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9. ABSTRACT Summarizes the major conclusions of studies on the effects of agricultural development programs and policies on the nutritional status of the rural poor. The studies show that agricultural policies and related development programs can affect rural poor through five impact vehicles: changes in the income of the rural poor; changes in the distribution of income in the economy; changes in the price of food; changes in demand patterns; and changes in fertility. Successful implementation of the green revolution can improve rural nutrition through increasing the real income of semi-subsistence farmers. As the supply curve for grain shifts to the right, small farmers gain as much as or more than large farmers. Improving the rural transportation network and education narrows the gap between the poor and rich by giving the poor better skills and better access to employment opportunities. The most effective policy instruments for lowering food prices are those which result in an increase in food production; these are subsidization of purchased agricultural inputs and improved agricultural education. Little is known about the impact of agricultural policies on demand patterns of the rural poor. It is possible that nutritional gains from improved income may be eroded by the perverse demand changes often associated with increased income. An agricultural policy which promotes greater skill application for production puts a premium on the education of rural youth. This may lead rural people to have less children so that they may better educate them. The accompanying reduction in family size would improve nutrition over what it would have been with a larger family size.		
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AGRICULTURAL POLICIES AND RURAL MALNUTRITION

by Phillips Foster
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EXECUTIVE SUMMARY

There has been considerable concern in recent years about the effects of agricultural development programs and policies on the nutritional status of the rural poor. A number of studies related to this concern are now available, most of them completed since 1970. This paper briefly summarizes the major conclusions of these studies and provides an annotated bibliography for persons needing more detailed information.

In brief, the studies show that agricultural policies (and related development programs) can affect the nutritional status of the rural poor through five nutritional impact vehicles, namely:

1. Changes in the income of the rural poor,
2. Changes in the distribution of income in the economy,
3. Changes in the price of food,
4. Changes in demand patterns, and
5. Changes in fertility.

Agricultural policies can affect the direction and speed of these changes.

1. Undernutrition and dietary deficiency have consistently been shown to be closely related to poverty. Thus an agricultural policy which results in an increase in the real income per capita of the rural poor can be expected to reduce malnutrition.

Successful implementation of the green revolution can be expected to improve rural nutrition through increasing the real income of semi-subsistence farmers because, as the supply curve for grain shifts to the right as a result of the green revolution, small farmers gain as much as or more than, large farmers when supply shifts faster than demand.

2. High income groups within an economy are usually characterized by overnutrition; low income groups by undernutrition. An agricultural policy which widens the income disparity can be expected to worsen the nutritional status of both groups. A policy which narrows the income disparity can be expected to improve nutrition among both groups because it decreases the capacity of the rich to bid food away from the poor.

Improving the rural transportation network and improving rural education can be expected to improve rural nutrition because these two actions will narrow the income gap between the poor and the rich by giving the poor both better skills and better access to employment opportunities.

3. Lowering the price of food will stimulate consumption and thus improve nutrition among the poor. The positive nutritional impact of lower food prices will be greatest among the lowest income people because they will increase their food consumption the most of any income group when the price of food falls.

The most effective policy instruments for lowering food prices are those which result in an increase in food production, e.g.: promotion of the green revolution, subsidization of purchased agricultural inputs, and improvement of agricultural education.

4. Many things may cause a change in demand patterns for food. Although the relationship between income and nutritional status of the rural poor is generally positive, special circumstances sometimes alter this relationship. For instance, if an increase in income leads to:

- a. the substitution of polished for unpolished rice, or
- b. the substitution of white for whole grain flour, or
- c. the substitution of fats and sugars for whole grain cereals,

this tends to negate the positive nutritional influence of such an increase.

Little is known about the impact of agricultural policies on demand patterns of the rural poor. About all we can say is that the nutritional gains resulting from agricultural policies which improve rural income may be eroded by the perverse demand changes often associated with increased income.

5. Other things being equal, a low income family will find it easier to feed fewer children than more.

An agricultural policy which promotes a higher level of skill application in agricultural production (as with the scientific farming associated with the green revolution) simultaneously puts a premium on the education of rural youth. This, in turn, may lead rural people to trade off having more children in exchange for educating better those children they already have. The accompanying reduction in family size would improve nutrition over what it would have been with a larger family size.

PREFACE

Purpose

This paper is concerned with the impacts of agricultural policies and programs on the nutrition of the rural poor in LDC's. The literature survey includes material on the relation between malnutrition and poverty, the economic implications of malnutrition, and the controversy over the quality vs. the quantity of food (the protein/calorie controversy).

About the Bibliography

The bibliography is divided into nine categories (see Table of Contents). Some of the literature, of course, falls into several categories. Such items have been placed where they are most useful. Most of the items in the bibliography are annotated. The bibliography is not exhaustive, but hopefully useful.

Acknowledgements

Many people contributed thoughts and helpful comments during the development of this paper. I am particularly indebted to Dick Ahern, John Day, Linda Haverberg, Whitney Hicks, Ed Krowitz, William Merrill, Harold Rice, Richard Suttor, Peter Timmer and Roberta van Haeften. I wish to thank Billy Lessley and other administrators at the University of Maryland for approving the released time to work on this project. Irene Hamud and Patricia Broderick assisted in abstracting the literature found in the bibliography. Christine Isherwood typed the various drafts.

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MALNUTRITION AND POVERTY IN THE LDC'S

The extent of malnutrition

In reviewing the dimensions of human hunger in 1976, Jean Mayer wrote, "The number of people in the world who are poorly nourished or undernourished can only be roughly estimated, but they probably represent an eighth of the human population. Most of them are found in Asia and Africa."¹

Using an alternative measure, Reutlinger and Selowsky² estimate that, based on average calorie consumption data in the mid-1960's, 50 percent of the population in developing countries had calorie-deficient diets in excess of 250 calories a day. Another 19 percent had deficits of less than 250 calories a day. By any measure malnutrition is a serious worldwide problem.

Mayer³ lists four types of malnutrition:

1. Undernutrition--a person may not get enough food.
2. Deficiency--he may lack one or more of the essential nutrients.
3. Secondary malnutrition--he may have an illness which prevents him from digesting his food properly or from absorbing some of its nutrients.
4. Overnutrition--he may take in too many calories.

This paper is concerned primarily with undernutrition, although some attention will be devoted to the second form, deficiency. Thus the word malnutrition generally will be used to mean undernutrition and/or deficiency.

