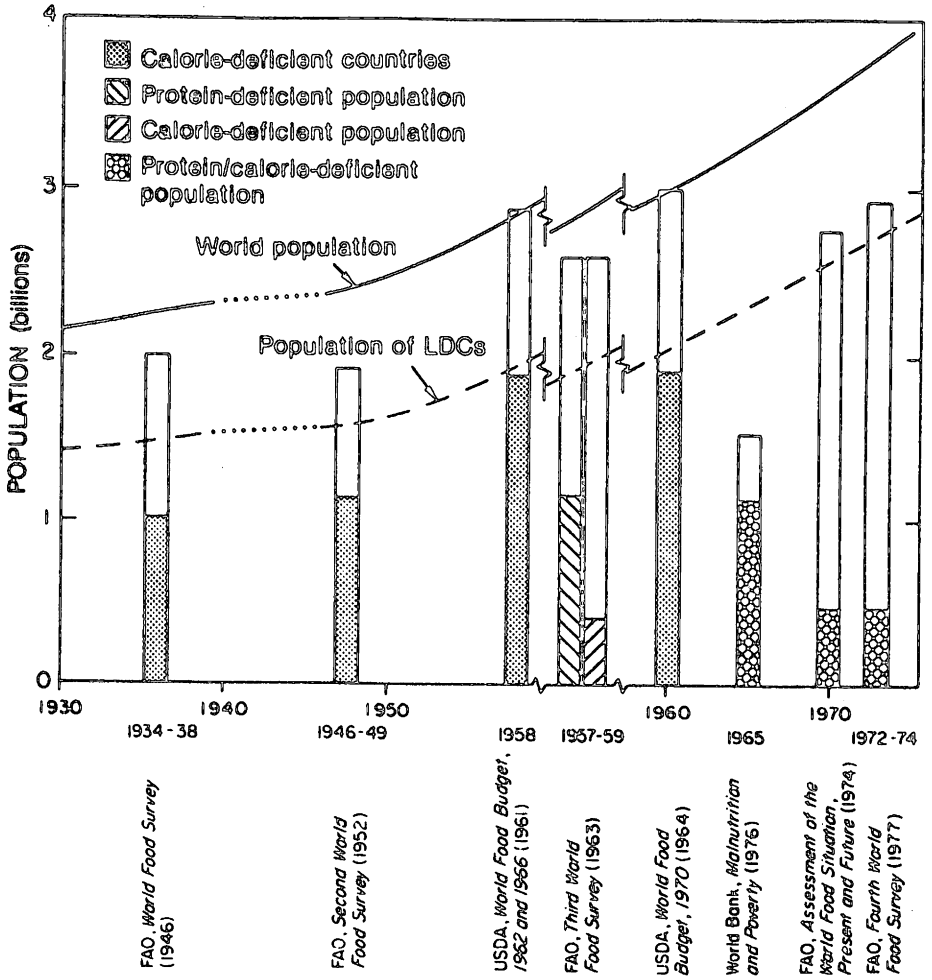
deficiency of energy or protein. Mild PEM is characterized by retarded growth, and moderate PEM, by additional biochemical changes. Severe cases are classified into marasmus, caused mainly by energy deficiency, and kwashiorkor, in which protein deficiency predominates (30, pp. 879-887). Leaving the formalities aside, it is common practice to use the terms malnutrition and PEM interchangeably and to equate undernutrition with energy deficiency.

FIGURE 1. PERSONS IDENTIFIED AS NUTRITIONALLY DEFICIENT IN IN MAJOR WORLD FOOD ASSESSMENTS*



The size of the populations to which the assessments apply is indicated by the total height of bars.

*Reproduced from Thomas T. Poleman, World Hunger: Extent, Causes, and Cures (Cornell/International Agricultural Economics Study No. 9, May 1982), p. 3.

do so. Consequently, what have been commonly employed as surrogates for minimal food needs are the so-called "recommended dietary allowances" designed for use by dietitians and other health workers. These include a significant safety factor to ensure that variations from one individual to another with respect to nutrient needs will be adequately covered.

The recommended allowances have been periodically modified downwards; and it can be inferred from this that "minimum" nutritional needs were overestimated in the past. In the case of protein, prior to 1971, the recommended allowance for adults was set by the FAO at 61 grams and thereafter a figure of 40 grams was used. The impact of this change was dramatic. Prior to it, the FAO's Third World Food Survey (14) suggested that virtually all the world's low-income countries were protein deficient. After it, a simple comparison of per capita availabilities and needs implied that none were.

With respect to calories, the change came a few years later. In the first two World Food Surveys (12, 13), energy requirements for Asia were set at 2,600 and 2,230-2,300 calories per person per day, respectively. The excessiveness of these figures was duly recognized by the FAO, and in preparation for the 1974 World Food Conference, it employed a new technique for estimating minimum energy needs. The energy cost for maintenance of an average, nonfasting person was set at 1.5 times the basal metabolic rate (BMR), minus a factor of 20 percent to take care of individual variations in BMR below the norm. From this formula of (.8) (1.5) (BMR) = 1.2 (BMR), the minimum per capita energy requirement obtained for Asia was in the order of about 1,500 calories. This, if anything, was an underestimation. It is likely that the correct figure lies somewhere between this new figure and the older ones employed by the FAO (27, p. 6).

The essential point is that the tendency on the whole was for the early FAO and USDA studies to overestimate food needs and underestimate food availabilities and thus exaggerate the extent of hunger. The FAO's Second World Food Survey (13) concluded that about two-thirds of mankind were hungry and the USDA's two World Food Budgets (32, 33) concluded that nearly the entire Third World population was nutritionally at risk.

The FAO's Third World Food Survey (14) was the first global study to attempt to quantify the impact of income on food intake. This relationship is now recognized as being critical and estimating its parameters was at the heart of the World Bank study of 1976 (29). The FAO's Fourth World Food Survey, conducted in 1977 (15), also stressed it.

Despite being conducted in two consecutive years, the World Bank and FAO evaluations of the Third World nutrition situation differed widely. Whereas the FAO put the number of protein-calorie deficient people at about 450 million, the World Bank arrived at the much larger figure of 1.2 billion. The main reason for this difference was not the manner in which access to food was estimated, but the manner in which food needs were derived. The FAO employed the 1.2 (BMR) floor criterion for calories, whereas the World Bank used the old recommended dietary allowances (27, p. 12). The result was a discrepancy of 700 million people.

During the last decade or so, an alternative methodology for defining and quantifying malnutrition has gained increasing prominence. The young science of nutritional anthropometry focusses on the preschool child on the eminently reasonable grounds that, because the early growth phase is the most demanding in the human life cycle, young children are the most vulnerable to PEM.

Anthropometry involves the measurement of growth and stature. It has the edge over most other field methods in that it requires little time and money and can be executed by any intelligent layman with a modest amount of training. But, as will be seen, it is not without problems.

Height-for-age (HA) and weight-for-height (WH) are two frequently used measures. To determine if a child is malnourished, his HA or WH is compared against the reference median of a universal growth standard (such as the Harvard standard), reduced by a certain amount to take care of possible differences in size between white and non-white children. If the child falls below the cutoff point, he is regarded as being malnourished, whereas if he is above, all is presumed well.

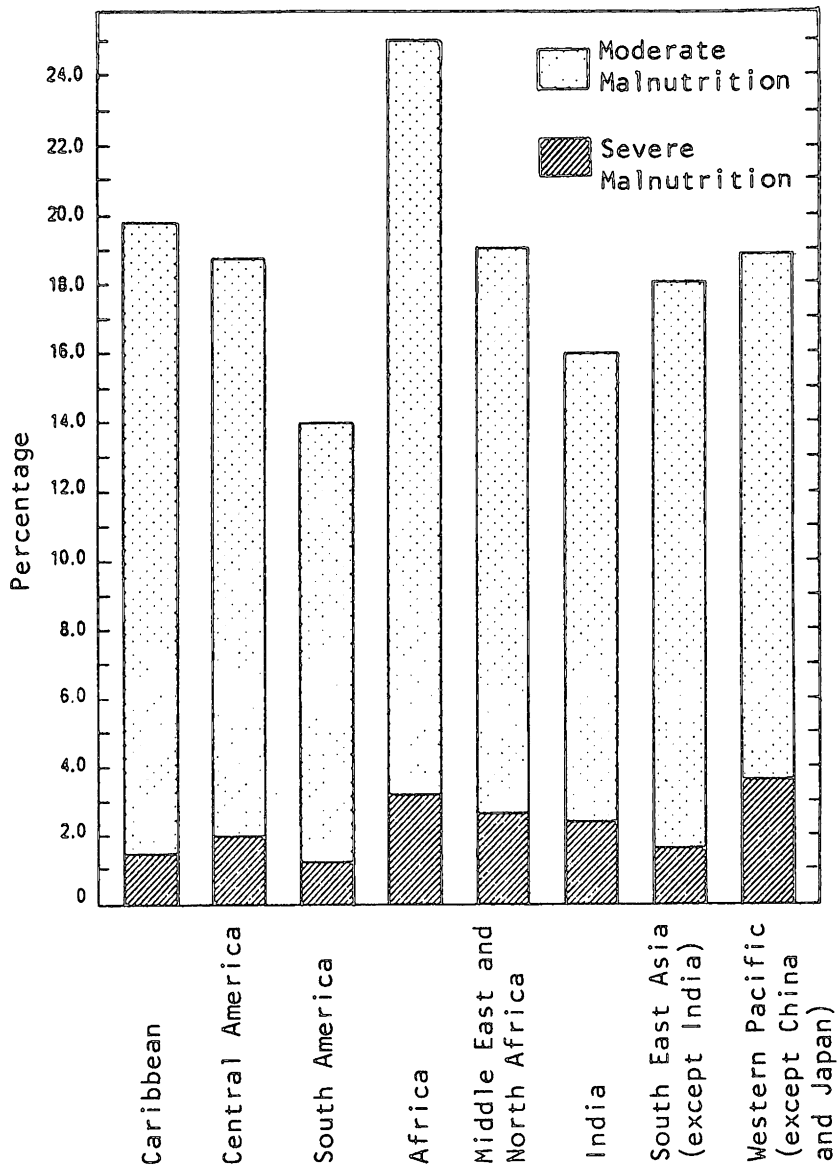
The HA and WH indicators conceptually belong to two different "classes." HA is a measure of linear growth and WH, a measure of tissue mass. Both HA and WH deficiencies are regarded as being caused by a diet low in energy and protein, but with a HA deficiency reflecting past "chronic" hunger and a WH deficiency recent "acute" hunger. These two disorders are frequently described by the terms "stunting" and "wasting." But because they conjure up images of severely emaciated children, we will use two milder expressions: linear undergrowth and leanness, respectively.

Another indicator is the weight-for-age (WA) index, which has been the one most used by nutritionists (34, p. 491). Children with marasmus and kwashiorkor are commonly found to have a WA less than 60 percent of the reference median, and accordingly, this cutoff point is widely used in defining the state of severe (or third degree) PEM. Likewise, children falling in the 60-80 percent range are regarded as suffering from moderate (or second degree) PEM, and from mild (or first degree) PEM if they fall in the 80-90 percent range.

Following these criteria, a large number of anthropometric surveys carried out over a period of roughly ten years were evaluated by Bengoa and Donoso (3). But no global assessment of PEM is possible on the basis of their findings (summarized in Figure 2), since many of the surveys were of small size and dubious typicality (27, p. 26). The fraction of sampled children suffering from severe PEM tended to range from about one to four percent, while the fraction experiencing moderate PEM ranged from about 14 to 25 percent. The study suggested that malnutrition was least prevalent in South America and most prevalent in Africa.

The criteria used by anthropometry in defining and quantifying PEM should be treated with caution. The cutoff points are unblushingly arbitrary and considerable debate attends the question of which of the three indicators -- HA, WH or WA -- is "best." There is also a question as to the applicability of western growth standards to the LDCs. Moreover,

FIGURE 2. PREVALENCE OF SEVERE AND MODERATE PROTEIN-CALORIE MALNUTRITION, BY REGION, 1963-73*



* Reproduced from: Bengoa, J. M. and G. Donoso. "Prevalence of Protein-Calorie Malnutrition, 1963 to 1973." PAG Bulletin, vol. IV, no. 1 (1974), p. 31.

little is known about the future health experience of children suffering from specific anthropometric deficiencies, and until such knowledge is at hand, the implications of these deficiencies cannot be stated with certainty.

Protein-Energy Malnutrition in Sri Lanka: The Evidence and Possible Interpretations

The principal source of anthropometric evidence for the island is the Sri Lanka Nutrition Status Survey (1). This survey was conducted over the period October 1975 - March 1976 and covered all fifteen Health Districts. Its assessment of malnutrition was based on measurements of height and weight collected from approximately 13,500 preschool children in the island's rural and estate sectors.

The Nutrition Status Survey (NSS) used the three standard indicators -- HA, WH and WA -- in presenting evidence of PEM. It concluded that 34.7 percent of preschoolers were suffering from linear undergrowth, 6.6 percent from leanness, and 42 percent from combined second and third degree PEM (1, pp. 20, 23, 29).

These results tend to convey the impression that child malnutrition is widespread in Sri Lanka. But they should not be accepted at face value. The data were compared against a western growth standard -- in this case, the American National Academy of Sciences (NAS) reference median. Although this was inevitable because no local standard was available, the question still remains as to whether or not it led to an overstatement of the problem. The cutoff points used in the study were 90 percent of the reference median for linear undergrowth, 80 percent for leanness, and 75 percent for combined second and third degree PEM. One could speculate as to whether the findings would have changed had the data been subjected to a "sensitivity analysis," i.e., if they had been compared against the median using lower cutoff points. Evidence from our survey suggests that indeed this change could be dramatic. Furthermore, there is little consensus about which of the three indicators is the best overall index of nutritional deprivation in Sri Lanka. If, for example, Sri Lankan children are characteristically thin, the WA index may not be the most appropriate.

Given these difficulties with interpretation, the NSS findings should be treated with caution. They further do not fit with the country's general health situation, which, by Third World standards, is impressive. Life expectancy at birth is about 69 years and infant mortality around 42 per thousand (4, p. 9). Such would not be the case if malnutrition were as widespread as the NSS suggests.

A major drawback of the NSS is that it collected no socioeconomic data. This was because its chief concern was with fulfilling the need for a data base to be used in planning nutrition intervention programs (1, p. 1). Prevalence rates in themselves disaggregated by geographical location are useful to the applied nutritionist. But they are not sufficient for the policy planner who is also interested in who the malnourished are and why they are malnourished.

The major data source on dietary intake is the comprehensive Socio-Economic Survey (7). This covered all three sectors -- urban, rural and estate -- and sampled nearly 10,000 households. To take care of seasonality, the survey was implemented in successive quarterly rounds over the twelve month period November 1969 - October 1970. Its findings on nutritional intakes were based on food consumption data collected at the household level.

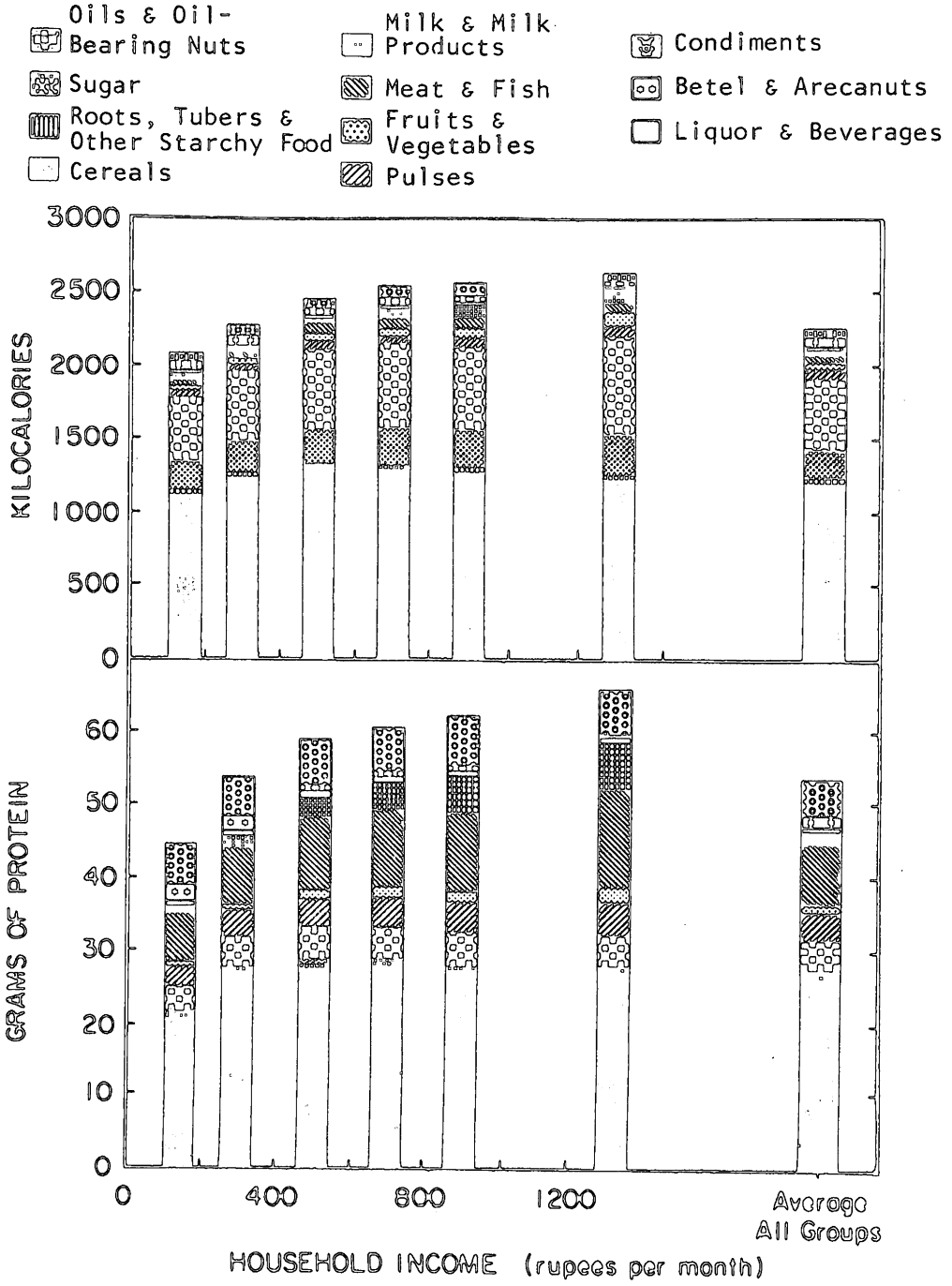
The Socio-Economic Survey (SES) gathered statistics on food expenditure as well as quantities consumed, with each household being monitored for a period of one week. The recall technique was used to collect both expenditure and consumption data. Food quantities purchased were converted into their protein and energy equivalents, and these were presented as apparent per capita intakes at the household level. A display of the results is contained in the Special Report on Food and Nutritional Levels in Sri Lanka (8).

For purposes of estimating the percentage of households with inadequate dietary intakes, one could compare the apparent intakes with a recommended allowance of 2,200 calories which, in 1970, was regarded as the appropriate standard for Sri Lanka. The households are divided into five income classes so that the average, apparent intake of each could also be compared against this standard. Such a comparison indicates that in the lowest income class (under Rs.200 per month), the average is below 2,200 calories, whereas in the other four income classes it is above (Figure 3). Accordingly it might be concluded that approximately 43 percent of households in Sri Lanka are undernourished, this being the share of households belonging to the lowest income class.

But this figure of 43 percent is difficult to interpret. As Figure 3 shows, the relationship between income and hunger is far from clear cut. It is a universally observed principle that as income rises, certain changes in food behavior take place. The relative importance of starchy staples in the diet declines as households begin to purchase more of the expensive foods such as meat, fish, milk and eggs. In the bar chart these changes are perceptible only in the upper four income classes and even there only slightly so. Between the lowest income class and the next there is no change in diet composition. The sole change is a quantitative one: an increase in apparent energy intake of about 200 calories per capita.

> This could mean either of two things. The 200 calorie jump could be interpreted as implying behavior consistent with enforced reduced activity among the very poor (or actual physical deterioration) and that the 1.2 (BMR) energy floor of 1,500 calories is an unrealistically low figure for minimum energy needs in Sri Lanka. But just as reasonably, one might postulate caloric adequacy among that element of society which is too poor to waste anything and which, given the very high rate of unemployment in Sri Lanka, leads a less active life and therefore has lower energy needs. Thus it is possible to have it either way: depending on your assumptions, you can prove beyond a statistical doubt that 43 percent of Ceylonese suffer from protein-calorie malnutrition or none do (26, p. 24).

FIGURE 3. APPARENT PER CAPITA DAILY ENERGY AND PROTEIN AVAILABILITIES IN SRI LANKA, 1969/70, BY INCOME CLASS*



*Reproduced from: Poleman, Thomas T. Income and Consumption: Report to the Government of Sri Lanka. Food and Agriculture Organization, Nutrition Division and United Nations Development Program Report No. TA-3198. Rome, 1973, pp. 18-19. Based on data from: Sri Lanka, Department of Census and Statistics. Socio-Economic Survey of Sri Lanka, 1969/70, Special Report on Food and Nutrition Levels in Sri Lanka. 1972.

Just as the NSS focussed on the individual and ignored the broader environment of the household, so the SES did the opposite. It collected only socioeconomic data and no anthropometric data. Linking individual nutritional status to household socioeconomic conditions hence is not possible on the basis of either of these two surveys. For this reason we contend that, from the point of view of tackling malnutrition through a knowledge of its causes, both the SES and the NSS are of little practical relevance to the planner.

The 1980 Rural Nutrition Survey

This survey, on which the current study is based, was implemented in June-July 1980 in the two southern Districts of Galle and Kalutara. The aim of the survey was to evaluate PEM in its socioeconomic context.

It thus was formulated with the idea of obtaining the sort of results that the SES and NSS would have yielded had they in effect been one survey. Given constraints of time, money and personnel, it was limited in size and scope to that of a pilot project. The specific objectives of the survey were as follows: (a) To define and quantify nutritional deprivation among infants and preschool chidren using certain key indicators of nutritional status, in a sample of rural households selected by an appropriate statistical method. The sample had to be sufficiently small so as to be of manageable proportions, and sufficiently large so as to capture variability of age and sex among infants and preschoolers and of income among households. (b) The construction, using anthropometric data, of a suitable household nutrition index to extend the analysis of the individual to the household. (c) Derivation of indices of socioeconomic status for different classes of households according to the occupation of the household head. (d) To identify, using suitable statistical techniques, the socioeconomic determinants of malnutrition and to relate these findings to nutrition policy.

Chapter II

THE 1980 RURAL NUTRITION SURVEY

Why Galle and Kalutara?

These two Districts are located in the Southwestern coastal region and belong to the low country wet zone (which also includes two other Districts: Colombo and Matara). Typically, the low country wet zone has high population pressure, excessive land fragmentation, low agricultural productivity, and widespread underemployment and unemployment. A great deal of nutritional deprivation is therefore likely to be prevalent in the area, and the 1976 NSS suggested that this was in fact so; it concluded that in both Galle and Kalutara over one-third of the preschoolers were experiencing combined second and third degree PEM.

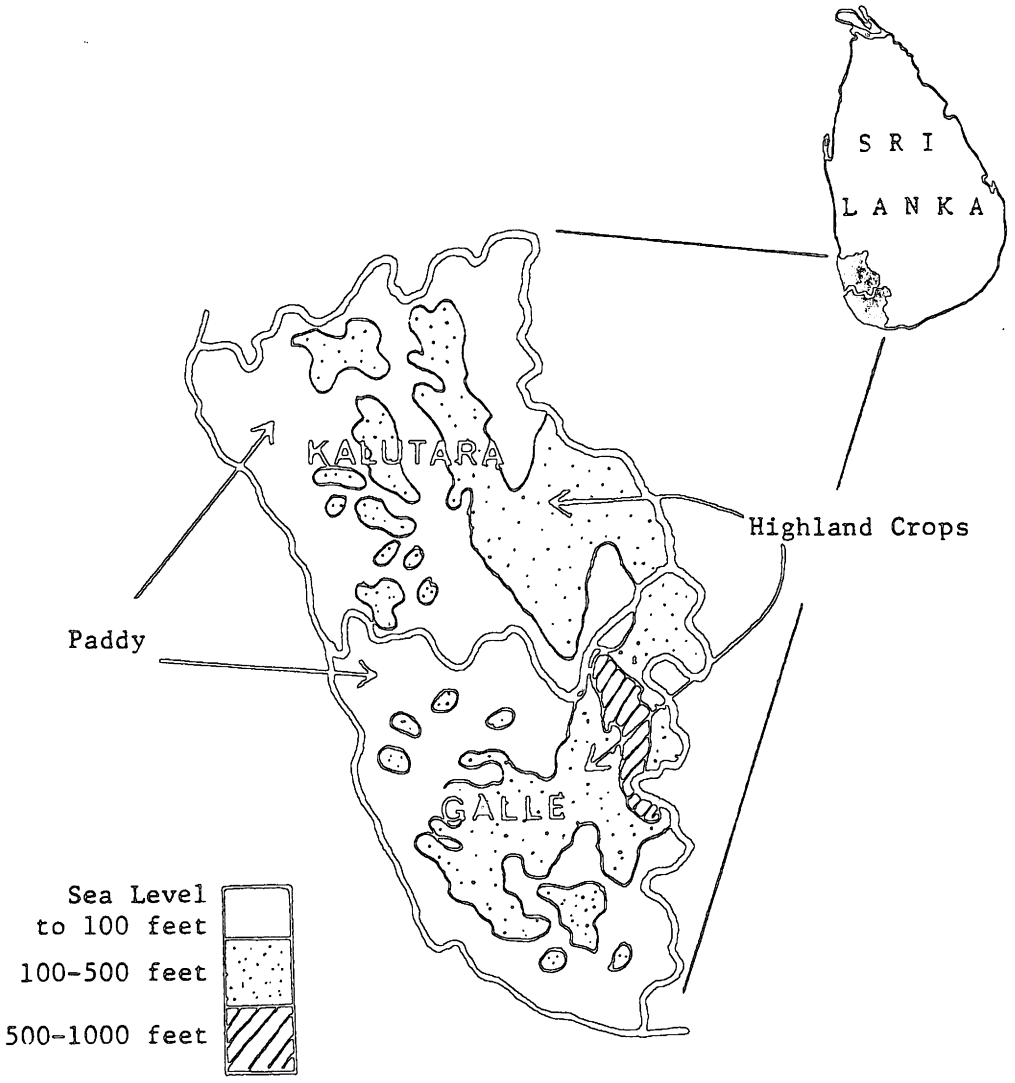
Many of the classic features of underdevelopment are thus present in the rural Southwest. At the same time the cities of Galle and Kalutara are two of Sri Lanka's most important nerve centres, playing a prominent role in such sectors as building and construction, manufacturing, transportation, fisheries and trade. Hence economic development in the area has been lopsided and probably resembles the kind of rural-urban dichotomy observed in other LDCs (23).

In the low country wet zone, crop cultivation is the basis of economic life. Rice is the principal food crop, grown in the lowlying lands (Map 1). Of a total of 1.5 million acres of paddy in Sri Lanka, approximately 27 percent lies in the wet zone. There are about 75,000 acres of paddy land situated in the low country wet zone, which amount to roughly a fifth of the total paddy extent in the wet zone.

The soils of the region are on the whole poor. The principal types are (in descending order of extent and importance) the Half Bog, Bog and mineral (alluvial and colluvial) soils. Given the nature of the two dominant types of landscapes -- the river type and the lagoon type -- flooding, poor drainage, and coastal salinity in dry weather are common physical occurrences (2, p. 33).

In terms of rainfall also, the region is adversely affected. It receives an annual precipitation of over 100 inches, and is one of the wettest parts of the island (Map 2). The two monsoons are unreliable and unpredictable, and tend to vary a great deal from year to year in terms of quantity, distribution and intensity. These factors add to the complex hydrology of the lowlying, poorly drained lands.

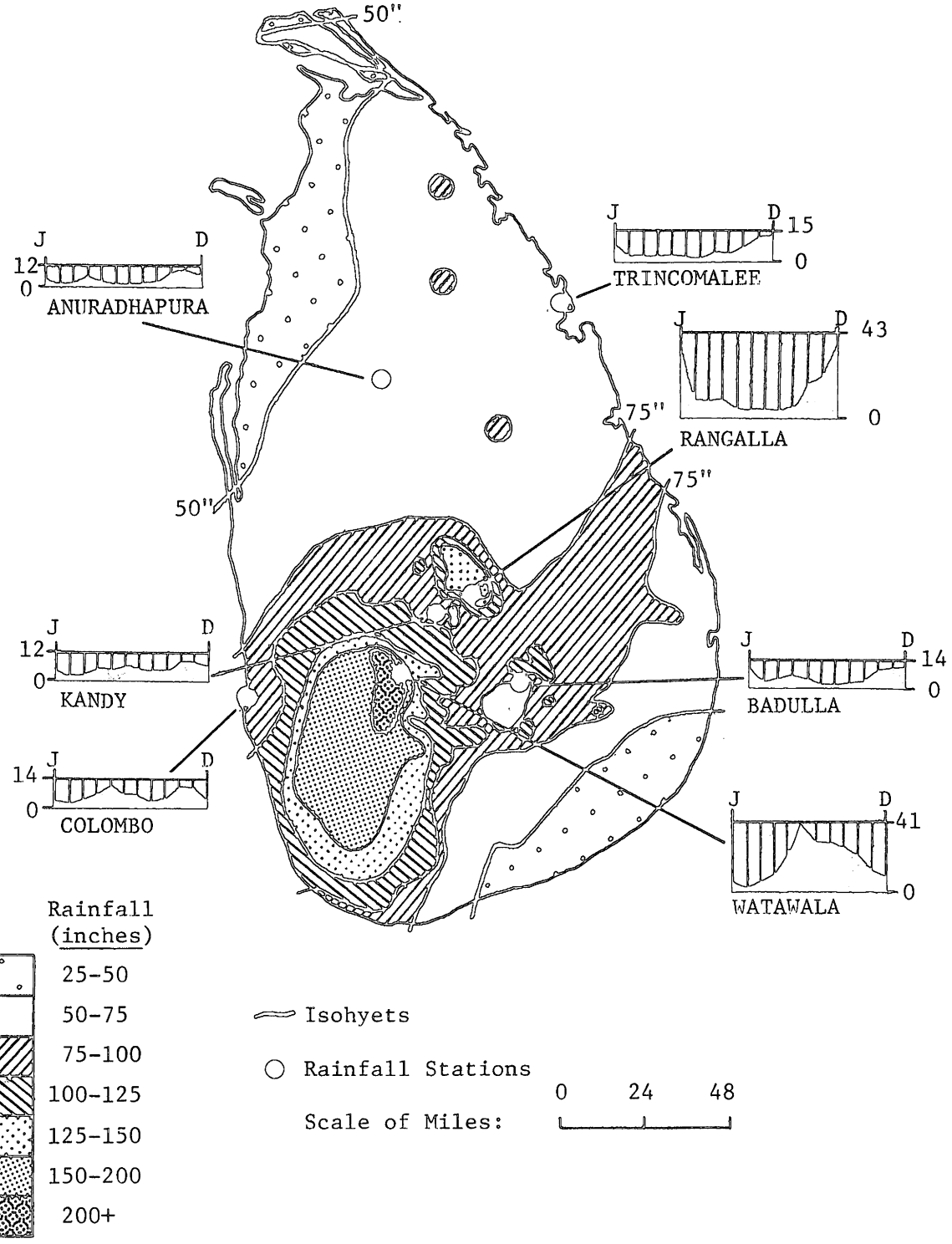
MAP 1. ELEVATION AND LAND USE IN GALLE AND KALUTARA DISTRICTS*



* Adapted from: Department of Census and Statistics, The Ceylon Economic Atlas, 1969, p. 10-A.

MAP 2. ISOHYETS, AND SEASONAL VARIATION IN RAINFALL IN SRI LANKA*

(inches)



Adapted from E. K. Cook, A Geography of Ceylon (London, 1931), pp. 114, 118.

The adverse physical conditions of the Southwest impose considerable constraints on rice productivity. Moreover, paddy holdings are highly fragmented and amount to less than an acre in size on the average. The combined effect of land fragmentation, erratic rainfall, flooding and poor drainage, salinity, and low chemical fertility has been to keep down average rice yields to about 25-30 bushels/acre/annum (1.4-1.7 m.t./hectare/annum). In the past ten years these yields have remained stagnant. In some other areas of the country by contrast, rice yields have grown rapidly and exceed 90 bushels/acre/annum (5 m.t./hectare/annum).

Rice cultivation is confined primarily to the lowlying, poorly drained and imperfectly drained soils. A diverse range of crops is grown in the better drained lands of higher relief. These crops are largely perennial and include tea, rubber, coconut, cinnamon, jak, and breadfruit. It is common to find a farmer cultivating a piece of highland as well as a piece of lowland, although physically they are in different locations. In this area, the bulk of the rice produced is retained for home consumption, so that farm income derives mostly from the sale of highland crops. But because of poor agro-climatic conditions, the productivity of highland agriculture has also grown little.

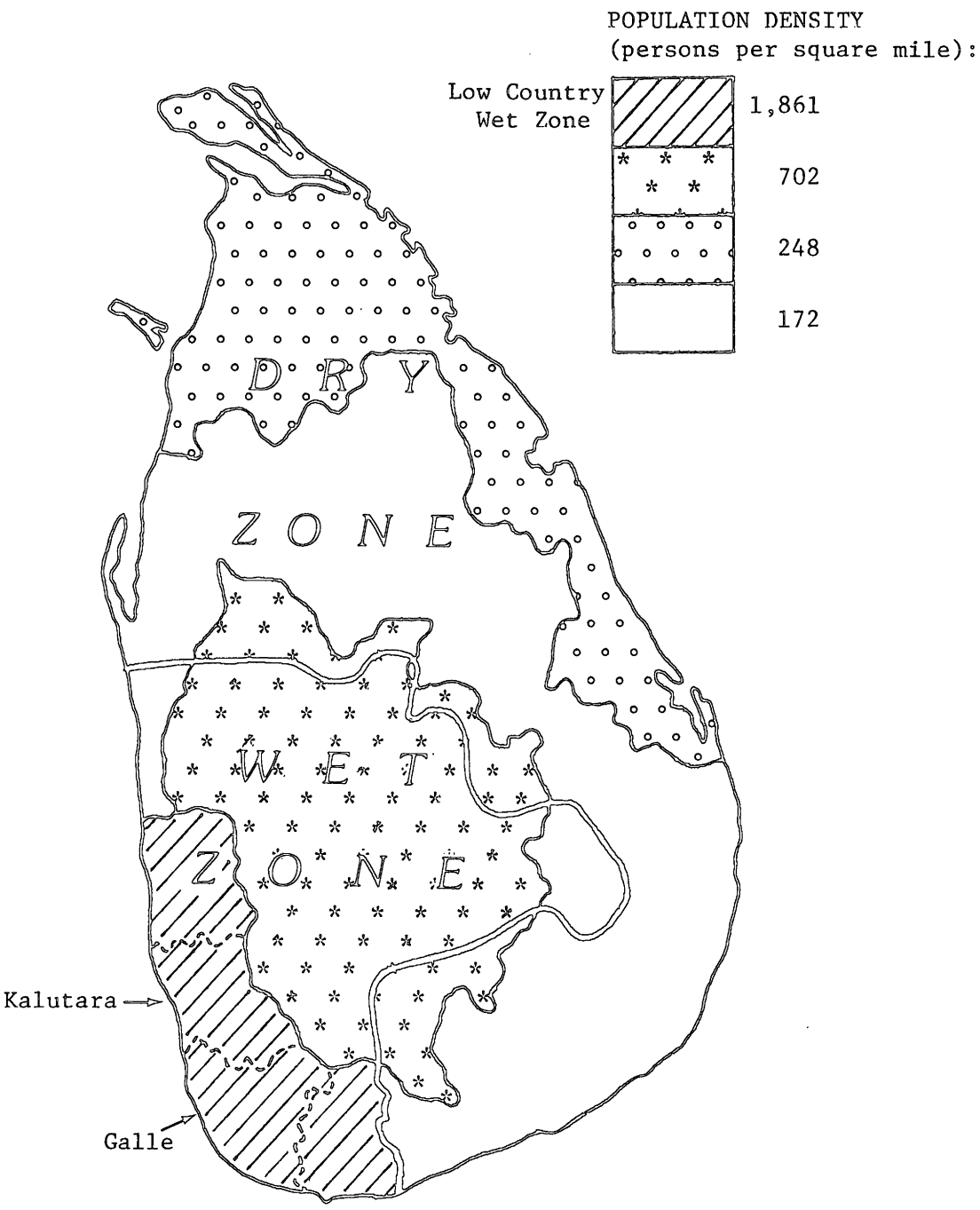
Limited land is a major constraint to sustained agricultural development in the Southwest. The wet zone has about 75 percent of the island's population and 40 percent of its land, while the dry zone has 60 percent of its land and only 25 percent of the population. Thus in terms of the man-land ratio the wet zone is unfavourably placed. The Southwest is the most densely populated part of the island; the number of persons per square mile is close to 1,900 as compared to 172 in the dry zone (Map 3).

On account of the intense competition for land in the rural Southwest, the process of fragmentation has gained increasing momentum over the years. That some of the most complex tenurial arrangements are found in this part of the island is a direct reflection of this. Rice lands have become increasingly subdivided and accompanying all this has been the increased displacement of farmers from the land.

On the whole the low country wet zone is an area where physical problems of the environment (poor soils, erratic rainfall, flooding) as well as its social problems (poverty, unemployment, landlessness) are highly pronounced and enmeshed in the most complicated fashion. These were compelling enough reasons for this region to be selected as the location for this study.

Nutritional factors were another key consideration. The findings of the NSS were that in the wet zone collectively, prevalence of malnutrition was far greater than in the dry zone. It was logical that some area of the wet zone, not the dry zone, should qualify as a candidate for in-depth research. Galle and Kalutara are representative areas of the Southwest. They are adjacent to one another and endowed with similar agro-ecological characteristics. This feature was a useful "control" from the point of view of the consideration that had the sample cut across two Districts with vastly different physical environments, the analysis could have been confounded. An urban component was excluded from the sample for the reason that a large share of the region's population, as well as its problems, belong to the rural sector.

MAP 3. DISTRIBUTION OF POPULATION DENSITY IN SRI LANKA



Adapted from Indrajith Balasuriya, Development of Coastal Poorly Drained Lands for Rice Cultivation in the Wet Zone of Sri Lanka (unpublished M.S. thesis, Cornell University, Ithaca, N.Y., 1982), p. 19.

Sampling Frame

The 24 Administrative Districts of Sri Lanka are subdivided into several Assistant Government Agent (AGA) Divisions, each of which is further subdivided into Grama Sevaka (GS) Divisions. In some instances several villages make up a GS Division, whereas in others a village and GS Division are one and the same.

The survey adopted a three-stage sampling frame with the principle of randomized selection being applied strictly only to the first stage. The sampling procedures followed in both Districts were identical: Eight rural GS Divisions were initially randomly selected. From these eight, four were selected in such a way as to give the best geographical spread between the coast and the interior. In Kalutara, the outcome was that three GS Divisions were located in the interior and one near the coast. In Galle, two were in the interior and two near the coast (Map 4). At the second stage, a village was selected randomly from each of the four GS Divisions.[1/] However, in one case the village was found to be too small in terms of population (under 50 families). This was rejected in favor of a larger one hand-picked from the relevant GS Division. At the third stage, all households with at least one preschool child (aged 6-59 months) in each of the four villages were earmarked for sampling. These were identified by prelisting all households in these villages prior to the survey.