¹Mayer, Jean, "The Dimensions of Human Hunger," Food and Agriculture, San Francisco: Freeman, 1976, p. 14.

²Reutlinger, Shlomo and Selowsky, Marcelo, Malnutrition and Poverty Magnitude and Policy Options, (World Bank staff occasional papers; No. 23) Baltimore: The Johns Hopkins University Press, 1976.

³Mayer, Jean, op. cit.

The close relationship between malnutrition and poverty

A number of studies have demonstrated a close relationship between malnutrition and poverty.^{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15} Table 1 presents representative data for Brazil.

⁴Battad, Josephine R., Determinants of Nutritional Status in Rural Philippines Household, Institute of Economic Development and Research, School of Economics, University of the Philippines, Discussion Paper No. 76-16, July 29, 1976.

⁵Beaudry-Darisme, M. N., Lesly C. Hayes-Blend and A. G. Van Veen, "The Application of Sociological Research Methods to Food and Nutrition Problems on a Caribbean Island", Ecology of Food and Nutrition, Vol. 1, No. 2. (March 1972).

⁶Berg, Alan, The Nutrition Factor--Its Role in National Development, Washington, D.C., Brookings, 1973.

⁷Sidney M. Cantor Associates, Inc., Ashkenay, Eleanor, et. al., The Tamil Nadu Nutrition Study, Vol. II, Section B, "Cultural Anthropology and Nutrition." Report to the U.S. Agency for International Development Contract No. AID/NESA-399, Mission to India, 1973.

⁸Keller, W., et. al., Some Observations Regarding Economy, Diet and Nutritional Statuses of Kikuyu Farmers in Kenya, ed. H. Krand and H. D. Cremer, Munich: I.F.O. Institute fur Wirtschaftorschung, 1969.

⁹Levinson, F. James, Morinda: An Economic Analysis of Malnutrition Among Young Children in Rural India, Cambridge Mass.: Cornell-M.I.T. International Nutrition Policy Series, 1974.

¹⁰Mayer, op. cit., p. 14.

¹¹Ofedal, Olav T. and J. James Levinson, Health, Nutrition and Income Distribution, International Nutrition Planning Program, M.I.T., Cambridge, Massachusetts, August, 1974.

¹²Pinstrup-Anderson, "The Impact of Increasing Food Supply on Human Nutrition: Implications for Commodity Priorities in Agricultural Research and Policy". American Journal of Agricultural Economics, May, 1976.

¹³Poyner, George, et. al., "Nutrition Sector Assessment for Nicaragua". Transmitted by USAID, Mission to Nicaragua, Managua, Nicaragua, May 14, 1976.

¹⁴Reutlinger, Shlomo and Marcelo Selowsky, The Anatomy of Hunger: an Overview of Malnutrition and Poverty Magnitude and Options. World Bank Staff, Occasional Papers, No. 23, 1976.

¹⁵Thimmayamma, B. V. S., K. Satyanarayana, Parvati K. Rao and M. C. Swaminathan, "The Effect of Socio-Economic Differences on the Dietary Intake of Urban Population in Hyderabad", The Indian Journal of Nutrition and Dietetics 10, No. 1, (January 1973), pp. 8-13.

Table 1. Calorie Consumption and Deficit by Income Groups, Brazil, 1960.*

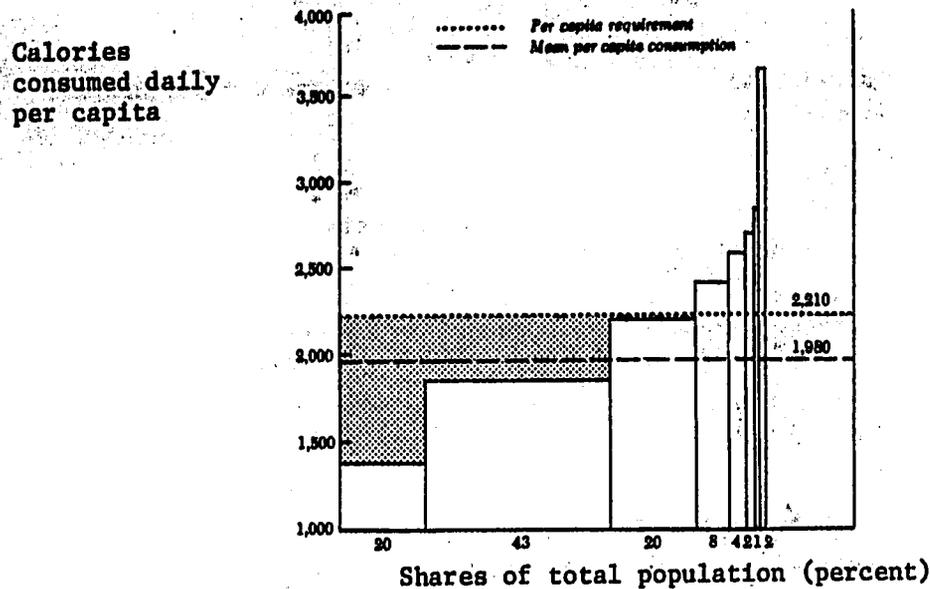
Annual family income (new cruzeiros)	Population		Daily calorie consumption		Daily calorie deficit*	
	Number (thou- sands)	Percent of total	Amount (millions)	Percent of total	Per capita	Total (mil- lions)
Under 100	3,583	5.05	5,172	2.87	1,006	3,604
100-149	4,873	6.87	8,847	4.91	634	3,089
150-249	12,235	17.25	25,940	14.41	330	4,037
250-349	10,197	14.37	23,378	12.98	157	1,601
350-499	11,145	15.71	28,293	15.71		
500-799	12,884	18.16	34,958	19.41		
800-1,199	7,198	10.14	22,689	12.60		
1,200-2,499	6,840	9.65	23,022	12.78		
2,500 and over	1,986	2.80	7,800	4.33		
Total	70,941	100.00	180,099	100.00		12,331

Source: Fundacao Getulio Vargas, Food Consumption in Brazil: Family Budget Survey in Early 1960's (Jerusalem: Israel Program for Scientific Translations, 1970), Tables 4, A.2, A.3, and A.4.

* Deficits are defined as the difference between daily calorie requirements (2,450 calories) and actual consumption.

Note: As quoted in Reutlinger, Shlomo and Marcelo Selowsky, op. cit., Malnutrition and Poverty--Magnitude and Policy Options, Baltimore: Johns Hopkins, 1976, p. 11.