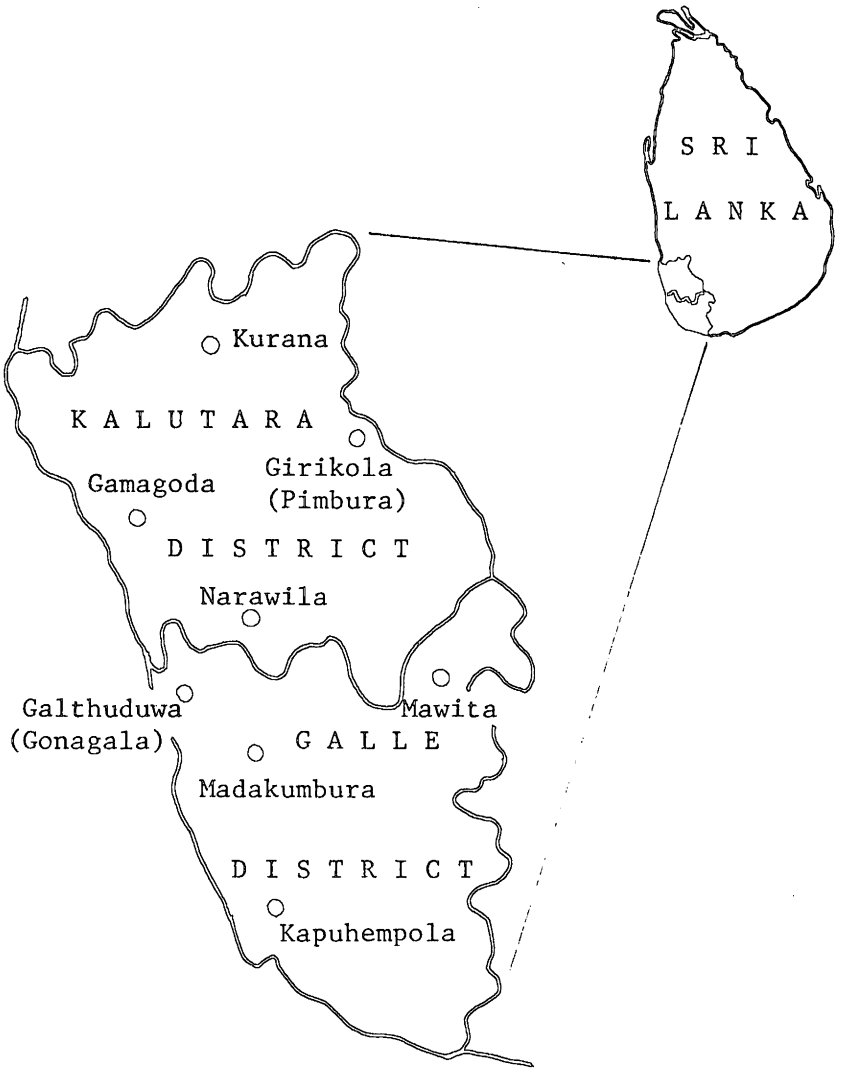
A total of 1,010 households were sampled (506 from Galle and 504 from Kalutara) of which 55 were rejected because of missing or "nonsense" data. The number of preschoolers corresponding to each District was, respectively, 667 and 689. On account of 55 households being rejected, 64 preschoolers were also dropped from the analysis. Details of the sampling frame are provided in Table 1.

Sampling Unit

The sampling unit was defined to be a household with at least one preschool child. A household in turn was defined as a collection of individuals eating from the same pot. Thus two families living under the same roof but cooking and eating separately were regarded as two separate households, whereas two families living under the same roof and eating from a common pot were regarded as one household. The socioeconomic investigation was conducted at the level of the household. Anthropometric measurements were collected for preschoolers, and only those belonging to households covered by the socioeconomic questionnaire. There was no instance of socioeconomic data being collected without anthropometric data, or vice versa, from any household.

[1/] But in the majority of cases, the village and GS Division were one and the same.

MAP 4. LOCATION OF SAMPLED VILLAGES IN GALLE AND KALUTARA DISTRICTS*



* Village names and Grama Sevaka Division names are the same, except where Grama Sevaka names are noted in parentheses.

TABLE 1. SAMPLED VILLAGES CATEGORIZED BY GS DIVISION, AGA DIVISION,[a/] AND DISTRICT

Village	GS Division	AGA Division	District
Madakumbura	Madakumbura	Karandeniya	Galle
Galthuduwa	Gonagala	Benthara-Walalwita Korala (West)	Galle
Kapuhempola	Kapuhempola	Bope-Poddala	Galle
Mawita	Mawita	Hinidum Paththuwa	Galle
Gamagoda	Gamagoda	Dodangoda	Kalutara
Narawila	Narawila	Mathugama	Kalutara
Girikola	Pimbura	Agalawatta	Kalutara
Kurana	Kurana	Horana	Kalutara

a/ AGA Divisions did not enter into sampling frame.

Data Collection

The questionnaire consisted of two parts (see Appendix).[2/] The first part corresponded to the socioeconomic components of the survey and was the responsibility of a team of Government Development Officers, all with Degrees in Science or Arts. The second part consisted of the anthropometric and related components and was handled by a team of Public Health Inspectors.

Information collected in the first part related to literacy, education, employment, consumption expenditure, dietary intake, food prices, housing quality and farm characteristics. Dietary information was obtained on the basis of recall and covered the two days prior to the day of the interview. Expenditure on food was not directly recorded, but food prices were collected from the major food outlets (usually one or two) in each village. The recall method was also used to record household expenditure on non-food items for a period of twelve months.

Data items in the second part included age, height, weight, and immunization. Age was directly obtained from birth certificates in over 90 percent of the cases and from horoscopes or similar documents in the remaining cases. Immunization records were procured from health cards. Height and weight were recorded using measuring boards and Salter scales, respectively. The portable wooden board allowed height to be read to the nearest 0.1 centimeter and the Salter hanging scale measured weight to the nearest 0.1 kilogram. Arm circumference was not included as a data item.

The Two Districts were sampled simultaneously. The survey began in the latter part of June 1980 and took about six weeks to complete.

2/Copies of the Appendix are available upon request from the Department of Agricultural Economics, Cornell University, Ithaca, New York 14853-0398.

Chapter III

THE FINDINGS: ASSESSMENT OF NUTRITIONAL STATUS

Anthropometry was the basis for defining malnutrition and quantifying its extent. The indicators used were height-for-age (HA), weight-for-height (WH), and weight-for-age (WA). The study followed the conventional practice of determining prevalence rates according to criteria suggested by Waterlow (35, pp. 13-26) for defining HA and WH deficiency, and Gomez (18, p. 77) for defining WA deficiency. The cutoff points were 90 and 80 percent of the reference median for linear undergrowth and leanness, and 75 and 60 percent of the reference median for second and third degree PEM, respectively.

The principal difference between the 1976 NSS and our survey was that the cutoff points were applied in the NSS to the NAS reference median, whereas in our survey they were applied to the Harvard reference median. This was done for reasons of convenience -- a computer compatible algorithm was available to us only for the Harvard standard -- and had minimal effect on the results. Although the NAS standard is more recent, its median differs from the Harvard median by less than five percent. Further, while the NSS employed two different medians for the male and female sex, our study used a unified one for both sexes, again for ease of analysis. Again the effect is negligible: among preschoolers, variances between the sexes with respect to growth and stature are at a minimum.

Evaluating Nutritional Anthropometry

Anthropometric measurements are easy to collect since only average intelligence (not that of specialists) is required. The procedure is quick, so large numbers of children can be surveyed in the space of a few hours. It is also simple and expensive, requiring little more than a measuring board and weighing scales. Above all, it inspires confidence insofar as data reliability is concerned because the measurements can be obtained with a relatively high degree of precision and accuracy.

While these are the advantages of anthropometry, its weaknesses are equally impressive. Anthropometric indicators are unreliable if applied to children over ten years because of the physical and biological changes associated with puberty. Nor can they be applied to pregnant and lactating women without producing similar distortions (36, p. 3). Thus as a method of appraisal, anthropometry is meaningless for anyone beyond puberty and probably beyond five years. Even with regard to children below this age limit, the scenario is not without blemish. The issue of how relevant anthropometric indices are for infants and toddlers (preschoolers) of

low-income countries remains unresolved, especially when they are being compared with children of Northern stock.

The way these indicators are derived is by expressing, say, the child's height, as a percentage of the corresponding HA value on the Harvard or NAS reference scale. This index, if above an arbitrary cutoff point is termed satisfactory, and if below, unsatisfactory. Similar procedures are used to derive and evaluate the WH index and WA index.

The question then is, does this technique, as an analytical device, really deserve merit? Does it not overstate the malnutrition problem since by and large the world's Southern races are of much smaller stature than the Northern races? Habicht and others (20, p. 611) argue that actually there is little or no evidence in support of this, so long as the subjects are only infants and preschoolers. Extensive study suggests that among children in the 6-71 month age group, ethnicity does not account significantly for differences in growth and stature; rather they are explained in terms of social class. This report deserves respect in view of its empirical basis and we accept the thesis that anthropometric indicators are unlikely to be greatly distorted by ethnic factors, so long as they pertain to infants and toddlers. But one should not interpret this over-zealously. If, for example, Sri Lanka children are characteristically thin and Thai children characteristically short, would not the WA and HA indicators (respectively) tend to mislead?

To this query, nutritional anthropometrists would respond along the following lines: (a) The so-called standard against which height and weight data of Third World children are compared is actually the fiftieth percentile (i.e., the median) of the particular (Western) reference population. (b) The cutoff point likewise is a percentage of the median of the reference population. Thus a cutoff point of 90 means 90 percent of the fiftieth percentile of, say, the Harvard Standard. A Third World child hence is being compared not with the ideal American child but the average American child, and with him adjusted downward.

In the final analysis, the objective is not so much to precisely define how much an individual is malnourished as it is to identify who in a particular community are less well nourished than others. As the FAO points out (16, p. 78):

> We are concerned here with a relatively crude measure of gross deprivation, and the degrees of deficit are such that the expense of generating a local standard could not be justified.

The Extent of Malnutrition

A total of 1282 infants and preschoolers (51 percent male and 49 percent female) were evaluated with respect to their growth characteristics. With regard to the three deficiency symptoms -- linear undergrowth, leanness, and combined second and third degree malnutrition -- prevalence rates were estimated in terms of simple percentages. In assessing distribution

according to age, use was made of the cross-tabulation technique and the chi-square statistic. Table 2 provides a summary of the simple prevalence rates found. Results of the earlier 1976 NSS are also included, but comparison between the two sets of figures must be made with caution.

The prevalence rates found by our survey were derived after pooling the Galle and Kalutara sub-samples into a single data set. Raw data, however, were not available to perform the same operation with the NSS figures. The NSS presented prevalence rates separately for each of the fifteen Health Districts. For our purposes, the Galle and Kalutara figures were simply averaged (with respect to each of the three anthropometric indicators) so that consistency was maintained.

Our survey found that of the 1,282 children, 22 percent were experiencing some degree of linear undergrowth. Prevalence of leanness on the other hand was around 15 percent. In terms of the WA criterion, close to 40 percent were experiencing combined second and third degree PEM. Thus depending on whether one is looking at the cumulative effects of nutritional inadequacy (HA deficiency), the recent effects of nutritional inadequacy (WH deficiency), or an index of general nutritional inadequacy (WA deficiency), the findings are very different. As linear undergrowth suggests a past history of chronic hunger and leanness a recent occurrence of acute hunger, differentiating between these two is desirable for policy formulation. If the prevalence of leanness is high, this suggests that short-term measures are required to alleviate PEM. But if linear undergrowth is more serious, then more long-term measures may be needed. If both are widespread, the suggestion is that a combination of short as well as long term measures may be appropriate.

In this context, the usefulness of the WA index is open to question, since it does not differentiate between the effects of chronic and acute hunger (34, p. 491). It is, however, important in one regard. In a majority of cases, children falling below the 60 percent cutoff point (in terms of WA) are found to be suffering from marasmus, kwashiorkor, or marasmic-kwashiorkor; to the applied nutritionist, constant knowledge of who and how many such children there are is vital, since a rise in severe malnutrition is associated with a rise in infant and toddler mortality. Thus as an index of gross nutritional deprivation and guide for malnutrition intervention, the WA indicator is not without merit. Table 2 shows that findings of our survey differ significantly from those of the NSS. The NSS had higher prevalence rates for linear undergrowth and combined second and third degree PEM but a lower prevalence rate for leanness. By comparing these two sets of figures, one might be tempted to postulate certain trends in malnutrition, but we refrain from doing so and merely note that they are different.

Nevertheless, both surveys found the prevalence of combined second and third degree PEM to be particularly high. Whether or not these results are an overstatement is a matter for debate.

TABLE 2. 1980 RURAL NUTRITION SURVEY AND 1976 NUTRITION STATUS SURVEY: SUMMARY OF ANTHROPOMETRIC FINDINGS*

(percentage of children sampled)

	1980 Rural Nutrition Survey		1976 Nutrition Status Survey	
	Normal	Deficient	Normal	Deficient
Height-for-Age	78.0	22.0	70.0	30.0
Weight-for-Height	84.9	15.1	92.8	7.2
Weight-for-Age	61.5	38.5	59.8	40.2

*See text for deficiency criteria employed.

Analysis of Height-for-Age by Age

The basic objective of relating PEM to age is to ascertain if any pattern is discernible. Should one be established, it is an important finding, since knowledge has been obtained about which particular age groups are most vulnerable to malnutrition. Table 3 sets out the relationship between linear undergrowth and age. Clearly, the data suggest that prevalence of linear undergrowth increases with age (from 3.7 percent in the first group to 33.8 percent in the last group), and that a sudden jump begins with the one year age group (13-24 months). A possible reason for this is that children being breastfed (those belonging to the infant category) tend to be better nourished than the others. A child taken off breast milk abruptly and transferred directly to an unmodified, or partially modified, adult diet experiences undernutrition when the food is not easily digestible, the diet is unbalanced, or nutrient density is inadequate.

To test these assumptions, the infants in the sample were compared against the preschoolers, who were all lumped into a single group. Prevalence of linear undergrowth was then found to be 24.6 percent for the preschool group as compared to 3.7 percent among the infants. These prevalence rates were statistically significantly different at the 5 percent level, thus supporting the general hypothesis that preschoolers generally are more vulnerable to growth deprivation than infants.

Analysis of Weight-for-Height by Age

From Table 4 it is evident that the relation between leanness and age is not the same as that between linear undergrowth and age. The category with the lowest prevalence is the three year cohort (9.8 percent) and that with the highest prevalence, the one year cohort (23.4 percent). In this instance the data do not suggest a tendency for nutritional deprivation to rise with increasing age.

A possible reason for this might lie in the etiological differences between the two indicators HA and WH. A poor HA index is a consequence of cumulated hunger whereas a poor WH index results from recent hunger. It was seen that preschoolers on the whole had a significantly higher incidence of linear undergrowth than infants, and that this might reflect the cumulative feeding practices of the mother. Age is a decisive factor for the the HA indicator. The WH indicator, on the other hand, is less likely to be sensitive to growth deficiencies related to age. This was why it did not behave like the HA indicator.

The WH prevalence rates obtained separately for infants and preschoolers were 14.2 percent and 15.3 percent, respectively. These figures do not differ significantly in the statistical sense. This probably is because acute hunger is less related to the mother's weaning practices than to recent scarcities of food; these would equally affect children off breast milk as well as those on breast milk. Less food for the lactating mother would mean less breast milk for the infant.

TABLE 3. 1980 RURAL NUTRITION SURVEY: HEIGHT-FOR-AGE (HA) FINDINGS, BY AGE

Age (months)	Normal	Deficient[a/]	Total
6-12	156 96.30[b/]	6 3.70[b/]	162 12.64[c/]
13-24	285 85.59	48 14.41	333 25.98
25-36	221 76.47	68 23.53	289 22.54
37-48	197 69.12	88 30.88	285 22.23
49-59	141 66.20	72 33.80	213 16.61
TOTAL	1,000 78.00	282 22.00	1,282 100.00

a/ Less than 90 percent of Harvard reference median.

b/ Row percentage

c/ Column percentage

TABLE 4. 1980 RURAL NUTRITION SURVEY: WEIGHT-FOR-HEIGHT (WH) FINDINGS, BY AGE

Age (months)	Normal	Deficient[a/]	Total
6-12	139 85.80[b/]	23 14.20[b/]	162 12.64[c/]
13-24	255 76.58	78 23.42	333 25.98
25-36	249 86.16	40 13.84	289 22.54
37-48	257 90.18	28 9.82	285 22.23
49-59	188 88.26	25 11.74	213 16.61
TOTAL	1,088 84.87	194 15.13	1,282 100.00

a/ Less than 80 percent of Harvard reference median.

b/ Row percentage

c/ Column percentage

Analysis of Weight-for-Age by Age

The relationship of combined second and third degree PEM to age is set out in Table 5. Save for a negligible dip in the two year old cohort, the trend is for prevalence of PEM to increase from a low of 19.1 percent in the youngest cohort to 46.5 percent in the oldest cohort. When all the preschoolers were lumped together, the extent of PEM in this group was found to be 41.3 percent. The chi-square test was statistically significant at the 5 percent level and confirmed that preschoolers as a group were more vulnerable to moderate to severe PEM than were infants.

The WA indicator thus has behaved like the HA indicator. This is not surprising since neither of them, unlike the WH indicator, is independent of age. The common denominator in both instances was probably an abrupt switch in feeding habits occurring about one year after birth, leading to deterioration in nutritional status. Children suffering from moderate to severe PEM also tend to be suffering from some degree of linear undergrowth. To this extent, the findings are not inconsistent.

But perhaps these findings should also be seen in another light. Might the ethnic factor be influencing the Harvard standard with respect to HA and WA at a much earlier age than previously thought? Could this be contributing to the dramatic increase in prevalence rates after the first year of life? If so, one would have to reexamine the relevance of applying Western growth standards to Third World situations. The WH indicator is affected less by these problems because it is independent of age. In this sense, WH may be the "safest" of the three anthropometric indicators for developing countries. These hypotheses, however, are largely conjectural and are presented in an exploratory spirit. They cannot be substantiated without further empirical research.

Our findings on the extent of malnutrition in Sri Lanka's Southwest do not necessarily imply that its nutritional situation is poor. Anthropometric measurements, though relatively easy to collect, do not lend themselves readily to interpretation. Although in terms of the three indicators, the prevalence rates are relatively high, we simply do not know, given the arbitrary nature of the cutoff points, whether they point to serious deprivation. As will be seen, a minor lowering of the cutoff points produces a dramatic decrease in prevalence rates. The most secure finding is that preschoolers by and large are less well nourished than infants. This has important implications for intervention policies.

TABLE 5. 1980 RURAL NUTRITION SURVEY: WEIGHT-FOR-AGE (WA) FINDINGS, BY AGE

Age (months)	Normal	2°&3°PEM[a/]	Total
6-12	131 80.86[b/]	31 19.14[b/]	162 12.64[c/]
13-24	206 61.86	127 38.14	333 25.98
25-36	180 62.28	109 37.72	289 22.54
37-48	158 55.44	127 44.56	285 22.23
49-59	114 53.52	99 46.48	213 16.61
TOTAL	789 61.54	493 38.46	1,282 100.00

a/ ≤ 75 percent of Harvard reference median

b/ Row percentage

c/ Column percentage

Chapter IV

THE FINDINGS: FOOD BEHAVIOR

Analysis of food behavior was performed using data from the first part of the questionnaire. Food intakes were recorded for 48 hours, but not the corresponding expenditures. We chose instead to collect prices of foods from the outlets that serviced these households, and to work out the expenditures indirectly. This approach was justified on the grounds that people remember more readily what they eat than what they spend for it.

The food data were "blown up" to obtain monthly estimates of food consumption, and corresponding expenditure estimates were derived by using the average price per food item. Thus expenditure on food was imputed; a price was pegged to each food item consumed, regardless of whether it was purchased or a product of the family farm or home garden. This took care of the problem of what value to attribute to those commodities consumed which were not paid for.

Expenditures on non-food items were obtained by asking the households to state the amounts spent on durable and semi-durable goods, services, festivities, and the like during the past twelve months. Monthly figures were then derived by "shrinking" the annual figures. Total household expenditures therefore equalled the monthly expenditures on food plus other items, and was used in the analysis as a proxy for income. In food consumption analysis, household income is frequently preferred to household expenditure as the more reliable explanatory variable; but the use of household expenditure can be justified on the grounds that (28, p. 81):

> while total expenditure may depend in a complicated way on income expectations and the like, the distribution of expenditures among the various commodities depends only on the level of total expenditure.