Figure 1. Calorie Consumption by Income Groups, Asia, 1965, with Calorie-Income Elasticity Equal to 0.30



Source: Reutlinger and Selowsky, *op. cit.*, p. 23.

Reutlinger and Selowski illustrate this relationship through estimates of the income elasticity of demand for calories by major regions of the underdeveloped world. Table 2 contains the two sets of calorie consumption functions they developed which, they felt, "bracketed the full range of functions consistent with data and observations from other studies."¹⁶

The resulting estimated calorie consumption by income groups for one calorie-income elasticity assumption, 0.30, are represented graphically in Figure 1. This estimate suggests that over 60 per cent of the Asian population consumes far less than the FAO recommended level of calories. This same device presents similar charts for the other regions.

A multitude of studies are unanimous that undernutrition is caused mainly by poverty. It should be kept in mind, however, that malnutrition in the broad sense is often due to or exacerbated by other variables such as illness or shortage of one or more of the essential nutrients (protein in the case of diets heavy in root crops, or widespread vitamin A deficiency, for example.)

¹⁶ Reutlinger and Selowsky, *op. cit.*, p. 18.

Table 2. Analysis of Calorie Consumption Equations Using Assumed Elasticities of 0.15 and 0.30 at Level of Calorie Requirements, 1965

Region	Equation	Implied per capita calorie consumption at per capita income of		Income needed to meet FAO calorie requirement (U.S. dollars)
		US\$25	US\$3,000	
Elasticity at level of requirements: 0.15 ^a				
Latin America	$C = 471 + 359 \text{ LnX}$	1,627	3,345	210
Asia	$C = 491 + 332 \text{ LnX}$	1,560	3,149	177
Middle East	$C = 455 + 368 \text{ LnX}$	1,640	3,401	226
Africa	$C = 574 + 353 \text{ LnX}$	1,710	3,400	153
Elasticity at level of requirements: 0.30 ^b				
Latin America	$C = -1524 + 717 \text{ LnX}$	784	4,217	235
Asia	$C = -997 + 663 \text{ LnX}$	1,137	4,311	126
Middle East	$C = -1399 + 735 \text{ LnX}$	967	4,486	188
Africa	$C = -1002 + 705 \text{ LnX}$	1,267	4,643	116

a. The elasticity implied at US\$25 per capita income is approximately 0.22 in all regions.

b. The elasticity implied at US\$25 per capita income varies from 0.55 in Africa to 0.91 in Latin America

Note: C = Estimated Calorie Consumption
LnX = Log of Income

Source: Reutlinger and Selowsky, op. cit., p. 19.

ECONOMIC IMPLICATIONS OF MALNUTRITION

Several authors have argued that malnutrition impedes economic growth.^{17, 18, 19} Malnutrition reduces savings, increases medical costs, reduces productivity, decreases intellectual capacity, and affects birth and death rates.

Malnutrition and the capacity to do work

A reduction in malnutrition can increase productivity through:

1. less work time lost due to sickness
2. higher productivity when working, and
3. increasing the total number of working years during a lifetime.

The capacity to work is affected by malnutrition at a very early age. Improving diets of malnourished infants during their first two years of life when total food consumption is so small yet quality of food intake is so important, increases their lifetime earnings potential.²⁰

The relationship between malnutrition and productivity appears to be synergistic. That is, malnutrition tends to cut down on productivity which, in turn cuts down on income, which perpetuates or exacerbates malnutrition. Furthermore, the illnesses which result from malnutrition, such as diarrhea often result in poor absorption of available food. Finally, the recovery from an illness requires an increased level of protein intake. In the case of growing children, the need for protein skyrockets during the period of recovery following sickness. While sick, the child usually stops growing. While he recovers he may need five times the normal intake for his normal growth to catch up.²¹

¹⁷Call, D. L., Longhurst, Richard, Evaluation of the Economic Consequences of Malnutrition. Cornell Agricultural Economics Staff Paper, No. 43, Cornell, 1971, p. 12.

¹⁸Selowsky, Marcelo, Taylor, Lance, The Economics of Malnourished Children, A Study of Disinvestment in Human Capital, Discussion Paper, No. 13, Minnesota, 1971, p. 34.

¹⁹Sen Gupta, P. N., "Nutrition and National Development", Cajanus, 8, No. 2 (1975).

²⁰Berg, op. cit., pp. 17-19.

²¹Scrimshaw, USDA, seminar talk.

A number of researchers have attempted to quantify the relationship between nutritional intake and capacity to do work.^{22, 23, 24, 25, 26}

In a study of agricultural workers in Columbia and the United States, Spurr, et. al., measured the relationship between nutritional status and physical work capacity in terms of maximum capacity to consume oxygen. Their results suggest that some nutritional status variables have a high enough correlation to maximal oxygen capacity to be utilized in predicting work capacity, particularly when several are combined.

Malnutrition, intellect, and education

There is widespread feeling that malnutrition in early life (especially protein undernutrition during the first year of life) hinders brain development and thus potential intellectual development.^{28, 29} Berg³⁰ states that "80 percent of eventual brain weight... is reached by age two." During the early years, he points out, "children require, relative to body weight, two and one-half times as much protein as adults" in their diet. A diet of root crops or cereals early in life may result in a reduction in intellectual capacity later on.

²²Astrand, P. O. and K. Rodahl, Textbook of Work Physiology, New York: McGraw-Hill Book Co., Inc. 1970.

²³Barac-Nielto, M., et. al., Physical Work Capacity, Endurance and Undernutrition in Colombian Rural Dwellers, Federation Proc. 33:678, 1974.

²⁴Correa, H., Nutrition, Working Capacity, Productivity and Economic Growth. In Proceedings of Western Hemisphere, Congress II, Chicago: American Medical Association, 1966, p. 188.

²⁵De Guzman, M. P., et. al., "A Study of the Energy Expenditure, Dietary Intake and Pattern of Daily Activity Among Various Occupational Groups: Laguna Rice Farmers"; The Philippine Journal of Science, 102, No. 1, March 1974, pp. 53-65.

²⁶Viteri, F. E., and B. Torun, Ingestion Calorica y Trabajo Fisico de Obreros Agricolas en Guatemala; Efecto de la Suplementacion Alimentaria y su Lugar en los Programas de Salud, Bol. Ofic. Sanit. Panam. 78:58, 1975.