All this meant that our survey differed considerably from the 1969/70 SES in the manner in which food consumption and expenditure data were obtained. Since the SES was carried out without rigid time constraints, it was able to monitor the food intake of each household for a period of one week. To the extent that it also recorded these intakes through recall, the techniques of the two surveys were the same. But whereas our survey did not record food expenditures directly, the SES did. Another difference was that the SES did not peg a value to rationed rice since at the time this was issued free. By the time our survey took place, the switch had been made from coupons to food stamps and the wealthier half of the population no longer had access to free rice. Since our survey used expenditure as a surrogate for income, a value was ascribed to rice regardless of whether it was obtained with cash or with food stamps.

Otherwise surrogate income would have been understated for those families enrolled in the food stamp scheme. This is a major reason why (as will be seen) our expenditure estimates were considerably higher than those of the SES.

An analysis of food behavior can lead to many important insights. Among these are an understanding of the quantitative and qualitative changes in diet that take place with rising income. Quantified in terms of income elasticities of demand, such analyses commonly form the basis for food planning in affluent countries. In the context of this study, what is of particular interest is the relationship between income and hunger. This is not as simple as it sounds. We have noted that, depending on one's assumptions, the SES results could lead to the conclusion that 43 percent of Sri Lanka's population suffers from PEM, or that none do.

Equally confusing can be the results of surveys in which the data either were not accurately collected or appropriately manipulated. A convenient way to ascertain whether or not this is the case is to determine if the findings are reasonably in accordance with expected food behavior, as embodied, say, in Engel's and Bennett's laws.

Operation of Engel's and Bennett's Laws

Engel's law is an empirical observation which notes that while absolute expenditure on food increases with household income, the proportion of expenditure devoted to food decreases. Bennett's law observes that the starchy staple ratio -- that is, calories from starchy staples as a proportion of total calories form food -- tends to decline as household income rises. For a survey's findings to conform to these patterns would inspire confidence in its accuracy; any conflicts would give cause for concern.

In the past it was customary to express household variables such as income, expenditure and caloric intake in per capita terms. More recently, the advantages of using adult equivalencies has been recognized. A breakdown of these equivalencies by age and sex is provided in Table 6. This method is preferable because it permits an adjustment to be made for age and sex variatioons within the household. This is important because all members of a household do not have the same nutrient requirements. Hence the use of the following terms in this paper:

CPA	-	calories/day/adult equivalent
TEPA	-	total household expenditure/month/adult equivalent
FEPA	-	household expenditure for food/month/adult equivalent

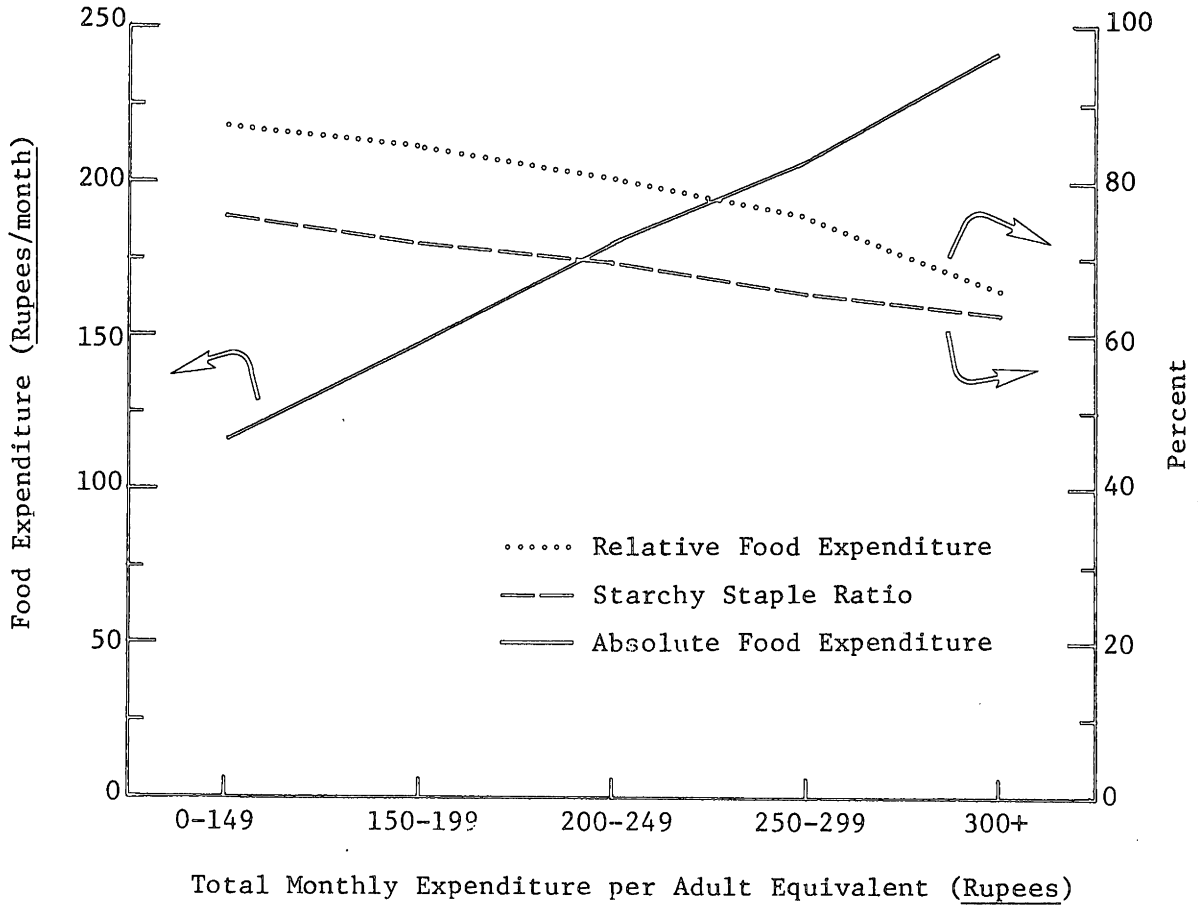
Figure 4 illustrates the effect a change in total expenditures (TEPA) has on absolute expenditures for food (FEPA), relative expenditures for food, and the starchy staple ratio. The curves conform reasonably well to expected patterns. FEPA increases from Rs. 177 in the lowest expenditure group (Rs.0-150) to Rs.242 in the highest expenditure group (Rs. 300+).

TABLE 6. ADULT EQUIVALENCIES BASED ON ENERGY REQUIREMENTS OF CHILDREN, ADOLESCENTS AND ADULTS, BY SEX AND AGE PERIODS

Age (years)	Energy/Input/Day (calories)	Adult Equivalents
Children		
1	820	0.27
1 - 3	1,360	0.45
4 - 6	1,830	0.61
7 - 9	2,190	0.73
Female Adolescents		
10-12	2,350	0.78
13-15	2,490	0.83
16-19	2,310	0.77
Male Adolescents		
10-12	2,600	0.87
13-15	2,900	0.97
16-19	3,070	1.02
Adult Female		
20+	2,200	0.73
Adult Male		
20+	3,000	1.00

Source: Based on FAO, Energy and Protein Requirements (Rome, 1973), p. 34.

FIGURE 4. 1980 RURAL NUTRITION SURVEY: TOTAL EXPENDITURE VS. ABSOLUTE AND RELATIVE EXPENDITURE ON FOOD, AND THE STARCHY STAPLE RATIO



Relative expenditure on food follows an inverse path, decreasing from 87 percent in the lowest expenditure group to 67 percent in the highest expenditure group. The starchy staple ratio also decreases from 76 percent in the lowest expenditure group to 63 percent in the highest expenditure group.[1/]

Of the three curves, only the upward sloping FEPA curve displays a sharp gradient; that is to say, a positive relationship between food outlay and household expenditure (income) is clearly evident. The two negatively-sloped curves on the other hand, decline modestly. But in the statistical sense, their gradients are significant. So all three curves are generally in accordance with expected behavior as embodied in Engel's and Bennett's laws, but the positive gradient is somewhat larger than we might expect and the two negative gradients, somewhat smaller. Indeed the reason why both relative expenditure on food and the starchy staple ratio decline only modestly in relation to TEPA is precisely because the increase in food outlay is so sharp. As to why this is so is not easy to explain. It could suggest that purchasing power in the lower income levels is inadequate, or it could be interpreted as typifying that while the poor are not necessarily hungry, substantial changes and improvements in dietary habits occur with rising incomes. In any event, what the chart illustrates is the overwhelming importance of food in the household budget, even among the wealthier classes. In terms of relative magnitude, nowhere does food expenditure fall below 50 percent.

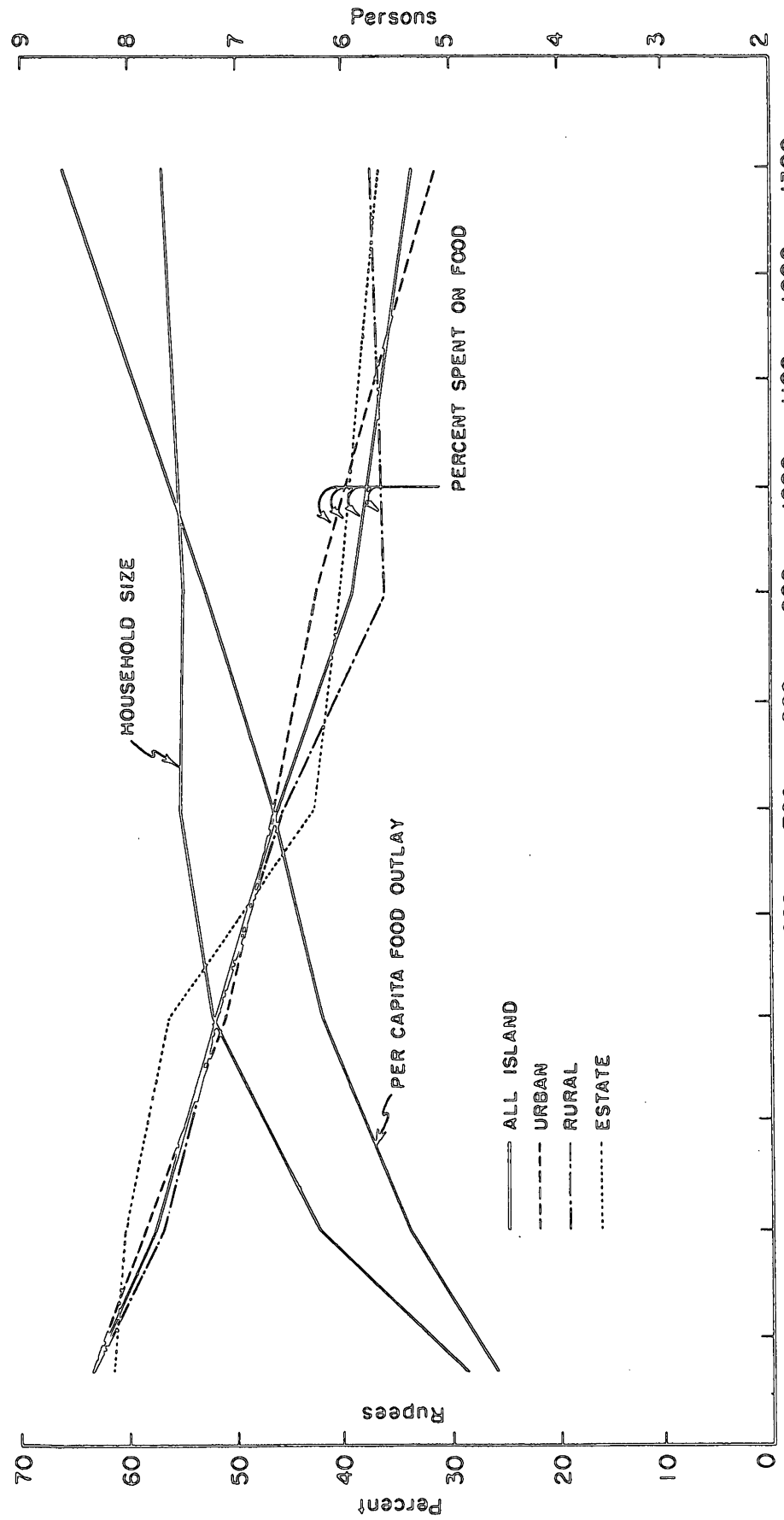
Figure 5 illustrates the comparable findings of the 1969/70 SES. The SES also found the importance of food to persist throughout the income spectrum, but at a relatively lower level than that observed in our survey. Thus relative expenditure on food is around 71 percent for the lowest income class (under Rs.200) and drops to under 50 percent when the Rs.600 to Rs.800 class is reached (the wealthiest 8 percent of households). By comparison, the high in our survey was 87 percent and the low, 67 percent.

Table 7 compares our survey with the SES in terms of the means obtained for absolute food expenditure, relative food expenditure, and the starchy staple ratio. The SES figures are lower in all instances.

At least three factors contribute to the large differences observed in absolute food expenditures. First, the SES did not peg a value to rice whereas we did. Second, the two surveys were separated by a ten year gap during which time the cost of living was far from idle. Between 1970 and 1980, prices in Sri Lanka increased by more than 300 percent for many foods. A third reason is the manner in which food expenditure is presented. In the SES, food expenditures are presented in per capita terms whereas in our survey they were calculated in terms of adult equivalents. Were our findings presented in per capita terms, monthly food expenditures would drop from Rs.175 to Rs.126.

[1/] Ordinary least squares (OLS) analysis showed all three relationships to be statistically significant ($p=.0001$) with R^2 values of .68, .34 and .16, respectively. Corresponding F values were 1,989, 495 and 184.

FIGURE 5. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: PERCENT OF TOTAL EXPENDITURE SPENT ON FOOD, PER CAPITA MONTHLY FOOD OUTLAYS, AND HOUSEHOLD SIZE, BY INCOME CLASS



*Source: L. N. Perera, W. S. M. Fernando, B. V. de Mel and T. T. Poleman, "The Effect of Income on Food Habits in Ceylon: The Findings of the Socio-Economic Survey," MARGA, Vol. 1, No. 4, 1972, p. 12.

TABLE 7. 1980 RURAL NUTRITION SURVEY AND 1969/70 SOCIO-ECONOMIC SURVEY: COMPARISON OF FINDINGS ON FOOD EXPENDITURE, FOOD RATIO, AND STARCHY STAPLE RATIO

	1980 Rural Nutrition Survey	1969/70 Socio-Economic Survey
Absolute Food Expenditure[a/]	174.6	34.04
Relative Food Expenditure (food ratio)	80.0	54.10
Starchy Staple Ratio	70.0	55.00

a/ Rupees/month/capita--Socio-Economic Survey

Rupees/month/adult--Rural Nutrition Survey

The differences observed between the two surveys with respect to mean food ratio and mean starchy staple ratio could be due in large part to the fact that the SES sampled both rural and urban households, whereas our survey sampled only the former. Rural families tend to have higher food and starchy staple ratios than urban families. A possible deterioration in real incomes between 1970 and 1980 could also help explain why our survey yielded higher figures than the SES.

These differences notwithstanding, the reasonableness of our survey's findings in terms of expected behavior is such that further inferences with regard to food behavior may be drawn with a fair degree of confidence in their validity.

The Income-Diet Relationships

Changing levels of income affect diets in two ways: on nutrient intake levels and on the relative contributions of the various foods and food groups. With cross-sectional data, the usual approach to understanding these changes is to divide the households into four or five income (expenditure) groups and compare them.

Figure 6 presents such a comparison in bar chart form. Apparent caloric intake per adult equivalent (CPA) broken down by major food group is set against monthly household expenditure level (TEPA), with percentage figures above the vertical bars giving the distribution of households across the expenditure range. The chart indicates that households obtain the bulk of the calories from five major food groups: cereals, oils and nuts, sugar and honey, vegetables, and livestock products. The cereals are composed of rice and wheat flour products -- mainly bread, buns and home preparations such as rotti, pittu and hoppers. Oils and nuts refer almost exclusively to coconut and coconut oil. With respect to sugar and honey, the relative importance of the latter is so negligible that for all intents and purposes it could be ignored. Of the two dozen or more vegetables, the most important is bread-fruit, accounting for a high proportion of vegetable calories. Among livestock products the principal item is powdered milk. Other items like fluid milk, meat and eggs are of lesser importance.

The relative contribution of these food groups to the diet is presented numerically in Table 8, in which for purposes of comparison, the SES rural sector findings are also included. It is evident that the SES also found cereals, oils and nuts, sugar and livestock products to figure prominently in the average diet. In these respects the two sets of results are reasonably consistent, a minor discrepancy being that in relative terms the SES did not find vegetable calories to be as important as our survey did.

The principal difference in the findings concerns the relative share of cereals in the diet. The SES found cereals accounting for 53 percent of average, daily per capita energy intake, with 42 percent of this coming from rice and the balance (11 percent) coming from bread and other wheat flour products. By contrast, our survey found cereals accounting for nearly 69 percent of CPA, with rice making up 61.5 percent of this and

FIGURE 6. 1980 RURAL NUTRITION SURVEY: APPARENT DAILY ENERGY INTAKE PER ADULT EQUIVALENT BY FOOD AND EXPENDITURE GROUPS

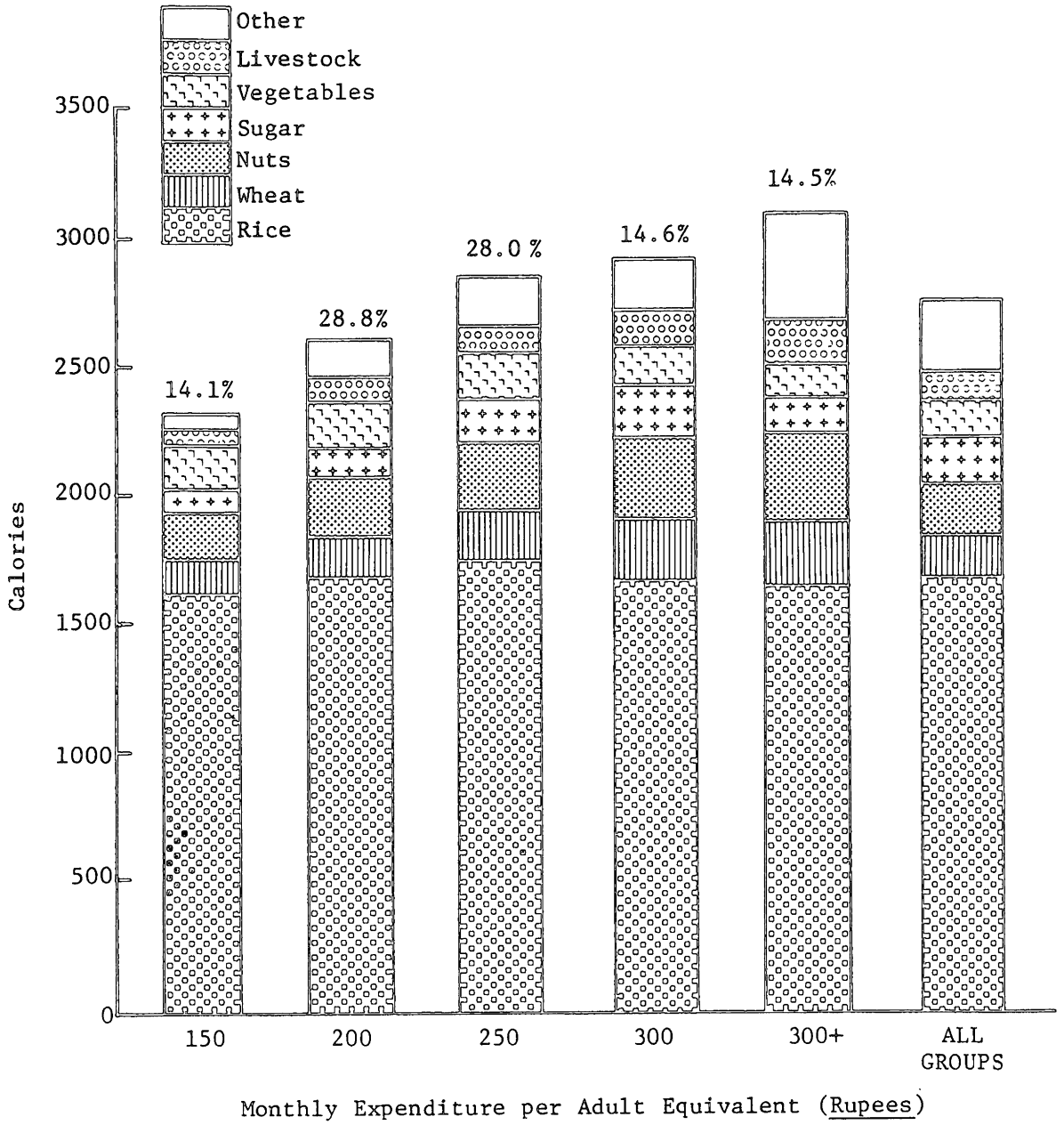


TABLE 8. 1980 RURAL NUTRITION SURVEY AND 1969/70 SOCIO-ECONOMIC SURVEY: COMPARISON OF AVERAGE, APPARENT INTAKE OF CALORIES PER DAY BY MAJOR FOOD GROUP

1980 Rural Nutrition Survey			1969/70 Socio-Economic Survey (Rural Sector)		
Food Group	Calories per Adult Equivalent	Percent Contribution	Food Group	Calories per Capita	Percent Contribution
Cereals			Cereals		
Rice	1,693	61.5	Rice	953.5	42.0
Wheat	197	7.2	Wheat	200.0	11.5
			Other Cereals	2.8	0.1
Oils and Nuts	269	9.7	Oils and Nuts	504.6	22.2
Sugar (and Honey)	188	6.8			
Vegetables	136	4.9	Sugar	201.4	8.9
Livestock	86	3.1	Milk, Milk Products, Eggs	126.8	5.6
Pulses	49	1.7	Pulses	49.4	2.2
Fish	48	1.7	Meat and Fish	46.2	2.0
Fruit	25	0.9	Yams	34.6	1.5
Yams	21	0.8	Fruits and Vegetables	33.4	1.5
Other*	45	1.6	Other*	165.9	7.3
TOTAL	2,755	100.0		2,268.1	100.0

*Betel, arecanut, condiments, liquor, etc.

wheat flour products the balance (7.5 percent). These changes suggest that since 1969/70, per capita consumption of rice has increased steadily and that per capita wheat consumption has decreased. The likely reason for this is that the ratio of the average, open market price of rice to the price of wheat flour has diminished rapidly over the past ten years. In 1980, this ratio was about 0.84. By contrast, in 1969/70 it stood at about 1.91 (10, p. 24). The price of wheat flour has increased at a much faster rate than the price of rice; the 1980 price of wheat flour was about 6.8 times its 1969/70 price, whereas in the case of rice its average 1980 price was about 3 times its 1969/70 price.