²⁷Spurr, G. B., Barac-Nieto, M., and Maksud, M. G, Clinical and Subclinical Malnutrition and Their Influence on the Capacity to do Work, Project AID/CSD 2943, Final Report, 1976

²⁸Barnes, Richard H., "Nutrition and Man's Intellect and Behavior", Federation Proc., Vo. 30, No. 4, July-Aug. 1971, pp. 1429-33. Printed in National Nutrition Policy: Nutrition and Health, May 1974.

²⁹Coursin, David B., "The Relationship on Nutrition to Brain Development and Behavior." National Academy of Sciences, National Research Council, June 1973.

³⁰Berg, op. cit., p. 24.

ancel Keys,³¹ working with conscientious objectors of World War II, found that undernutrition among these male adults first resulted in intellectual problems--loss of memory and difficulty of concentration. Later, as the period of undernutrition continued, the men experienced physical dexterity difficulties

Malnutrition affects education not only by lessening an individual's capacity but also by increasing the school days missed through sickness. Berg, for instance, cites the case of four Latin American countries where illness caused children to miss more than 50 days of school a year."³²

Malnutrition and demographic variables

The bulk of childhood deaths in developing countries are attributable to otherise minor childhood infections that are aggravated by the malnourished state of the child. A minor illness such as measles or chicken pox or even a cold cannot be overcome because the child's resistance has been lowered by nutritional deficiency. Diarrhea occurs and more nutrients are lost.³³

The tendency for improved nutrition to increase population growth³⁴ rates through a reduction in infant and child mortality is widely accepted. The evidence also suggests that improved nutrition may cause at least temporary increases in population growth rates through increased fertility rates.

Reduced malnutrition may increase fertility through:

1. Reduced incidence of spontaneous abortion or fetal wastage,
2. Increased fecundity or reproductive capacity (probability of conception of the woman at any given point in her reproductive period),
3. Increased length of the reproductive period by reducing the age at menarche and increasing the age of menopause.
4. Increased coital frequency, and
5. Reduced adult mortality which reduces the number of widows of childbearing age (women not exposed to conception).

³¹Keys, A., J. Brozek, A. Henschel, et. al., The Biology of Human Starvation, Minneapolis: University of Minn. Press, 1950.

³²Berg, op. cit., p. 11.

³³Berg, op. cit., p. 35.

³⁴Marshall, Carter L., et. al., "Improved Nutrition vs. Public Health Services as Major Determinants of World Population Growth." Clinical Pediatrics, July 1971, Vol. 10, No. 7.

On the other hand, to the extent that reduced malnutrition enhances the mother's ability to nurse her child and thus prolongs lactation, and the accompanying post-partum amenorrhea, it will increase the interval between births, thus reduced fertility.

Furthermore, the very reduction in infant mortality rates caused by reduced malnutrition may eventually be a major factor in reducing fertility over the long run. Parents seem to adjust their fertility in order to achieve a desired number of surviving children. If this is true, and if improved levels of nutrition result in reductions in infant mortality, then couples will be increasingly motivated to reduce the number of births.

THE CONTROVERSY OVER THE QUALITY VS. THE QUANTITY OF FOOD

Around the world, as income changes from low to high, there are striking and fairly constant differences in the proportion of calories in diet derived from various types of food. The types of dietary shifts which take place as income varies are illustrated in Figure 2.

Typically, as income rises, the proportion of food energy derived from fats rises steeply. This is the result of:

1. A rise in the consumption of separated fats (oils, butter, margarine, shortenings, and lards) and of unseparated animal fats found principally in meat and milk, and
2. A reduction in the consumption of unseparated vegetable fats found in cereals, nuts, and oilseeds.

The proportion of cereals in the diet declines as incomes increase, while the proportion of dietary energy from animal protein increases with income. Consumption of sugar rises dramatically with income.³⁵

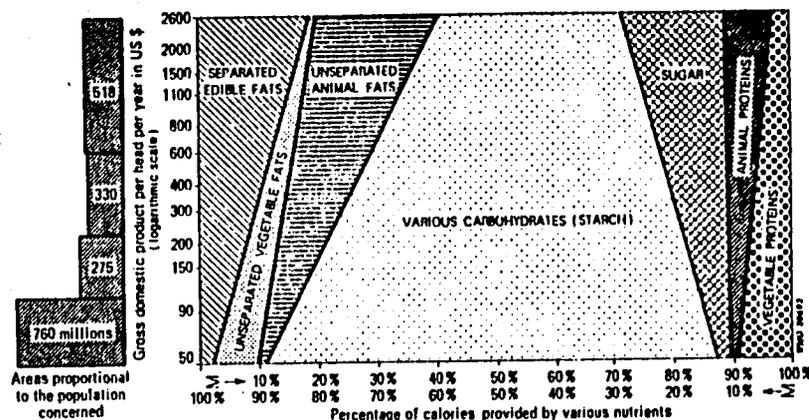
For many reasons, high income people usually enjoy better health than low income people. It is therefore not surprising that early nutritionists assumed that the diets of healthy people (who usually had high incomes) were better than the diets of low income people. Healthy people usually consumed more animal proteins than sickly people did. As a result, more importance was placed on the desirability of animal protein in diet than was justified.³⁶ It now appears that, except for vitamin B₁₂, which must come from animal products, most individuals could enjoy an adequate diet from unrefined cereals and pulses alone. Such a diet could be fortified with vitamin B₁₂ at a cost of a few pennies a year.³⁷

³⁵ FAO/WHO ad hoc expert committee, Energy and Protein Requirements, Rome, FAO/WHO, 1973. (Report dated 1971.)

³⁶ Conversation with Dick Ahern, University of Maryland, April, 1977.

³⁷ Burton, Benjamin, Human Nutrition, N.Y.: McGraw Hill, 1976.

Figure 2. Calories Derived from Fats, Carbohydrates, Proteins as Percentage of Total Calories According to the Income of the Countries (1962)*



* Correlation based on 85 countries.

Source: Perisse, J., Sizaret, F. and Francoise, P. (1969)
FAO Nut. Newsletter, 7, 3, p. 1.

The daily dietary allowances for "practically all healthy people in the U.S.A." as recommended by the National Academy of Sciences are shown in Table 3.³⁸ The NAS protein recommendations are approximately half those of some years back, and are part of a long term downward trend in the amount of protein felt necessary for good nutrition. The most recent protein recommendation of a Joint FAO/WHO Expert Group (1974)³⁹ is even lower than the NAS figures (Table 4). The American figures are higher in part because of the larger size of Americans.