Figure 6 indicates that intake of calories from oils and nuts, sugar and powdered milk increases in relative importance across the income spectrum, while that of vegetables diminishes. These changes, though in accordance with Bennett's law, appear to become significant only when the Rs.250 expenditure group is reached. Some are discernible at lower expenditure levels but only slightly so.

Essentially the same pattern was observed in the findings of the SES (Figure 3) where these changes became evident only after the Rs.400 income group was reached. From the Rs.200 to the Rs.400 income group, the sole change was quantitative and little or no change occurred in diet composition.[2/] It is an interesting coincidence that in both surveys the proportion of total households among whom dietary changes are primarily quantitative and not qualitative is approximately 43 percent. Among this bottom 43 percent, dietary changes pertain primarily to increased intake of nutrients whereas among the top 57 percent, these changes pertain to both nutrient levels and composition. According to the SES, the bottom 43 percent were consuming less than the recommended allowance of 2200 calories/day/capita. Similarly, we found the bottom 43 percent of the 1980 survey's households to be consuming less than 2600 calories/day/adult equivalent, which is the standard calculated on the basis of the above allowance of 2200 calories/day/capita.

We have noted that to arrive at conclusions about nutritional status through a study of the income-diet relationship is a delicate matter, since they depend largely on what assumptions are made. Accordingly, on the basis of the SES findings, one could argue that 43 percent of Sri Lanka's population are undernourished or none at all. The 1980 survey is faced with precisely the same predicament. Because, in crossing the 2600 calorie threshold, households reflect largely quantity changes (and not quality changes) in their diet, this behavior could imply either of two things: that actual physical deterioration is the lot of the poor or that given a possible coincidence of unemployment with poverty, this is nothing more than a case of the poor eating less because their energy needs are

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[2/] In the case of cereal consumption (particularly rice), both the SES and the 1980 survey are not in harmony with Bennett's Law, since its relative importance persists throughout the income spectrum. This is probably because rice was and still is made cheaply through the cooperatives. A daily "rice plate" is a deeply entrenched food habit in Sri Lanka, even among the affluent class.

proportionately less. Thus, as with the SES, our survey can argue either way; that 43 percent of the people in the rural Southwest suffer from undernutrition, or none do.

Chapter V

DERIVING INDICES OF HOUSEHOLD NUTRITIONAL STATUS

We noted at the outset that the usefulness of the 1976 NSS was limited by the fact that it collected anthropometric data, but no socioeconomic information; while the 1969/70 SES survey was wanting in that it did the opposite. Our survey collected both kinds of evidence and this chapter lays a foundation for linking the results.

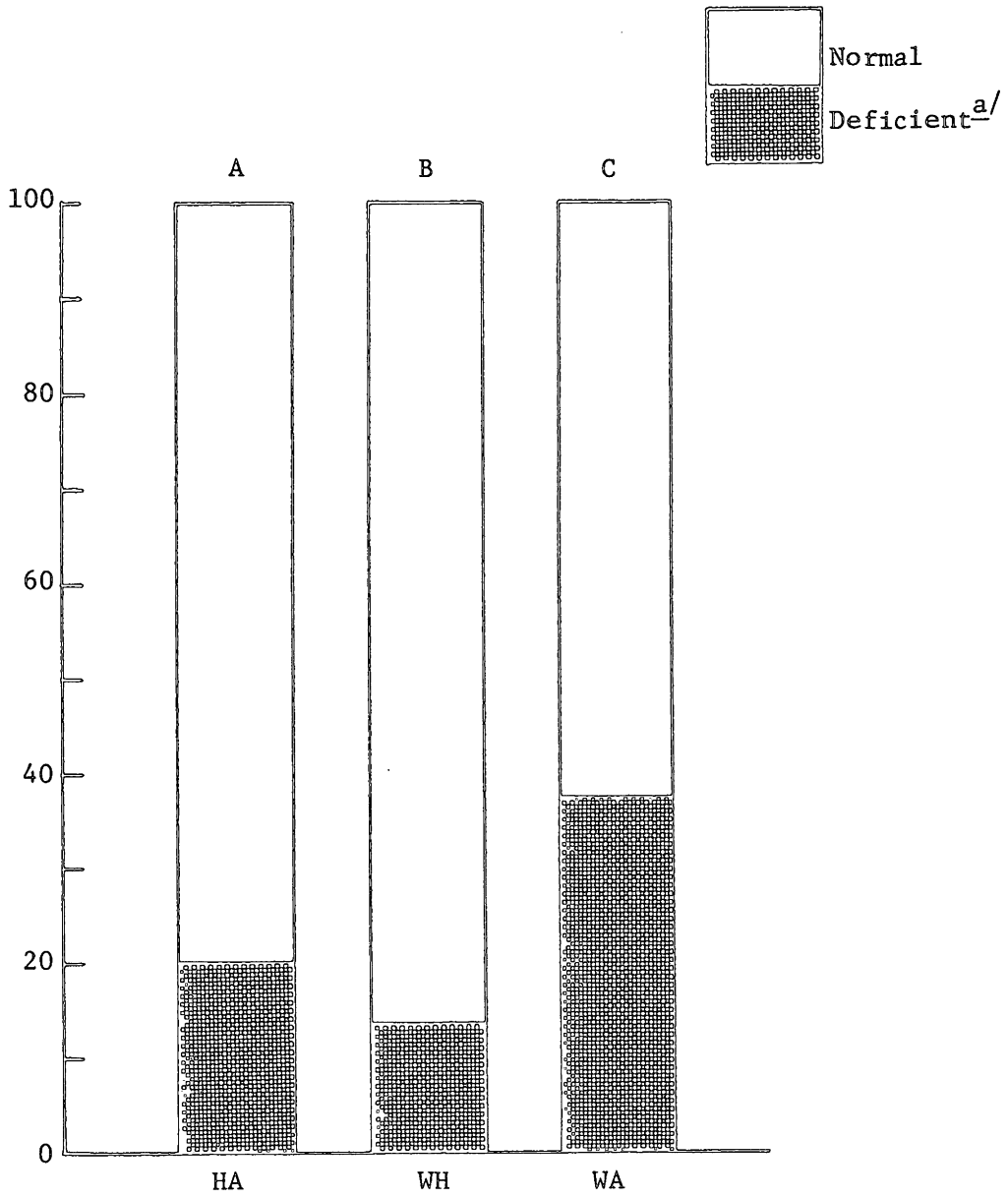
Household Nutrition Indices: The Findings

In order to relate anthropometric findings to the household socioeconomic situation, one must first derive household anthropometric indices that reflect the average nutritional status of infants and preschoolers in the household. In the case of households with only one sample child, the matter is simple because the average and individual anthropometric index are one. But in a household with more than one child, the question is which of the two methods entails less bias: using the average index or an arbitrarily selected index for one individual. Common sense suggests that the average index is more appropriate. If, for instance, the individual index were chosen in a situation where a household has one overweight child and two underweight, the outcome would be determined entirely in terms of the "luck of the draw"; that is, which of the three was chosen. An average index in this siutation would be less biased, although it would still not be entirely reflective of the household.

The algebra for deriving the household score from individual scores is the same for all three anthropometric indicators: HA, WH, and WA. Taking, say, HA, the household score is simply the arithmetic mean of the HA scores of all infants and preschoolers within the household. A similar calculation gives the household score in terms of WH and WA. These scores would mean that with respect to any particular anthropometric indicator, a household with a higher average is of higher nutritional status than one with a lower average. Using this method, the results shown in Figure 7 were obtained.

Of the total of 955 households, 20 percent were found to be experiencing linear undergrowth, 13.7 percent to be experiencing leanness, and 37.6 percent to be experiencing combined second and third degree PEM. The corresponding figures for individual infants and preschoolers were 22 percent, 15.1 percent and 38.5 percent, respectively. Thus switching from individual to household scores had hardly any effect on the prevalence rates.

FIGURE 7. 1980 RURAL NUTRITION SURVEY: SUMMARY OF HOUSEHOLD ANTHROPOMETRIC SCORES



a/ A - HA < 90 percent of Harvard Reference Median
B - WH < 80 percent of Harvard Reference Median
C - WA ≤ 75 percent of Harvard Reference Median

Figure 8 gives a breakdown of the three indicators by District according to the findings of both the 1980 Survey and the NSS. The chart indicates that according to our survey prevalence of linear undergrowth is slightly higher in Galle (21 percent) than in Kalutara (19 percent). Similarly, prevalence of leanness is 15.5 percent in Galle and 12 percent in Kalutara. Hence the two Districts do not appear to differ significantly from one to another in terms of nutritional status. This is further borne out by the fact that in both Districts prevalence of combined second and third degree PEM is the same: 37.6 percent.

The NSS did not yield identical results. But like our survey, it suggested that in terms of HA and WH, Kalutara was better off than Galle, though only slightly so. The prevalence of linear undergrowth was 33.3 percent in Galle and 26.8 percent in Kalutara, and prevalence of leanness 8.2 percent and 6.2 percent, respectively. In terms of combined second and third degree PEM, Kalutara had a prevalence rate of 35.7 percent as compared to 44.6 percent in Galle. On the whole, however, the findings of the two surveys are not really in disagreement; they indicate that the extent of nutritional deprivation in the two Districts is roughly of similar proportions.

It is pertinent to ask whether on the basis of this comparison, inferences can be drawn about changes in nutritional situation in Galle and Kalutara between 1976 and 1980. If we go by HA, which in a sense is a longitudinal indicator, the evidence suggests that nutritional status improved in both Districts. Since the prevalence rates for linear undergrowth declined, this improvement can be regarded as significant. We have refrained from using the WH or WA indicators to make similar comparisons, since neither indicate how nutritional status has changed over the long run.

Sensitivity Analysis

That the cut off points employed in nutritional anthropometry are arbitrary has already been stressed. An indication of the extent to which the point selected can influence the findings may be had by dividing the sampled group of children according to the percentile of the Harvard reference median to which they belong and illustrating this graphically. The percentage of children falling in each centile becomes evident at a glance.

> This analysis gives a more complete picture of the differences between the sampled population and the reference population, because it takes into consideration the whole range of the distribution (36, p. 12).

Figure 9 illustrates how the households sampled by our survey are distributed according to WA, the most commonly used index in this type of analysis.[1/] The distributions for Galle and Kalutara are superimposed on one another so as to facilitate a comparative analysis. It is evident that

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[1/] The index used in this instance is the averaged household score and not the individual score.

FIGURE 8. 1980 RURAL NUTRITION SURVEY AND 1976 NUTRITION STATUS SURVEY: SUMMARY OF ANTHROPOMETRIC FINDINGS, GALLE AND KALUTARA DISTRICTS

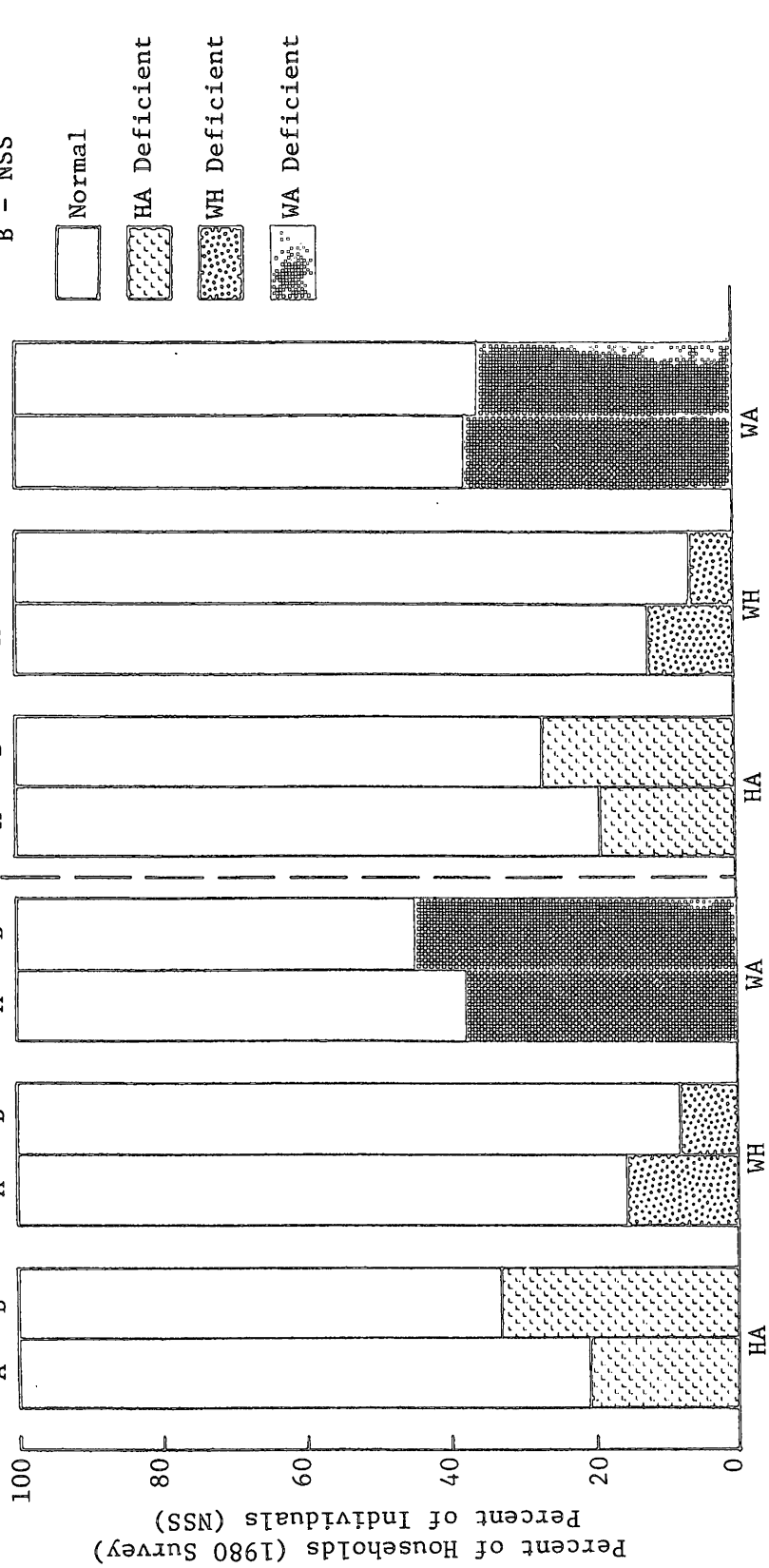
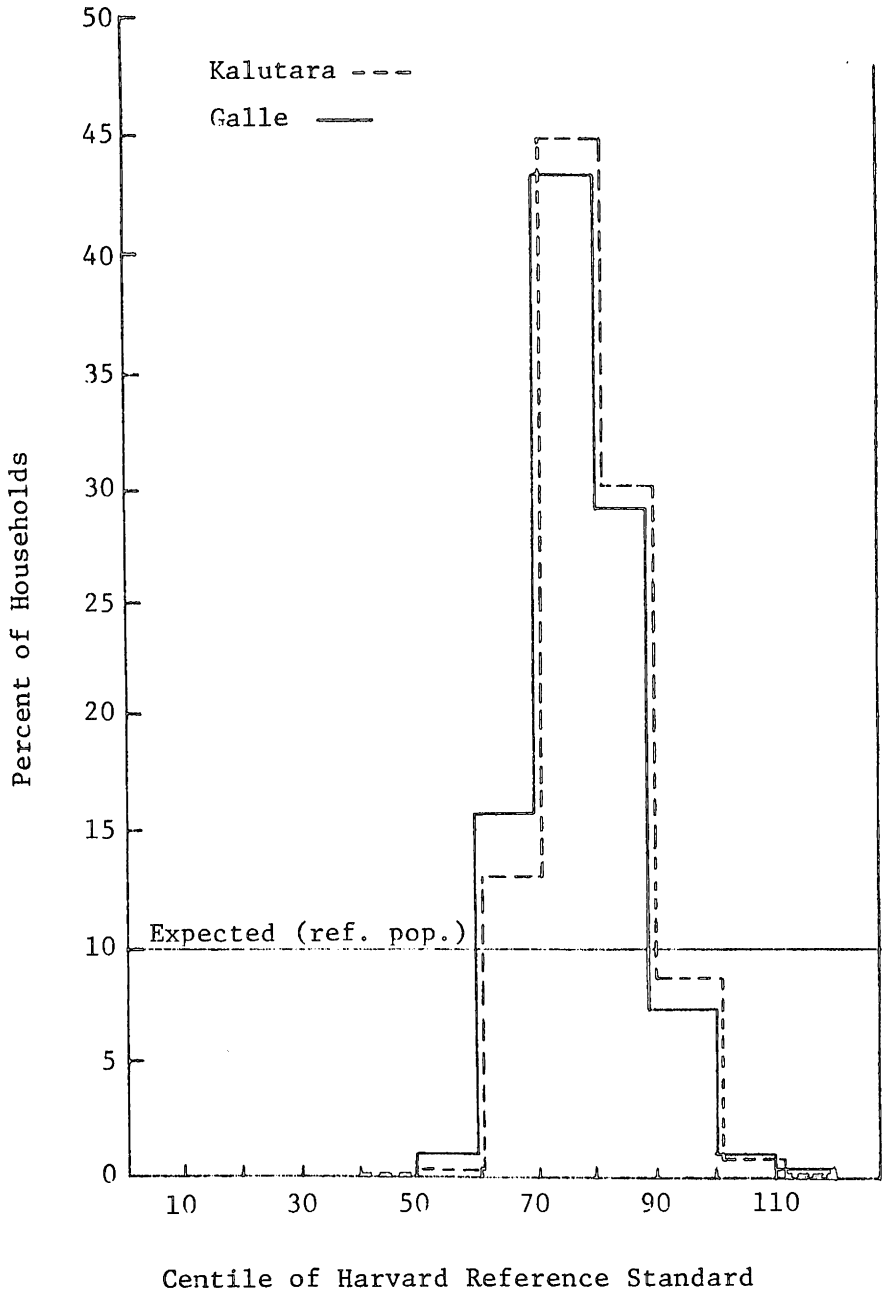


FIGURE 9. 1980 RURAL NUTRITION SURVEY: PERCENTAGE DISTRIBUTION OF HOUSEHOLDS BY WEIGHT/AGE DECILES



neither of the two distributions fall below the 40th percentile or exceed the 120th percentile, and moreover, that both are remarkably alike. To ascertain what percentage of households fall into a particular decile, say the 70-80 centile range, one identifies the appropriate co-ordinate on the horizontal axis (which in this case is the plateau of each distribution) and reads off the corresponding value on the vertical axis. The values are around 44 percent for Galle and 47 percent for Kalutara. One can ascertain also what percentage of households fall below or above the 70th percentile, and what percentage fall below or above the 80th percentile. What cannot be ascertained are the percentage of households falling below or above a percentile within this centile range, such as the 73rd or 77th percentile.

The WA indicator is often used in identifying severe PEM: that is, a state of physical deterioration experienced by children falling below 60 percent of the reference median. From Figure 9 it is clear that the percentage of households with severe PEM is probably less than 2 percent in both Districts. The term combined second and third degree PEm has been constantly used in this analysis with reference to all children below the 75 percent cutoff point in terms of WA. What is observed from the chart is that the large majority of PEM cases are moderate and that only a minute fraction is severe.

It is of extraordinary importance to note that if the cutoff point for WA is dropped from 75 to 70 percent, prevalence of combined second and third degree PEM is more than halved in both Districts. From around 38 percent (not evident from chart), the prevalence rate falls to about 17 percent in Galle and 14 percent in Kalutara. These reductions are dramatic and change the picture from one of gloom to one of slight relief. More striking is the case with HA. It was found that if the cutoff point was lowered to 80 percent from 90 percent, the prevalence of linear undergrowth vanished in both Districts. Thus a modest difference in the cutoff point can cause enormous swings in the pendulum of assessment. Criticisms levelled against use of international growth standards in developing countries on the grounds that they are too high are therefore not without merit. Our findings suggest that their imprudent use could lead to very misleading conclusions.

Chapter VI

LINKS BETWEEN SOCIOECONOMIC CHARACTERISTICS AND NUTRITIONAL WELL-BEING: A QUALITATIVE ANALYSIS

Although our sensitivity analysis indicates that anthropometric findings can be misleading unless used with caution, they do provide measures of deprivation which can be put to a variety of uses. They can in particular identify those within a community who are less well nourished than others. Combined with information on socioeconomic status, this can lead to an understanding of why they are so.

Figure 10 summarizes our findings with respect to the impact of household type on nutritional status. The households are divided into six occupational groups following criteria presented in Table 9. The HA indices are shown using both the 80 and 90 percent cutoffs.

The disaggregation of households by occupational criteria presented some problems because in many cases there was more than one income-earner in the household. Deriving a classification based on occupation of all income earners in the household is a complex exercise. To avoid disaggregation to a level that is unsatisfactory either because it is too simple or too complex requires a tradeoff between depth of information and analytical convenience; and we opted for convenience.

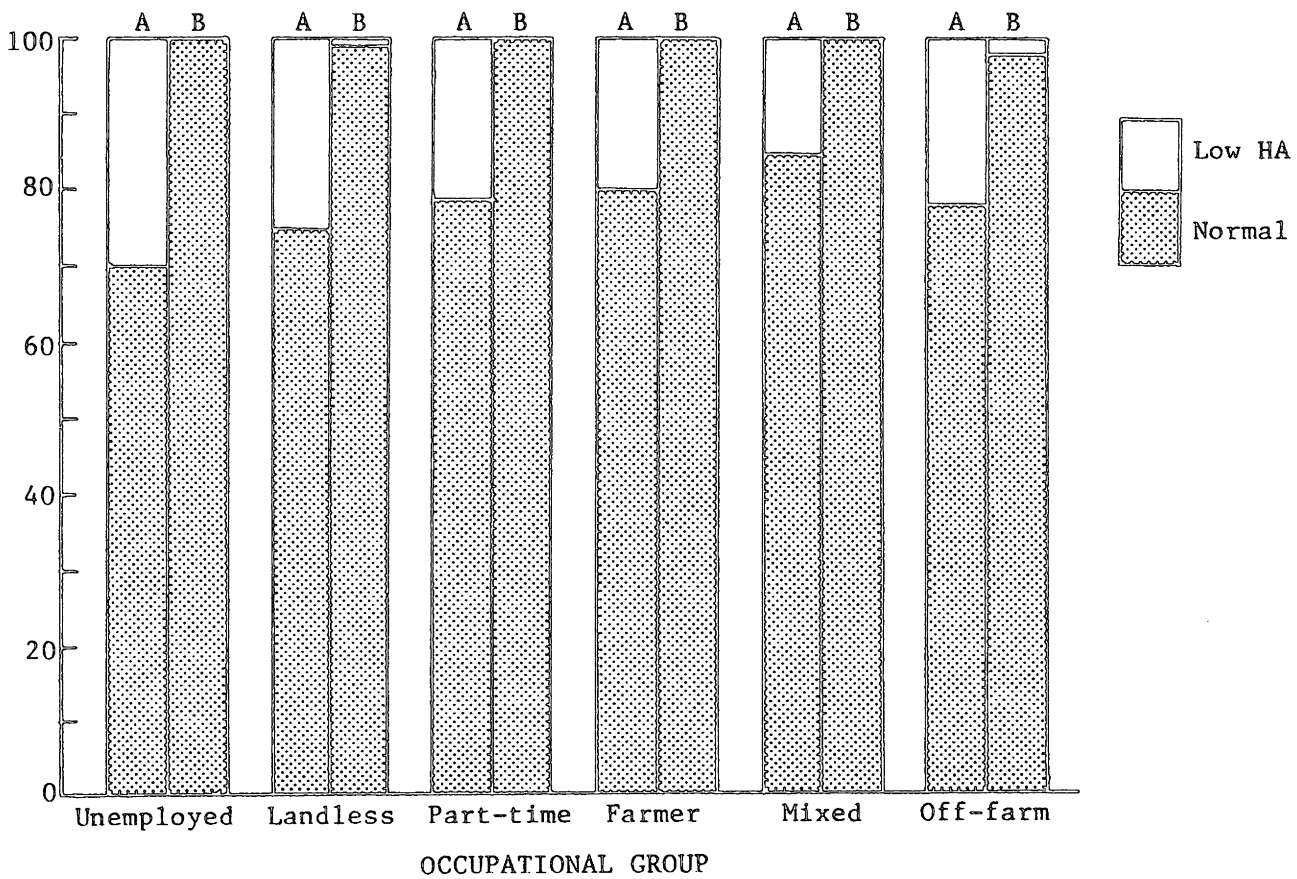
Accordingly, households were classified on the basis of the occupation of the household head (Table 9). To have adequate representation of households in each category, the number of occupational groups was restricted to a total of six.

The first group (Unemployed = UNEMPLOYED) consists of all households in which the household head had been unemployed for a period of at least one month at the time of the interview. It was considered useful to single out this category in order to identify possible links between unemployment and deprivation.

The second group (Landless Agricultural Laborers = LANDLESS) characterizes those households in which the household head had no direct access to land. His income was obtained by the hiring out of his labor to landowners or tenant-operators.

The chief characteristic of the third group (Part-time Agricultural Laborers = PARTTIME) is that household heads hired out their labor only on a part-time basis. None of these individuals were landless; their primary occupation was the cultivation of land either as owner or tenant-operators.

FIGURE 10. 1980 RURAL NUTRITION SURVEY: PERCENTAGE DISTRIBUTION OF HOUSEHOLDS WITH NORMAL/LOW HA ACCORDING TO OCCUPATION GROUP AND ALTERNATIVE CUTOFF POINTS ON THE HARVARD STANDARD



Column A - Cutoff point ≤ 90 percent of Reference Median

Column B - Cutoff point ≤ 80 percent of Reference Median

TABLE 9. 1980 RURAL NUTRITION SURVEY: CRITERIA FOR CLASSIFYING HOUSEHOLDS IN TERMS OF OCCUPATIONAL STATUS OF HOUSEHOLD HEAD

Occupational Group	Code	Criteria
Unemployed	UNEMPLOYED	Household Head unemployed for at least one month prior to interview.
Landless Agricultural Laborers	LANDLESS	Household Head has no access to land. Works for wages in farm sector.
Part-time Agricultural Laborers	PARTTIME	Household Head not landless. Is either owner or tenant-cultivator. Also works for wages part-time, in farm sector.
Full-time Farmers	FARMER	Household head is full-time owner or tenant-cultivator. Does not work for wages.
Mixed on-farm/off-farm Income Earners	MIXED	Main occupation of Household Head is off-farm. Operates land part-time or works for wages (on-farm).
Off-Farm Income-Earners	OFFFARM	Household Head employed full-time, off-farm.

In the fourth group (Full-time Farmers = FARMER), household heads did not engage in work for wages. They were all either owners or tenants and cultivated land on a full time basis.

In the fifth group (Mixed on-farm/off-farm Income Earners = MIXED), household heads engaged in both an on-farm and an off-farm activity. The off-farm occupations were diverse and included construction work, masonry, carpentry and teaching. The on-farm occupation was largely a part-time activity and in this (MIXED) group, about 17 percent of the individuals were landless while the other 83 percent were either owner or tenant - operators of land.

The sixth group (Off-farm Income Earners = OFFFARM) consists of those households in which the household head worked full-time, off-farm. Like the fifth group, this group also contains a wide range of income earners, such as teachers, clerks, bus-conductors, merchants, carpenters and manual laborers. It is observed from Figure 11 that the fifth and sixth groups together account for about 57 percent of all households.

Ranking of Occupational Groups According to Nutritional Status

Since we wished to focus on nutritional status in its cumulative sense, the HA index was the indicator used. We have noted that for the sample as a whole the 90 percent cutoff pointed to about 21 percent linear undergrowth in Galle and 19 percent in Kalutara, whereas with a lower cutoff point of 80 percent, the problem disappeared. Figure 10 indicates a similar result when households are stratified by occupational status. All six groups have a significant proportion of households experiencing linear undergrowth, ranging from 29 percent in the first group (UNEMPLOYED) to 13 percent in the fifth group (MIXED).[1] But with the cutoff point lowered to 80 percent, in four of the six groups, the problem vanishes. In the other two groups the prevalence does not exceed 1 percent.

We emphasize once more the arbitrariness of these cutoff points. A great deal remains to be learned about what growth standards are appropriate for developing countries. Still, use of the conventional standards is not invalid so long as they are used to measure nutritional status in a relative, and not absolute sense; and in this sense the findings in Figure 10 at the 90 percent cutoff are revealing. They indicate that, while prevalence of linear undergrowth is approximately 20 percent in the aggregate, there is considerable variation above and below this level. The highest prevalence rates are among the UNEMPLOYED and LANDLESS groups (29 and 26 percent) and lowest prevalence rates among the FARMER and MIXED groups (19 and 13 percent), respectively. The other two groups (PARTTIME and OFFFARM) fall in the middle with a common prevalence rate of roughly 20 percent.[2]

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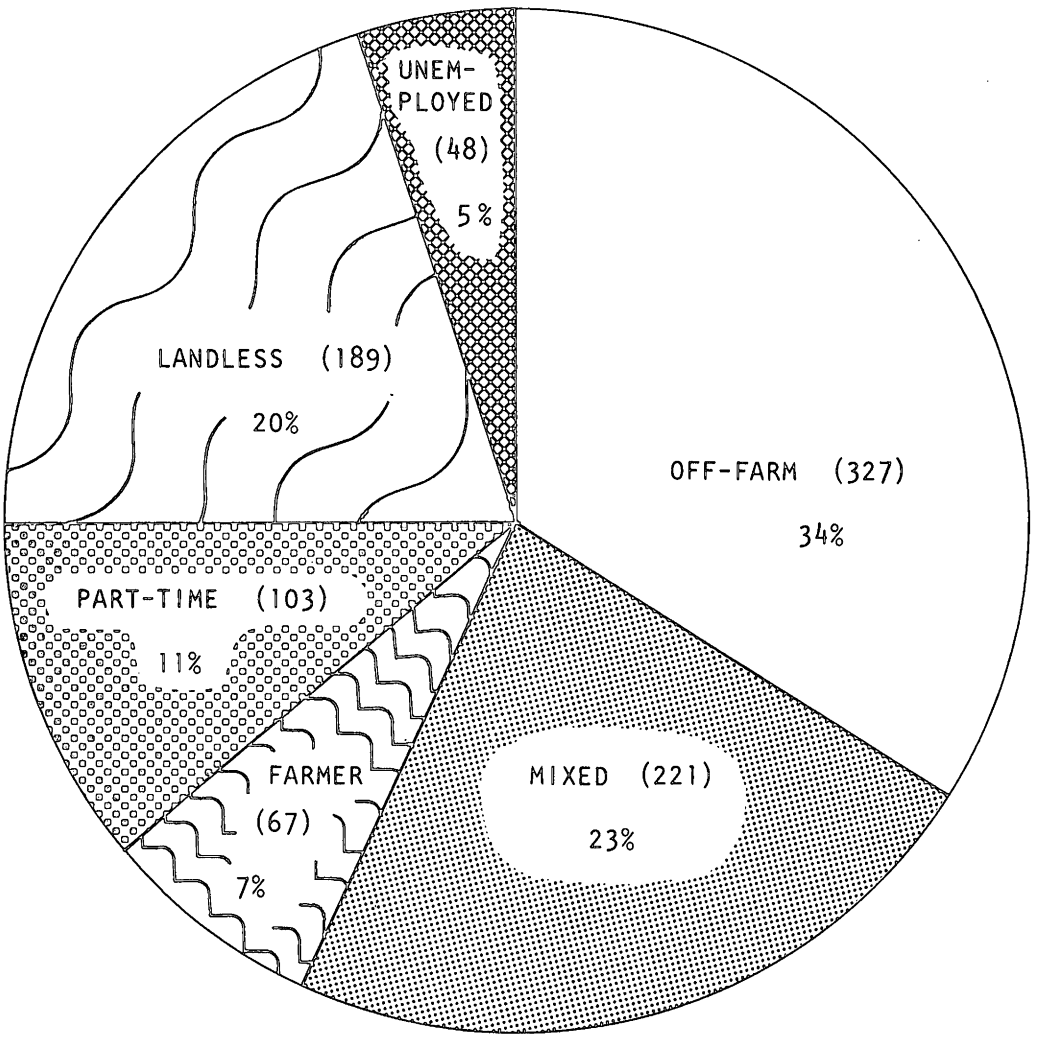
[1] These prevalences were significantly different (at the 5 percent level), as indicated by a chi-square test.

[2] To be precise, the prevalence rates are 20.4 and 20.2 percent for the PARTTIME and OFFFARM groups, respectively.

FIGURE 11. 1980 RURAL NUTRITION SURVEY: PERCENTAGE DISTRIBUTION OF HOUSEHOLDS ACCORDING TO OCCUPATIONAL STATUS*



* Numbers in parentheses are actual number in occupational group.

If these groups were ranked on a continuous scale with a score of zero ascribed to the most deprived and five to the least deprived, then the first three groups in Figure 10 would fall in the lower half of the scale and the last three groups in the upper half:

Score	Group
5	MIXED
4	FARMER
3	OFFFARM
2	PARTTIME
1	LANDLESS
0	UNEMPLOYED

The bottom group is the UNEMPLOYED category, which suggests that in the rural sector, households that are among the most nutritionally deprived are those undergoing economic hardship because of the inability of the household head to find sustained employment. At the same time this group is relatively small, making up only 5 percent of the sample. The other two in the lower half are the LANDLESS and PARTTIME groups. A common factor is that in both groups the household head works on-farm for wages; except that in the latter case he is also a farm operator,[3/] whereas in the other he is not. The reason why these operators work part-time for agricultural wages is probably because their farms are too fragmented to provide an adequate livelihood.

The top group, by contrast, is made up of the mixed on-farm/off-farm income earners (MIXED), who together with the off-farm income earners (OFFFARM) comprise over half the sample. Two points are of interest here: one being that the MIXED group is better nourished than the FARMER group, and the other, that the MIXED group is the best nourished of all. Why the children of full-time farmers are of lower nutritional status than the MIXED group is probably because in the Southwestern coastal area, the farms that they operate are exceedingly small in size. Our data indicate that average farm size is about 1.4 acres. A farm of this size is not likely to provide a family of five with anything more than a barely adequate diet. Therefore, households able to tap incomes from both the farm and non-farm sectors are comparatively better off.

As to why the MIXED group is better nourished than the OFFFARM group needs to be explained as well. The reason appears to be relatively simple. The off-farm jobs held by members of both groups are roughly of the same kind. On this score, the income differentials between the two groups are likely to be minimal. But the MIXED group engages in additional remunerative work in the farm sector. Total income of this group thus is higher.

It is interesting that the FARMER group is also better nourished than the OFFFARM group. The cost of food is higher for the OFFFARM group since it purchases 100 percent of its food requirements. This is probably a major reason why the FARMER group by and large is of higher nutritional status than the OFFFARM group.

[3/] The terms "land operator" and "farm operator" are used synonymously in the text. So are the terms "farmer," "cultivator," and "operator."

An additional factor is access to livestock. About 27 percent of households in the FARMER group own farm animals (mainly cattle) as compared to 8 percent in the OFFFARM group. In the three groups -- PARTTIME, FARMER and MIXED -- the proportion of households rearing livestock ranges from 23 to 29 percent whereas in the three remaining groups -- UNEMPLOYED, LANDLESS and OFFFARM -- the corresponding range is 7 to 8 percent.

Ranking of Occupational Groups According to Socioeconomic Status

Using the same five to zero scale, the six occupational groups may also be ranked according to selected socioeconomic indices. This is done in Table 10. Six variables are considered: expenditure, household size, literacy, water supply, sanitation, and crowding. Each cell in the matrix shows the rank of a particular occupational group with respect to a particular socioeconomic index. By summing vertically across the rows, a grand score is obtained for each occupational group, which can be regarded as a composite socioeconomic index. A higher grand score equates with higher socioeconomic status; and for convenience, we give a final ranking of the occupational groups on the same zero to five scale.

The results of this ranking are also shown in Figure 12. The final rank is given in the lower right chart. The proportion of households in each occupational group which meet the socioeconomic criteria discussed below are illustrated in the top six charts.

Expenditure

Among all the socioeconomic variables, expenditure (or income) should best reflect the level of living since it represents the purchasing power of the household. It is common practice to regard a household with a higher level of per capita expenditure as enjoying a higher level of living than a household with a lower level of per capita expenditure.

The relationship between occupational status and expenditure was examined using the chi-square technique. Two levels of TEPA (total household expenditure/month/adult equivalent) were defined: low or high depending on whether it was $<$Rs.200 or $\geq$ Rs.200.[4/] The proportion of households in each occupational group belonging to the "high" expenditure level was then determined; these were found to be significantly different at the 5 percent level. This indicated that expenditure varied significantly with occupational status.