No single recommended allowances will be ideal for all people. This is because "environmental, dietary and physiological factors all interact to set nutritional needs of individuals and populations. Recommended energy and nutrient allowances are thus statistical approximations."⁴⁰ Dietary allowances usually are calculated by adding two standard deviations to the mean value of a nutrient requirement.

³⁸ Filer, Lloyd J., Jr., Chairman, "Recommended Dietary Allowances". National Academy of Sciences, Eighth Edition, 1974.

³⁹ Passmore, R., et. al., Handbook on Human Nutritional Requirements, Rome, FAO and WHO, 1974.

⁴⁰ Scrimshaw, Nevin S., and Vernon R. Young, "The Requirements of Human Nutrition," in Food and Agriculture, San Francisco: Freeman, 1976, pp. 27-40.

TABLE 3

FOOD AND NUTRITION BOARD, NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL
RECOMMENDED DAILY DIETARY ALLOWANCES,* Revised 1974

Designed for the maintenance of good nutrition of practically all healthy people in the U.S.A.

	Age (years)	Weight		Height		Energy (kcal) ^b	Protein (g)	Fat-Soluble Vitamins			Water-Soluble Vitamins						Minerals							
		(kg)	(lbs)	(cm)	(in)			Vita- min A Activity (μ E) ^c	Vita- min D (IU)	Vita- min E Activity ^d (IU)	Ascor- bic Acid (mg)	Fola- cin ^e (μ g)	Nia- cin ^f (mg)	Ribo- flavin (mg)	Thia- min (mg)	Vita- min B ₆ (mg)	Vita- min B ₁₂ (μ g)	Cal- cium (mg)	Phos- phorus (mg)	Iodine (μ g)	Iron (mg)	Mag- nesium (mg)	Zinc (mg)	
Infants	0.0-0.5	6	14	60	24	kg \times 117	kg \times 2.2	420 ^d	1,400	400	4	35	50	5	0.4	0.3	0.3	0.3	360	240	35	10	60	3
	0.5-1.0	9	20	71	28	kg \times 108	kg \times 2.0	400	2,000	400	5	35	50	8	0.6	0.5	0.4	0.3	540	400	45	15	70	5
Children	1-3	13	28	86	34	1,300	23	400	2,000	400	7	40	100	9	0.8	0.7	0.6	1.0	800	800	60	15	150	10
	4-6	20	44	110	44	1,800	30	500	2,500	400	9	40	200	12	1.1	0.9	0.9	1.5	800	800	80	10	200	10
	7-10	30	66	135	54	2,400	36	700	3,300	400	10	40	300	16	1.2	1.2	1.2	2.0	800	800	110	10	250	10
Males	11-14	44	97	158	63	2,800	44	1,000	5,000	400	12	45	400	18	1.5	1.4	1.6	3.0	1,200	1,200	130	18	350	15
	15-18	61	134	172	69	3,000	54	1,000	5,000	400	15	45	400	20	1.8	1.5	2.0	3.0	1,200	1,200	150	18	400	15
	19-22	67	147	172	69	3,000	54	1,000	5,000	400	15	45	400	20	1.8	1.5	2.0	3.0	800	800	140	10	350	15
	23-50	70	154	172	69	2,700	56	1,000	5,000		15	45	400	18	1.6	1.4	2.0	3.0	800	800	130	10	350	15
	51+	70	154	172	69	2,400	56	1,000	5,000		15	45	400	16	1.5	1.2	2.0	3.0	800	800	110	10	350	15
Females	11-14	44	97	155	62	2,400	44	800	4,000	400	12	45	400	16	1.3	1.2	1.6	3.0	1,200	1,200	115	18	300	15
	15-18	54	119	162	65	2,100	48	800	4,000	400	12	45	400	14	1.4	1.1	2.0	3.0	1,200	1,200	115	18	300	15
	19-22	58	128	162	65	2,100	46	800	4,000	400	12	45	400	14	1.4	1.1	2.0	3.0	800	800	100	18	300	15
	23-50	58	128	162	65	2,000	46	800	4,000		12	45	400	13	1.2	1.0	2.0	3.0	800	800	100	18	300	15
	51+	58	128	162	65	1,800	46	800	4,000		12	45	400	12	1.1	1.0	2.0	3.0	800	800	80	10	300	15
Pregnant					+300	+30	1,000	5,000	400	15	60	800	+2	+0.3	+0.3	2.5	4.0	1,200	1,200	125	18+	450	20	
Lactating					+500	+20	1,200	6,000	400	15	80	600	+4	+0.5	+0.3	2.5	4.0	1,200	1,200	150	18	450	25	

* The allowances are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses. Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined. See text for more detailed discussion of allowances and of nutrients not tabulated. See Table I (p. 6) for weights and heights by individual year of age.

^b Kilojoules (kJ) = 4.2 \times kcal.

^c Retinol equivalents.

^d Assumed to be all as retinol in milk during the first six months of life. All subsequent intakes are assumed to be half as retinol and half as β -carotene when calculated from international

units. As retinol equivalents, three fourths are as retinol and one fourth as β -carotene.

^e Total vitamin E activity, estimated to be 80 percent as α -tocopherol and 20 percent other tocopherols. See text for variation in allowances.

^f The folacin allowances refer to dietary sources as determined by *Lactobacillus casei* assay. Pure forms of folacin may be effective in doses less than one fourth of the recommended dietary allowance.

^g Although allowances are expressed as niacin, it is recognized that on the average 1 mg of niacin is derived from each 60 mg of dietary tryptophan.

^h This increased requirement cannot be met by ordinary diets; therefore, the use of supplemental iron is recommended.

Source: National Academy of Sciences, Recommended Dietary Allowances, Washington, D.C., 1974, p. 129.

Table 4 — RECOMMENDED INTAKES OF NUTRIENTS

Age	Body weight	Energy		Protein	Vitamin A	Vitamin D	Thiamine	Ribo- flavine	Niacin	Folic acid	Vitamin B ₁₂	Ascorbic acid	Calcium	Iron
		(1)	(1)											
	kilo-grams	kilo-calories	mega-joules	grams	micro-grams	micro-grams	milli-grams	milli-grams	milli-grams	micro-grams	micro-grams	milli-grams	grams	milli-grams
Children														
< 1	7.3	820	3.4	14	300	10.0	0.3	0.5	5.4	60	0.3	20	0.5-0.6	5-10
1-3	13.4	1360	5.7	16	250	10.0	0.5	0.8	9.0	100	0.9	20	0.4-0.5	5-10
4-6	20.2	1830	7.6	20	300	10.0	0.7	1.1	12.1	100	1.5	20	0.4-0.5	5-10
7-9	28.1	2190	9.2	25	400	2.5	0.9	1.3	14.5	100	1.5	20	0.4-0.5	5-10
Male adolescents														
10-12	36.9	2600	10.9	30	575	2.5	1.0	1.6	17.2	100	2.0	20	0.6-0.7	5-10
13-15	51.3	2900	12.1	37	725	2.5	1.2	1.7	19.1	200	2.0	30	0.6-0.7	9-18
16-19	62.9	3070	12.8	38	750	2.5	1.2	1.8	20.3	200	2.0	30	0.5-0.6	5-9
Female adolescents														
10-12	38.0	2350	9.8	29	575	2.5	0.9	1.4	15.5	100	2.0	20	0.6-0.7	5-10
13-15	49.9	2490	10.4	31	725	2.5	1.0	1.5	16.4	200	2.0	30	0.6-0.7	12-24
16-19	54.4	2310	9.7	30	750	2.5	0.9	1.4	15.2	200	2.0	30	0.5-0.6	14-28
Adult man														
(moderately active)	65.0	3000	12.6	37	750	2.5	1.2	1.8	19.8	200	2.0	30	0.4-0.5	5-9
Adult woman														
(moderately active)	55.0	2200	9.2	29	750	2.5	0.9	1.3	14.5	200	2.0	30	0.4-0.5	14-28
Pregnancy														
(later half)		+350	+1.5	38	750	10.0	+0.1	+0.2	+2.3	400	3.0	30	1.0-1.2	(9)
Lactation														
(first 6 months)		+550	+2.3	46	1200	10.0	+0.2	+0.4	+3.7	300	2.5	30	1.0-1.2	(9)

¹ Energy and Protein Requirements. Report of a Joint FAO/WHO Expert Group, FAO, Rome, 1972. — ² As egg or milk protein. — ³ Requirements of Vitamin A, Thiamine, Riboflavin and Niacin. Report of a Joint FAO/WHO Expert Group, FAO, Rome, 1965. — ⁴ As retinol. — ⁵ Requirements of Ascorbic Acid, Vitamin D, Vitamin B₁₂, Folate and Iron. Report of a Joint FAO/WHO Expert Group, FAO, Rome, 1970. — ⁶ As cholecalciferol. — ⁷ Calcium Requirements. Report of a FAO/WHO Expert Group, FAO, Rome, 1961. — ⁸ On each line the lower value applies when over 25 percent of calories in the diet come from animal foods, and the

higher value when animal foods represent less than 10 percent of calories. — ⁹ For women whose iron intake throughout life has been at the level recommended in this table, the daily intake of iron during pregnancy and lactation should be the same as that recommended for nonpregnant, nonlactating women of childbearing age. For women whose iron status is not satisfactory at the beginning of pregnancy, the requirement is increased, and in the extreme situation of women with no iron stores, the requirement can probably not be met without supplementation.

Source: FAO/WHO Handbook on Human Nutritional Requirements, FAO Nutritional Studies No. 28, Rome, FAO, 1974

Table 5. Estimated Amino Acid Requirements of Man*

Amino Acid	Requirements (per kg of body wt.), mg/day			Amino Acid Pattern for High Quality Proteins, mg/g of protein
	Infant (3 - 6 mo.)	Child (10 - 12 yr.)	Adult	
Histidine	33	?	?	17
Isoleucine	80	28	12	42
Leucine	128	42	16	70
Lysine	97	44	12	51
Total S-containing amino acids	45	22	10	26
Total aromatic amino acids	132	22	16	73
Threonine	63	28	8	35
Tryptophan	19	4	3	11
Valine	89	25	14	48

*Two grams per kilogram of body weight per day of protein of the quality listed in column 4 would meet the amino acid needs of the infant.

Source: FNB, in press, as quoted in National Academy of Science, Recommended Dietary Allowances, 1974, p. 44.

The reduction in the amount of the protein believed necessary for adequate nutrition in the human diet should not obscure the important difference in protein requirements between children and adults. For several amino acids, for instance, the daily requirements per kilogram of body weight for infants runs eight times that of the daily requirements for adults (calculated from Table 5). Nevertheless, the evidence suggests that, even among pre-school children, if intake of calories from grains is adequate, protein deficiencies are rare. For instance, Joy⁴¹ quotes evidence from a survey of 15,000 Indian preschoolers which suggests that none of the children who had sufficient calories had evidence of protein deficiency in their diets. Thirty five percent of the children surveyed exhibited symptoms of protein deficiency and all of that thirty five per cent also exhibited calorie deficiency (Table 6).

⁴¹Joy, Leonard, "Food and Nutrition Planning," Journal of Agricultural Economics, Vol. 24, No. 1, January, 1973, pp. 166-197.

Table 6 Protein and Calorie Deficiencies in Pre-school Children: India

	Protein Deficient	Not Protein Deficient	Sub-Total
Not Calorie Deficient	0	8	8
Calorie Deficient	35	37	92
Sub-Total	35	65	100

Source: Gopalan, C., "Some Recent Studies in the Nutrition Research Laboratories: Hyderabad," Journal of Clinical Nutrition, January, 1970, pp. 35-53, as quoted by Leonard Joy, "Food and Nutrition Planning," Journal of Agricultural Economics, Vol. 24, No. 1, January, 1973, Table 3, p. 166.

Joy remarks, "the nutrition problem is commonly regarded as being, above all, a problem of protein deficiency. Seen in this light, the solution lies in feeding more protein to those who are suffering from protein deficiency."⁴² Joy disputes this argument and concludes: "Most people, and certainly most people in poor countries, live on cereal-based diets whose protein content is adequate when calorie needs are met. It is the starch eaters or, still rarer, those who depend to a large extent upon calories from fats or sugar, who do not automatically get enough protein when their minimum calorie needs are met."⁴³

In spite of the optimism generated by data such as Joy cites, the "quantity vs. quality" controversy in human nutrition is not necessarily resolved. In a classic study, McCay⁴⁴ found that rats fed near starvation diets for periods of up to three years have longer life spans than rats raised on normal diets.