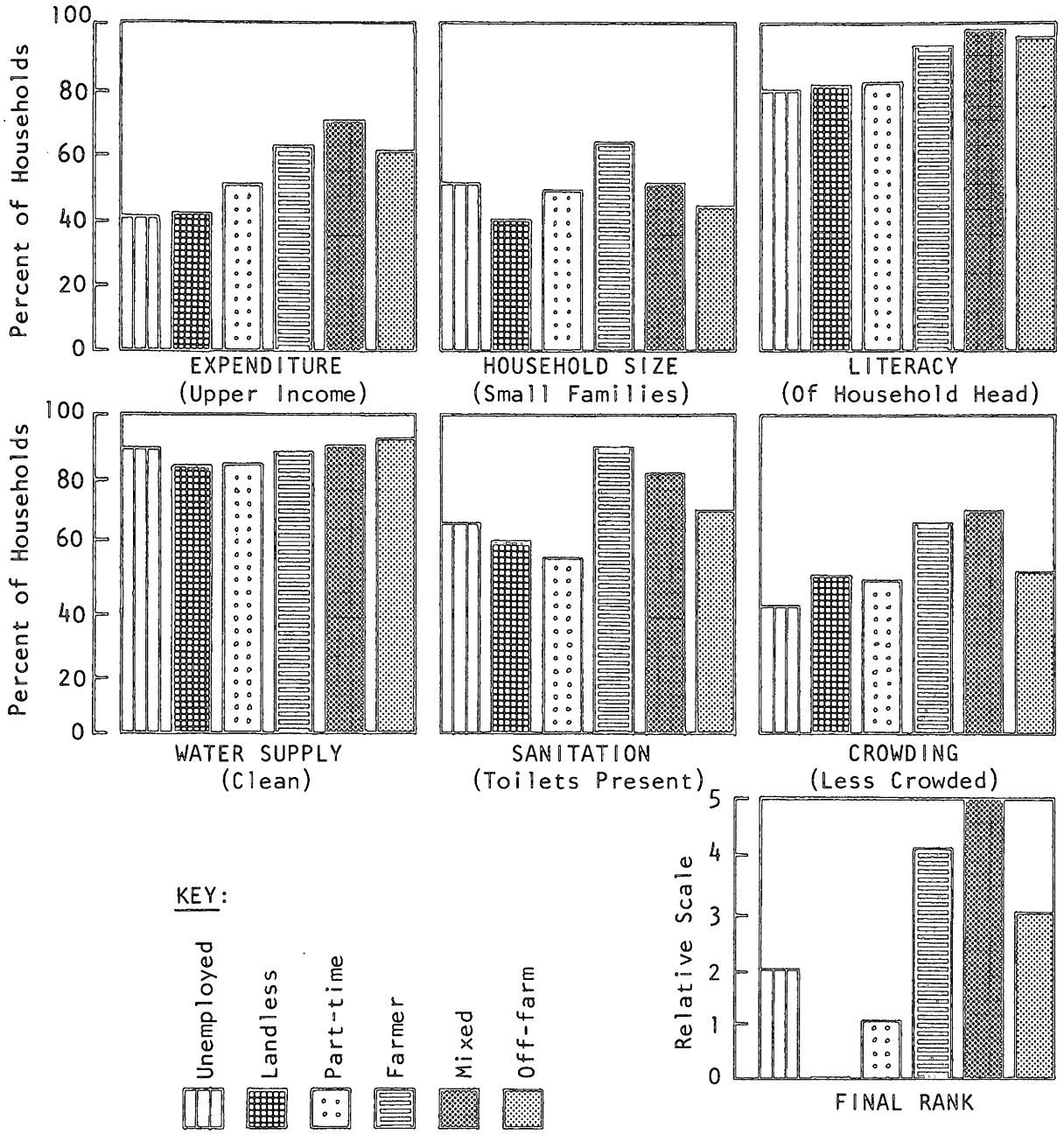
In the aggregate, about 57 percent of the households fell in the high expenditure bracket. The first chart of Figure 12 shows distribution by the occupational group. Three groups -- MIXED, FARMER and OFFFARM -- had more than 57 percent of their households fall within the wealthy category, with the MIXED group having the highest proportion: 68 percent. The other three groups -- UNEMPLOYED, LANDLESS and PARTTIME -- included appreciably smaller proportions of the wealthy, with the UNEMPLOYED group having the least: 42 percent.

4/This cutoff was chosen because average TEPA was found to be about Rs.225.

TABLE 10. 1980 RURAL NUTRITION SURVEY: RANKING OF OCCUPATIONAL GROUPS ACCORDING TO SOCIOECONOMIC STATUS

Variable	Unemployed	Landless	Part-time	Farmer	Mixed	Off-farm
Expenditure	0	1	2	4	5	3
Household Size	3	0	2	5	4	1
Literacy	0	1	2	3	5	4
Water Supply	4	0	1	2	3	5
Sanitation	2	1	0	5	4	3
Crowding	0	2	1	4	5	3
Grand Score	9	5	8	23	26	19
FINAL Rank	2	0	1	4	5	3

FIGURE 12. 1980 RURAL NUTRITION SURVEY: ANALYSIS OF OCCUPATIONAL GROUPS ACCORDING TO SELECTED SOCIOECONOMIC INDICES



These results are as one would expect. The landless and the unemployed are poorer on the whole than those having access to land and off-farm employment. Moreover the findings support the earlier hypothesis that the MIXED group was the best nourished because it was also likely to be the most advantaged in terms of income. What is clearly brought out by the analysis is that the class of families enjoying the greatest purchasing power in the rural Southwest is that having the means to combine off-farm employment with part-time, on-farm economic activities.

Household Size

A chi-square technique similar to the previous one was used to test the relationship between occupational status and household size. The occupational groups were divided somewhat arbitrarily into two categories: small or large depending on whether household size was <5.7 or ≥ 5.7 persons, the sample mean. Smaller household size typically equates with a higher level of living, and we determined the proportion of households in each occupational group which fell in the small category. These proportions were found to be significantly different at the 5 percent level, thus establishing a link between household size and occupational status. In the aggregate, around 50% of the households fell in the small category.

The second bar-chart of Figure 12 shows how the occupational groups fared on the scale. The three groups -- FARMER, UNEMPLOYED and MIXED -- fell in the upper half. On top is the FARMER group with around 66 percent of its household belonging to the small category. Of the other three groups -- LANDLESS, OFFFARM, and PARTTIME -- falling in the lower half, the LANDLESS group lies at the bottom with only 42 percent of its households falling in the small classification.

It is interesting that full-time farmers have the highest proportion of small families. Traditionally it has been observed that farmers in developing countries have large families, since more family hands means lower production costs on the farm. It is possible that in Sri Lanka this is no longer so. For one thing, children could be more of an economic liability, than an asset. Education and prospects for a non-farm job are greater lures than the "dignity of farming"; consequently, parents have to budget for books, school uniforms, bus-fares, and the like. Moreover, farms in the wet zone are rapidly shrinking in size -- to a point where their economic viability is in question. Both these factors would encourage farmers to have small, not large families.

The findings on household size do not match those on expediture, particularly with regard to the UNEMPLOYED and OFFFARM groups. Nevertheless, expenditure and household are sigificantly inversely related, with a correlation coefficient (r) of -0.45.

Literacy

The households were divided according to whether the household head was literate or not. It was found that nearly 92 percent of the household heads were literate (in the aggregate), but the variance around this figure was large across the occupational spectrum.

The third chart in Figure 12 illustrates the relative situation. In three groups -- MIXED, OFFFARM and FARMER -- the percentage of literacy is above 92 percent. In the MIXED group it is 99 percent. In the other three groups -- UNEMPLOYED, LANDLESS and PARTTIME -- the percentage is below 92 percent. In the UNEMPLOYED group it is lowest: around 79 percent.

Despite this variability, the percentage figures are high for all occupational groups.[5/] This is not surprising since literacy in Sri Lanka on the whole is over 80 percent. Furthermore, there is nothing surprising about the way the occupational groups are placed on the scale; the hierarchy corresponds fairly closely with that obtained for expenditure. Literacy is to some extent an indicator of upward mobility; hence a correspondence between this and the expenditure variable is to be expected.

Water Supply

Since the presence of tap water within the house is frequently correlated with healthful conditions, we originally set out to determine its prevalence. However, the questionnaire revealed that only one household had tap water. Well water, on the other hand, was used by 91 percent, while 8 percent relied on a stream or river and 1 percent on a small reservoir (or tank).

For the purpose of relating water supply to occupational status, we therefore divided the sources into two categories: healthy and less healthy. These terms are used strictly in the relative sense and should not be taken to imply literally that well water is healthy and stream, river or tank water is unhealthy. They do, however, indicate that a well is typically cleaner than a stream, river or tank, since the latter are commonly contaminated with human and animal waste.

A high proportion of households in each occupational group used well water, and were significantly different at the 5 percent level. As seen from the fourth chart in Figure 12, in the three groups -- OFFFARM, UNEMPLOYED and MIXED -- well users exceeded the aggregate of 91 percent, with the OFFFARM group having the highest figure: 95 percent. In the three remaining groups -- LANDLESS, PARTTIME and FARMER -- the proportion of well users was slightly under 91 percent, with the LANDLESS group having the lowest figure of 86 percent.

[5/] These were significantly different at the 5 percent level as shown by the chi-square test.

In that a relatively high proportion of households in all occupational groups use well water, the water supply variable did not turn out to be a particularly useful socioeconomic index. Though these proportions are significantly different in the statistical sense, their variance is minimal. No sharp differences between the upper half and lower half of the scale are evident.

Sanitation

Sanitation is also an important socioeconomic factor. Like water supply, it is to some extent a predictor of health status, and it is not unreasonable to expect wealthier households to have better sanitary conditions than poorer ones.

Although the term sanitation can mean several things, we chose to represent it by a single proxy variable, the presence or absence of toilet facilities. The data showed that in the aggregate some 71 percent of the households had toilets of some type, such as cesspits and waterseals, whereas the other 29 percent were without toilets of any type. This ratio, however, varied significantly between occupational groups.

The findings are shown in the fifth bar-chart of Figure 12. Some occupational groups are markedly better off than others. In the three groups of the upper half -- FARMER, MIXED, and OFFFARM -- the proportions of households with toilets are all over the aggregate of 71 percent, with FARMER having the best record (91 percent). In the three groups of the lower half -- PARTTIME, LANDLESS and UNEMPLOYED -- the proportions are below 71 percent, with PARTTIME having the poorest record (56 percent).[6/]

The sanitation variable is thus a revealing socioeconomic index. The differences between the upper half and lower half of the scale are sharp. Although the correspondence between this scale and the expenditure scale is not identical, there are close parallels. The three wealthier groups are at the same time more privy to privies and the three poorer groups less so. This is suggestive of a link between economic and health status.

Crowding

Among the various indices of socioeconomic status, crowding is a particularly useful one, since it can be regarded as a surrogate for the quality of life. Less crowded households on the whole are wealthier than more crowded households. Crowding therefore reflects one effect of wealth.

6/ These differences were significantly different as shown by the chi-square test, at the 5 percent level.

The households were divided into two classes with the sample average of 3.3 persons per room taken as the dividing point. Those with $\geq$ 3.3 persons per room were defined as more crowded and those with <3.3 persons per room as less crowded. In the aggregate, 58 percent of the households were found to be less crowded and 42 percent to be more crowded. Disaggregation of the households by occupational status yielded the results shown in the sixth bar-chart of Figure 12.

The MIXED group has the highest proportion of less crowded households: around 71 percent. The other two groups falling in the upper half are FARMER and OFFFARM, with figures of 67 and 54 percent respectively. The UNEMPLOYED group has the lowest percentage of less crowded households: 42 percent. The other two groups falling in the lower half are the PARTTIME and LANDLESS groups, with figures of 52 and 53 percent, respectively. Therefore going from the top to the bottom group, the differences are widespread, and are statistically significant at the 5 percent level.

Thus, like the sanitation variable, crowding proved to be a useful measure of socioeconomic status. A comparison of the first and sixth bar-charts again shows a close resemblance between the expenditure and crowding outcomes.

The Composite Socioeconomic Index

The bars in the lower right chart of Figure 12 indicate the final ranking of the occupational groups, corresponding to the grand scores in Table 10. The grand score is the composite socioeconomic index, since it is a measure of overall socioeconomic status obtained through individual analysis of each of the six socioeconomic indicators.

It is apparent that the MIXED, FARMER and OFFFARM groups come off as the three occupational classifications with higher soicoeconomic status and the LANDLESS, PARTTIME and UNEMPLOYED groups as the lower. The same division obtains with respect to income/expenditure. It is thus apparent that the wealthier households are also better off in terms of overall socioeconomic status.

The analysis has identified mixed on-farm/off-farm income-earners to be the most advantaged socioeconomic group and landless agricultural laborers as the least advantaged. These findings clearly indicate that access to both land and off-farm employment is important in relation to improved socioeconomic status. Individuals adopting this combination have higher socioeconomic status than full-time farmers, while those combining farming with part-time, on-farm work (for wages) have lower socioeconomic status than full-time farmers. This suggests that farmers having meagre agricultural holdings are better off seeking additional work off-farm than on-farm.

It is further evident that full-time, off-farm income earners are among the three most advantaged socioeconomic groups. This further strengthens the conclusion that access to urban employment contributes to higher levels of living.

Finally, it is noteworthy that the two groups having access to off-farm employment (MIXED and OFFFARM) are the same as those having the highest literacy rates. The conclusion that education leads to improved levels of living is inescapable.

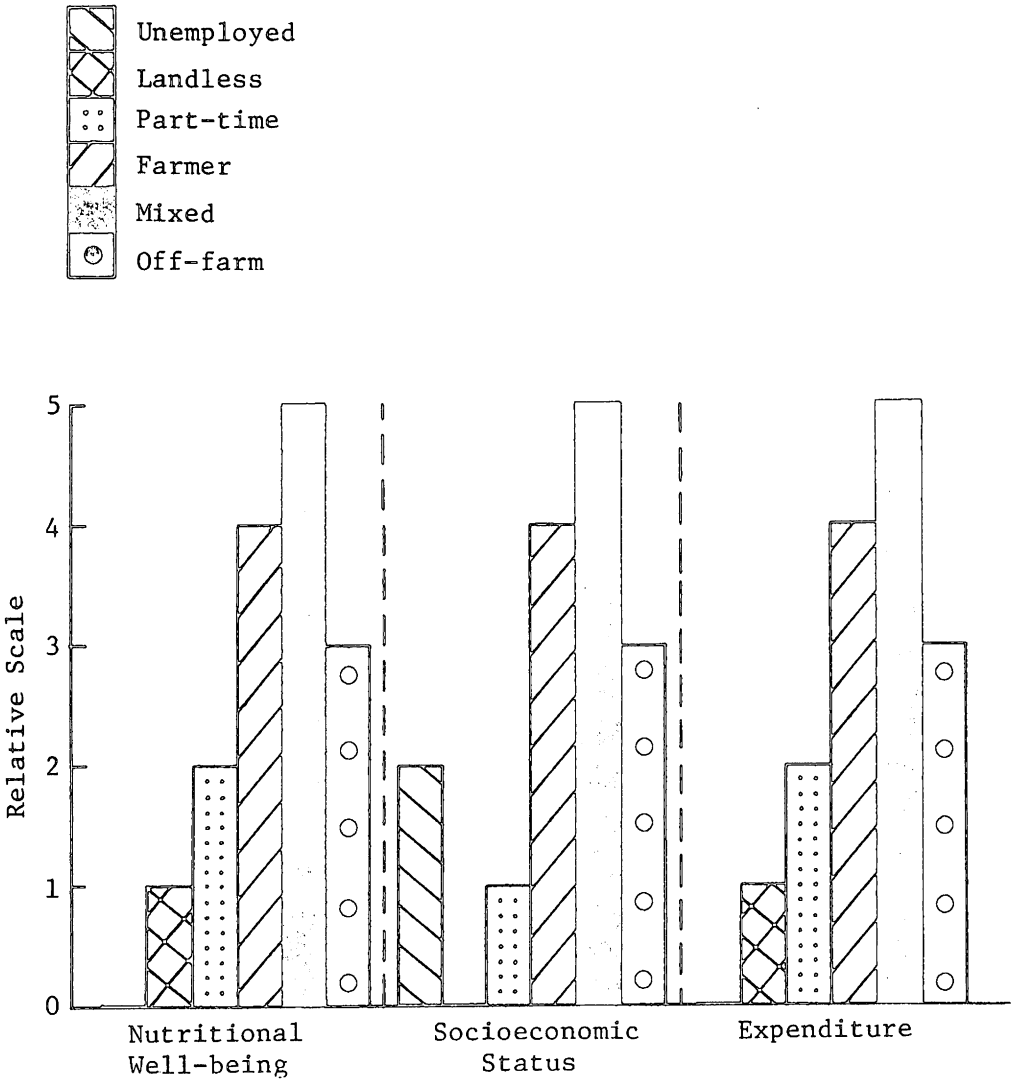
Relationship Between Nutritional and Socioeconomic Status

Figure 13 summarizes our findings with respect to occupational group, nutritional status, and socioeconomic well being. For convenience, the relevant indices are again arranged on a scale of zero to five. The imaginary line dividing the occupational groups into an upper and lower half is the same for both the anthropometric and composite socioeconomic index.

The similarity between the outcomes for nutritional and socioeconomic status is striking. In both cases, the most favored occupational group is the mixed on-farm/off-farm income earners. They are the least deprived nutritionally and the most advanced, socioeconomically. With respect to the most disadvantaged group, there is some disagreement; the HA analysis identified the unemployed to be the most nutritionally deprived, whereas in the socioeconomic analysis, agricultural laborers are the least favored.

This divergence is muted, however, if we argue that income/expenditure is likely to be more closely correlated with nutritional well-being than a composite socioeconomic index. Figure 13 indicates that the occupational groups rank identically with respect to expenditure and nutritional status. The conclusion that emerges is that malnutrition and depressed socioeconomic and income status go together. Clearly, improving the latter two is the long-term solution to the problem of malnutrition. At the same time one must recognize that these changes will not be easily brought about in Sri Lanka, given the rate of population growth and the continuing shortage of employment opportunities. The question is, do our findings point to other measures for alleviating malnutrition? To the identification of some specific policy variables we now turn.

FIGURE 13. 1980 RURAL NUTRITION SURVEY: APPARENT LINKS BETWEEN NUTRITIONAL WELL-BEING, SOCIOECONOMIC STATUS, AND EXPENDITURE



Chapter VII

ALLEVIATING MALNUTRITION: SOME POLICY CONCLUSIONS

Nutrition policy formulation needs to distinguish between those factors which directly affect nutritional status and those which do so indirectly. This helps identify what measures might help alleviate malnutrition in the short run and those whose impact would be only felt over the longer course of time.

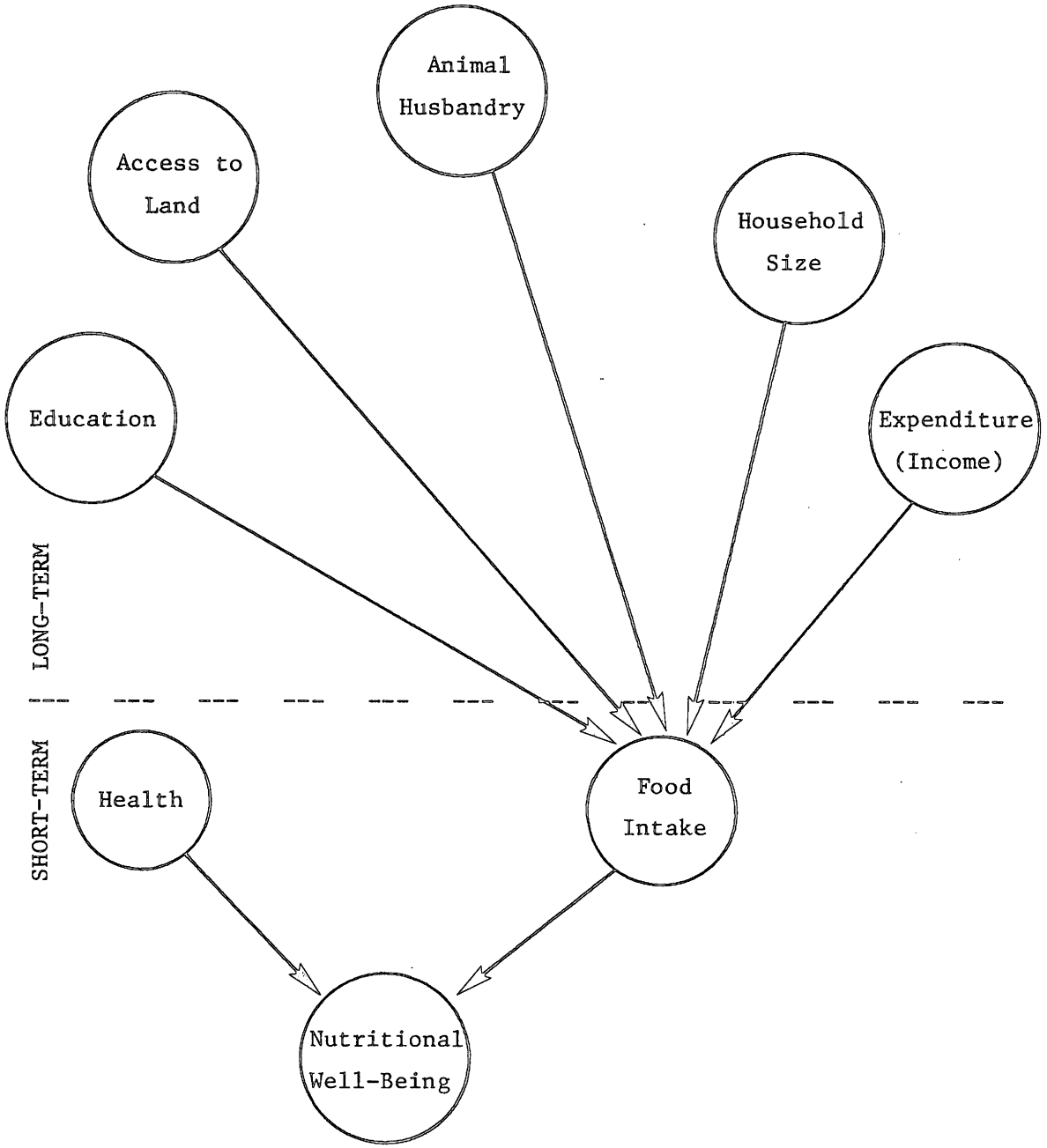
Malnutrition is first and foremost a biological phenomenon, and is caused by the synergistic interaction of two factors: poor diet and poor health. Inadequate food intake leads to physical and mental growth impairment in children and lowers the body's resistance to disease. Prolonged disease reduces the body's capacity to absorb and utilize nutrients and also reduces appetite. Hence malnutrition and infection[1/] reinforce one another. Infection aggravates malnutrition, and malnutrition increases the severity of infectious disease. (22, p. 4). Therefore both a healthy diet and control of infection are necessary to produce a healthy individual. These two factors -- diet and health -- could be regarded as the only two having a direct impact on nutritional well-being. All others affect it indirectly because they operate through these two factors. These linkages are illustrated schematically in Figure 14.