⁴²Joy, op. cit., p. 165.

⁴³Joy, op. cit., p. 167.

It is apparently an oversimplification to say, as Joy does, that because a person does not eat, in total, enough calories, "the protein that they eat is not utilized as protein for growth or maintenance of body tissue but as calories to supply their energy needs."⁴⁵ An undernourished yet otherwise healthy human whose diet is insufficient in energy will use at least some of the protein he consumes for growth and/or maintenance of body tissue and burn some of the protein for energy. Protein is thus still important in the diet of an undernourished individual.

Joy may be right in saying that most cereal consuming individuals in the LDC's will get adequate protein if they get enough calories from cereals but this hardly suggests totally abandoning a stress on at least some pulses in diets consisting largely of grains. There are several reasons for this:

1. Infants, pregnant women, and lactating mothers need more protein than they can get from the consumption of cereals alone.
2. It is almost universally customary to allow the "working" male members of the family first choice of food within the household. If the working male decides to eat some higher quality protein than that which he is getting from cereals alone, then for there to be some left over for the infants, pregnant women, and lactating mothers, there must be enough of the higher quality protein available to feed both the working male and the others.
3. The protein found in leguminous crops is usually complementary to protein found in cereals. Fed in conjunction with cereals, pulse protein can increase the efficiency of utilization of cereal protein.

⁴⁴McCay, Clive M., et. al., "Growth, Ageing, Chronic Diseases, and Life Span of Rats," Archives of Biochemistry, Vol. 2, 1943, p. 469.

⁴⁵Joy, op. cit., p. 163.

AGRICULTURAL POLICIES AND RURAL NUTRITION

There are five major "nutrition impact vehicles" through which an agricultural policy can impact on the nutrition of the rural poor.

1. A change in the income of rural poor.
2. A change in the distribution of income in the economy.
3. A change in the price of food.
4. A change in demand patterns.
5. A change in fertility and/or infant mortality.

An agricultural policy or development program which results in one or more of the changes listed above can be expected to have an impact on the nutrition of the rural poor.

Increasing the income of the rural poor will improve nutrition

Since malnutrition is so closely related to poverty, an increase in the per capita real income of the rural poor can be expected to result in an improvement of their nutritional status.

Increasing the income of the rural poor--policy examples

The most famous example of policies designed to increase the income of the rural poor are those associated with the implementation of the green revolution. (The green revolution is here defined as a process through which a package of high yielding varieties, fertilizer and perhaps other inputs such as irrigation water are combined to accomplish an increase in crop yields in the underdeveloped world.⁴⁶)

⁴⁶Dalrymple, Dana G., "Development and Spread of High-Yielding Varieties of Wheat and Rice in the Less Developed Nations," USDA, Foreign Agricultural Economic Report No. 95, July, 1976.

Although the green revolution is sometimes accused of leaving the poor behind and concentrating its benefits in the hands of a few, Hayami and Herdt⁴⁷ have successfully argued that, as the supply curve for grain shifts to the right as a result of the green revolution, "small farmers gain as much or more than large farmers when supply shifts faster than demand." Their argument is summarized in Figure 3.

The upshot of this argument is that the green revolution can not only add income to the small (semisubsistence) farm household but at the same time does not necessarily make him worse off incomewise, relative to the large (commercial) farmer.

The impact of the green revolution on the rural landless laborer must be looked at separately from that of the farmers. To the extent that the green revolution does not displace him, his real income, will increase as he shares with other consumers in the increase in the consumers surplus ($P_0 ABP_1$ in Figure 3), generated by the green revolution.

Other agricultural policies (besides those most directly associated with the green revolution) which are likely to increase the income of the rural poor include the improvement of rural transportation, communication, and extension education, as well as the promotion of labor-saving or time-saving devices for rural homemakers.

Improving rural transportation provides the rural householder with better access to employment opportunities which may raise his income. Better communication and extension education programs increase his productivity through upgrading his skills. And labor-saving or time-saving devices for rural homemakers free up energy and time among this group which can be spent on income producing activities.

Depressing the income of the rural poor--policy examples

Just as increasing the income of the rural poor can be expected to improve their nutrition, depressing their income can be expected to worsen their nutrition. No matter how well intended, certain agricultural policies have a tendency to discourage agricultural production, thus depressing farm income and therefore adversely affect the nutrition of the rural poor.

Saleh and Goolsby identified approximately 4,600 institutional disincentives to agricultural production in developing countries.⁴⁸ In a recent study they list and discuss the following types of disincentives to agricultural production:

⁴⁷ Hayami, Yujiro and Robert Herdt, "Market Price Effects of Technological Change on Income Distribution in Semisubsistence Agriculture," American Journal of Agricultural Economics, May, 1977, pp. 245-256.

⁴⁸ Saleh, Abdullah, and O. Halbert Goolsby, "Institutional Disincentives to Agricultural Production in Developing Countries," Foreign Agriculture, Supplement, August, 1977, USDA, Washington, D.C.