Diet and health are two variables that are open to policy manipulation in the short term. The state can, for instance, intervene with a food subsidy scheme to enhance food intake of the nutritionally vulnerable, and improve sanitation as a means of improving health status. The impact on malnutrition could be substantial.

Modification of those factors which affect it indirectly can have an impact only over the long run. We hasten to add that there could be exceptions. To take an example, income growth and redistribution are ultimately long-term phenomena. But it is possible to increase income in the short term, although the effect may not be widespread. Similarly, in rural areas with adequate water supply and supporting services, a well planned agricultural extension program is likely to achieve quick results.

[1/] Infection is here equated with diseases caused by both parasites and microorganisms.

FIGURE 14. 1980 RURAL NUTRITION SURVEY: SCHEMATIC ILLUSTRATION OF THE LINKAGES BETWEEN SELECTED SOCIOECONOMIC FACTORS AND NUTRITIONAL WELL-BEING



Long-Term Policy Options

Policy options can be most persuasively discussed if it can be demonstrated that they rest on solid empirical evidence. To that end, we have incorporated the findings of the 1980 rural nutrition survey into a statistical model. It is possible to produce a long list of variables influencing nutrition in the long run, but this complicates constructive analysis. We selected a few key variables, as described in Table 11.

Caloric intake (CPA) was selected as the outcome indicator, since this is an acceptable proxy for food intake, and this was regressed on five independent variables:

$CPA = a_o + a_1 EDUC + a_2 LAND + a_3 LIVESTK + b_1 TEPA + b_2 HHSZ + e$, where the first three independent variables are discrete and the last two are continuous. A correlation matrix showed that many of these variables were interrelated but the extent of collinearity by and large was harmless.

Education of the household head (EDUC) is related to wealth and food habits. The household head was considered "more" or "less" educated depending on whether or not his education exceeded Grade 9.

Two farm characteristics were also considered: access to land (LAND) and access to livestock (LIVESTK) -- the rationale being that access means more food and non-access, less food for the household. Along with education, these two regressors were represented as dichotomous variables.

The model included two continuous variables: household expenditures (TEPA) and household size (HHSZ). Expenditure is critical, since dietary levels are determined more by purchasing power than by any other factor. Some indication of this was seen in the previous chapter when occupational groups were compared with respect to expenditure and nutritional status. Household size also exerts an influence on food behavior. One could hypothesize that at similar levels of income, smaller families would be better fed than larger ones.

We noted at the outset that our study does not deal with causality:

> A statistical relationship, however strong and suggestive, can never establish causal connection; our ideas of causation must come from outside statistics, ultimately from some theory or other (21, p. 279).

Hence, our model does not imply causality, but rather the dependence of one variable (nutritional status) on other (socioeconomic) variables. For this reason the term "socioeconomic determinants" is used, rather than "causal factors."

Regression of the outcome indicator -- CPA -- on the five socioeconomic variables produced a goodness of fit (R^2) of 0.42. A large F-ratio (of

TABLE 11. 1980 RURAL NUTRITION SURVEY: DESCRIPTIVE SUMMARY OF VARIABLES USED IN REGRESSION ANALYSES

Variable	Code	Label
Mean, Household HA Score	Continuous	HA
Daily, Household Caloric Intake per Adult Eqivalent	Continuous	CPA
Sanitation (Household Level)	0 = No toilet 1 = Have toilet	SANIT
Educational Level of Household Head	0 = Grade IX or less 1 = Grade X or over	EDUC
Access of Household Head to Land	0 = Noncultivator 1 = Owner/tenant operator	LAND
Access of Household Head to Livestock	0 = Does not own livestock 1 = Owns livestock	LIVESTK
Monthly Household Expenditure per Adult Equivalent	Continuous	TEPA
Household Size-Number of Adult Equivalents per Household	Continuous	HHSZ

136) was indicative that these variables jointly had a powerful effect on dietary intake.

The estimates were as follows:

CPA = 2584 + 57.25EDUC - 12.64LAND + 66.66LIVESTK
(t) (45.66)* (2.3)** (-0.51) (2.26)**

+ 2.21TEPA - 82.0 HHSZ
(14.26)* (-10.89)*

R^2 = 0.42 F = 135.8*
* p<0.01 ** 0.01<p<0.05

Inspection of the partial, independent effects, however, revealed that not all variables were statistically relevant. The t-ratios were statistically significant for only four of the five variables. The effects of the education, livestock and expenditure variables on the outcome indicator CPA were positive. It was evident that better education (of the household head), rearing of livestock, and greater purchasing power all contributed to higher household dietary standards. The slope of the household size variable was negative and confirmed that apparent caloric intake increased as size of family decreased.

The land variable had no effect on CPA. This was a surprising result, given that in terms of both socioeconomic and nutritional status, landless laborers were among the most deprived. A possible reason why the outcome was different in the regression analysis is the following:

In the dichotomous variable LAND, the two categories being compared were not landless laborers vs. the rest. The sole criterion of distinction was whether or not the household head operated farm land. Into one category fell the full-time farmers, part-time agricultural laborers, and the bulk of the mixed on-farm/off-farm income earners, while into the other fell the unemployed, off-farm income earners, landless agricultural laborers, and a small proportion of mixed on-farm/off-farm income earners -- that is, all those having no land. Thus each category was a mixed bag of advantaged and disadvantaged socioeconomic groups. What this finding established was that access to land per se was not a relevant factor in determining dietary outcome, mainly for the reason that a large number of families without land had gainful employment in the off-farm sector.

In sum, the regression analysis confirmed four important socioeconomic variables as having a significant effect on food intake. The links between education and nutritional well-being are self-evident. The more educated a parent is, the more enlightened he will be about health, nutrition and child care. A broader issue is the link between education, employment and human welfare. An individual with the right kind of education has good prospects for obtaining a remunerative job and satisfying his family's basic needs. Yet vast numbers of educated youth in Sri Lanka have been unable to find employment because their degrees are not marketable.

The links between agriculture and nutrition are too complex to be dealt with thoroughly in this study. But our findings encourage the conclusion that most holdings in the Southwest are too small to support a family adequately as presently exploited, and therefore, a long-term agricultural strategy for the region should include crop and stock integration as a major component. Other promising avenues for the low-country wet zone are inland fisheries, aquaculture, and intensive vegetable cultivation in the rice paddies at higher elevations. These are discussed in an exhaustive study by Balasuriya (2).

But Figure 10 provides evidence that the impact of agriculture on nutrition and income could be limited. Among mixed on-farm/off-farm income earners (MIXED), prevalence of linear undergrowth was the lowest: 13 percent. This is also the most favored occupational group, in terms of income. Among the next most favored group -- full-time farmers (FARMER) -- the prevalence of linear undergrowth jumps to 19 percent. And this trend continues. The poorer the occupational group, the greater the extent of malnutrition.

That the MIXED group is of superior income and nutritional status yields an important insight. This is that agricultural development alone is unlikely to solve problems of poverty in the rural Southwest, although it may mitigate them to some extent. Solutions to these problems must lie ultimately in the creation of adequate off-farm employment opportunities. So, rapid expansion of the service and industrial sectors is a crucial policy concern. This conclusion also opens up promising avenues for future socioeconomic research. Perhaps the time has come to close old doors and open new ones. Is growth with equity possible through agriculture alone? Should we be looking at broader alternatives? Our findings certainly encourage us to do so.

The link observed between household size and nutritional status suggests that substantial benefits could accrue from family planning. Other methods to bring down family size also deserve consideration. Supplementary feeding programs have the potential to achieve this if properly administered. The logic is that such programs help reduce child mortality and that this has the effect of encouraging parents to have fewer children. Sri Lanka's Thriposha program for infants and mothers may be in part justified in this light. In the long term, though, a widespread, secular decline in family size is best equated with the participation by all in the process of economic development.

Equitable income growth is also the most effective means for eliminating malnutrition in the long run, and our study has clearly confirmed the linkages between income, socioeconomic status and nutritional well-being that most people would accept as obvious. But the objective of growth with equity is easier praised than attained. Sri Lanka's three decades of independence have been accompanied by what for the developing world is almost a unique package of public welfare programs. The rice subsidy, free education, free public health services, land reform: all are redistributive measures with whose objectives few would quarrel. But such has been their expense that the rate of income growth experienced during this period has paled in comparison to that attained by Malaysia, Korea, and Taiwan -- all

of whom entered the 1950s no better off than Sri Lanka, but emphasized thereafter development of their economic infrastructure.

Given the apparent tradeoffs between long-term policies aimed at achieving growth and redistribution, are there short-term options for minimizing PEM which are not incompatible with the present government's growth-oriented philosophy?

Short-Term Policy Options

In order to empirically confirm the links between short-term factors and malnutrition, we created a new model which had as its nutritional outcome indicator the household HA score. We have previously justified using this index because it best captures the effects of cumulated hunger on physical growth. This index was regressed on two variables -- caloric intake (CPA) and sanitation (SANIT).

Formally, the equation is:

$HA = a_o + a_1 SANIT + bCPA + e$, where SANIT is discrete and CPA is continuous.

The use of caloric intake as a proxy variable for food intake can be justified on the grounds that an energy-deficient diet causes growth retardation in children. In the case of health, the matter is far less straight-forward. Health status is a composite measure; and for convenience of analysis, one has to decide on a reasonable proxy variable. The presence or absence of certain infections may be a reasonably good one; but trained medical personnel are needed to diagnose them. Further, such diagnoses pertain to the individual, whereas our interest was with obtaining a household health indicator.

Sanitation is another proxy for health, because good and poor sanitary conditions contribute to good and poor health. A clean environment reduces the risk of disease whereas an unclean one increases it. While infections themselves are not easy to record, sanitary conditions (such as type of toilet and water supply) are. These variables have the advantage that they refer collectively to the health situation of the household.

In our study, water supply was not suited for the regression analysis, because most households used only one type: well-water. As an explanatory variable it is of no significance. But this is not so in the case of toilets, since there was no overwhelming share of households relying on one type. Hence this variable is a better proxy for health.

The model produced a goodness of fit (R^2) of only 0.12, indicating that these two variables jointly explained only a small proportion of the variation in HA. However, the t-values showed that their independent effects on HA were highly significant.

Findings of the regression analysis were as follows:

$$HA = 83.35 + 1.44SANIT + 0.003CPA \qquad R^2 = 0.12$$
$$(t)^* \quad (88.76) \quad (4.87) \quad (9.98) \qquad F = 63.4$$

* All t-ratios highly significant ($p = 0.001$).

Thus the model confirmed a statistically significant link between growth (nutritional status) and its two proximal determinants, though this was not as strong as expected.

The relatively large t-ratios for the estimates of the slope coefficient (b) and the differential intercept coefficient (a_1) could be interpreted as follows: First, that the effect of increased caloric intake on HA was significant, and second that households with better sanitary conditions (those possessing toilets) also had taller children (modified by age). These findings suggest that children who are "healthier" and eat better also have a better physical growth record than those less privileged in these respects. Hence measures for simultaneously improving both dietary and health status are necessary for the control of malnutrition. These are the two key policy variables in the short run.

Control of infectious disease is the main avenue for improving health. This is crucial, and accordingly, sanitation and primary health care should receive high priority. In Sri Lanka, provision of new water supplies is programmed by the Finance and Planning Ministry to absorb Rs.5,650 million and primary health care, Rs.1,140 million, over the period 1982-86 (24, pp. 117, 127). These figures amount to 5.8 percent and 1.2 percent of the total projected public investment allocations for this period.

Only 13 percent of the households in rural areas have piped water (4, p. 82). But a plan covering the needs of the whole island for the "water decade" of the 1980s is being formulated by the Ministry of Housing (24, p. 125).

A major constraint in expanding primary health care facilities has been a shortage of health man-power. The Central Bank indicates that compared with the required number, the actual availability of doctors is considered to fall short by 38 percent. The corresponding deficit for nursing and paramedical services is 48 percent, and in the non-medical categories, 34 percent (5, p. 85).

Table 12 shows the percentage of government consumption expenditures allocated to health activities in selected countries. In Sri Lanka this has been roughly 11 percent, much higher than comparable figures for other developing countries, such as India and Pakistan, but much lower than those for developed countries, like Sweden and the U.K. Yet no doctor in Sri

TABLE 12. EXPENDITURE ON HEALTH AS A PROPORTION OF TOTAL GOVERNMENT CONSUMPTION EXPENDITURE, FOR SELECTED COUNTRIES, 1972-80*

Country	Percent
Sweden	25.5
United Kingdom	22.5
Denmark	20.4
Sri Lanka	11.5
India	7.0
Sierra Leone	6.9
Pakistan	6.2
Thailand	4.6
Bolivia	3.4

*Source: Various World Bank publications.

Lanka would pretend that rural health services are adequate, in either quantitative or qualitative terms.[2/] Much remains to be done.

But this is not easy to do. The majority of LDCs are too poor to afford massive investments in public health and sanitation. Cheaper alternatives have to be explored in the short run; and there is at least one holding great promise. We have stressed the control of infectious disease as a necessary corollary to the control of malnutrition. For infants this is crucial, for otherwise the outcome can be fatal. As the Director-General of UNICEF puts it (19, p. 1):

> Perhaps as many as half of all cases of severe child malnutrition, for example, are precipitated not primarily by the lack of food but by intestinal parasites, fever and infection -- especially diarrheoal infection -- which depresses the appetite, burns the energy, and drains away the body-weight of the child.
>
> The net result is that everyday of this last year more than 40,000 young children have died from malnutrition and infection, and for everyone who has died, six now live on in a hunger and ill-health which will be forever etched upon their lives.

In recent years, new scientific and technological advances have been made against some of the more intractable health problems. Chief among these is the discovery of oral rehydration therapy (ORT):

> Its importance is that it can stop the dehydration -- caused by the draining of the child's body as a result of diarrhoeal infection -- which now kills an estimated 5 million young children a year and is by far the biggest single cause of death among the developing world's children (19, p. 2).

Diarrhoea causes severe loss of body-weight; and ORT is nothing more than administering to the child the correct mixture of sugar, salt and water, a task which can be performed by the mother in her own home.

Until recently, it was thought that diarrhoea could be only combatted by trained medical personnel using expensive, intravenous saline drips: a recourse not available to the poor. But the change brought about by the discovery of ORT is revolutionary. This is cheap and effective, and could save the lives of up to 13,000 children every day. The breakthrough is so significant, The Lancet claims, that it could become the most important medical advance of this century (19, p. 2).

Complementing such measures for improving health status are those designed to enhance food intake. These usually involve some form of price manipulation by government, whether through direct procurement in the countryside, by subsidizing aspects of production or consumption, or by controlling the price paid by consumers.

[2/] The percentage figures in Table 12 show the level of government commitment to public health in selected countries, but they do not indicate how advanced these countries are with respect to one another in terms of public health infrastructure.

Virtually all LDCs have one or more programs of this type and, as their effect is to transfer income, the motivation for them has been more political than nutritional. Nonetheless their nutritional impact can be appreciable. Most observers credit Sri Lanka's program of, until a few years ago, providing the entire population with two pounds of rice per week -- the equivalent of 475 calories per person per day -- at little or no cost with having contributed to the country's nutritional well-being. But the cost has been high. The rationing program in Sri Lanka regularly absorbed between 15 and 20 percent of the government's budget, and was abandoned by the present government as being incompatible with rapid economic growth. Even today, the food stamp program -- covering families with monthly incomes below Rs.300, or roughly half the island's population -- costs in the neighborhood of Rs.2,000 million, some six percent of total government expenditure (5, pp. 213, 232).

A less costly alternative -- and one which our findings lead us to recommend -- is to channel assistance in kind directly to those at greatest risk nutritionally. Such programs usually focus on infants and mothers and provide them with an industrially processed, fortified food product at nominal cost or free. Their effectiveness is a function of how many of the malnourished are reached and this in turn reflects the government's capacity to correctly identify the individuals in need and to effect efficient delivery.

Sri Lanka has one such scheme, the Thriposha program, operated by the Ministry of Health in collaboration with CARE. The fortified food (a wheat soya blend flour, with precooked, local cereal/legumes being progressively added to it) is distributed mainly through various health clinics, but some amounts are also distributed through hospital wards, primary schools and certain voluntary agencies.

Earlier in our study, we presented an important finding: that during the weaning period, children experience a sudden deterioration in nutritional status. We attributed this to the feeding practices of the mother. Breast milk contains all the essential amino acids, and is easily digested. But after the first year the child may be put on a partially modified adult diet, characterized by a protein imbalance and low palatability. The consequence is malnutrition. We recall that among preschoolers, prevalence of combined second and third degree PEM was 41 percent, as compared to 19 percent among infants. It has been common practice up to now to regard pregnant and lactating women in poor countries as the principal vulnerable group. But perhaps this is not so. Our findings suggest that preschoolers could be equally vulnerable.

The channelling of specially prepared weaning foods to hungry preschoolers therefore could be critical in minimizing child malnutrition. Thriposha is a nutritious weaning food, is both palatable and rich in protein, and forms the perfect supplement to the household diet.

In the fiscal year 1979/80, there were 533,000 approved Thriposha beneficiaries, of whom 319,574, or 60 percent, were reached (17, p. 44).

The cost of the program that year was Rs.17 million, so that the per capita outlay was Rs.53, a small price to pay for so worthy a cause. Expansion of the program to reach 100 percent of the approved beneficiaries thus should be given the highest priority.

We conclude, then, on an optimistic note. Although our findings indicate that it is still not possible to quantify the extent of PEM in Sri Lanka with precision, the sensitivity analysis presented in Chapter 5 suggests that rigid interpretation of the arbitrary criteria employed in anthropometry has led to exaggeration in the past. We saw that a modest lowering of the cutoffs applied to the reference median reduces the PEM problem to relatively mild proportions. Moreover, means are at hand -- chiefly through oral rehydration therapy and the Thriposha weaning food program -- for cheap, immediate rectification. The joint impact of these measures could be such as to improve nutritional well-being and reduce child mortality, swiftly and cost-effectively. These are short-term measures to protect the needy and the sick while economic growth is pursued in the long run, and their contribution to Sri Lanka's welfare development could be profound.

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