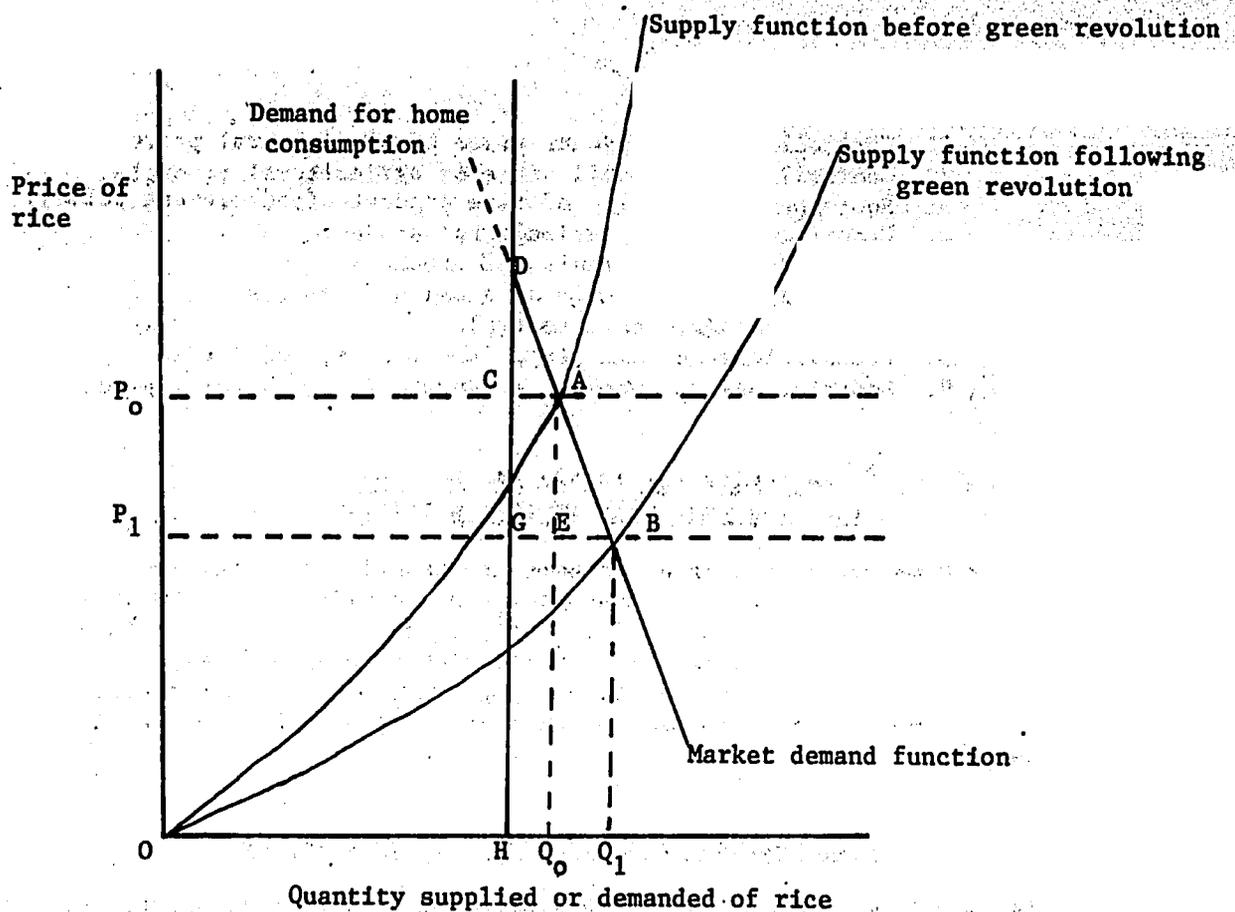


Figure 3. The Impact of Technological Change in a Subsistence Crop on a Semisubsistence Farm Household

P_0CHO = Market value of rice consumed by semisubsistence farm household before green revolution. (A semisubsistence farm is one where a major fraction of the produce of the farm is consumed in the household of the producers and not traded in the market place.)

CAQ_0H = Market value of rice marketed by semisubsistence household before green revolution.

P_1GHO = Market value of rice consumed by semisubsistence farm household after green revolution.

GBQ_1H = Market value of rice sold by semisubsistence farm household after green revolution.

Note that, although the market value of the rice consumed at home falls as the green revolution depresses the price of rice, the semisubsistence farmer experiences no real decrease in welfare from this fall in price since he wasn't selling that rice anyway. His income from rice sales, on the other hand, may increase, even though the demand for rice is inelastic, because the amount of rice he sells after the green revolution (relative to what he sold before) increases so dramatically.

Source: Hayami and Herdt, *op. cit.*, p. 246.

1. Controlling the producer price of agricultural products.
2. Controlling the retail price of agricultural products.
3. Noncompetitive buying of farm products (procurement policy).
4. Export controls on agricultural products.
5. Export taxes on agricultural products.
6. Importing food for sale at subsidized prices.
7. Foreign exchange rate controls.
8. Restrictions on farm size, land tenure, and credit.
9. Restrictions on domestic movement of agricultural products.

Narrowing the income gap between
rich and poor will improve nutrition

High income groups within an economy are usually characterized by overnutrition; low income groups by undernutrition. A widening of the income disparity (an increase in the Gini Coefficient) tends to worsen nutrition among both groups as it increases the capacity of the rich to bid food away from the poor. Conversely, a narrowing of the income gap tends to improve the nutritional status of both groups as it decreases the capacity of the rich to bid food away from the poor.

Decreasing the income gap between rich and poor--policy examples

The improvement of the rural transportation network will increase access to jobs and thus narrow the income disparity that may exist in a region due to job location. Improved education for the rural poor can narrow the income gap as it improves the relative productivity of these people. And of course, a sharing of the wealth program (as through land reform) will also reduce income disparity between rich and poor.

Increasing the income gap between rich and poor--policy examples

Although it was argued above that the green revolution may benefit small farmers "as much or more than large farmers when supply shifts faster than demand," it should be pointed out that there still can be income concentrating effects of the green revolution.

Policies which successfully promote the green revolution may, to some extent, increase the income gap between the rich and poor because farmers on good land are usually able to make better use of the new technology than farmers on poor land. Subsidized credit for lumpy items of capital, such as tractors, may increase the income gap between operators on large vs. small farms because those on small farms can't effectively utilize these lumpy items of capital. Hyami and Herdt⁴⁹ mention other arguments as to why a technological advance such as that of the green revolution may contribute to an increase in concentration of income among the farmers on larger holdings:

⁴⁹Op. cit., p. 245.

1. Faster adoption of "big" compared with "small" farmers or by owners compared with tenants,
2. Labor-saving bias in the technology that reduces labor's share,
3. A tendency for public services to be available to big farmers but not to small, and
4. Incentives for landlords or wealthy farmers to consolidate small holdings into larger units, therefore promoting a polarization of the rural population.

Lowering the price of food will
improve nutrition among the poor

Lowering the price of food, especially lowering the price of whole grain cereals and pulses, will stimulate consumption and thus improve nutrition among the poor. The positive nutritional impact of price decreasing policies will be proportionally greatest on the lowest income people because they have the highest elasticity of demand for food of any income group,⁵⁰ that is, they will increase their food consumption the highest percent of any income group when the price of food falls.

The most effective policy instruments for lowering food prices are those which result in an increase in food production, e.g.: promotion of the green revolution, subsidization of purchased agricultural inputs, and improvement of agricultural education.

Unfortunately, a policy intended to decrease food prices to the consumer may also decrease farm gate prices for the farmer. Such a policy may therefore result in a disincentive to agricultural production,⁵¹ e.g.:

1. Export taxes on food.
2. Non-competitive procurement of food for sale in fair price shops.
3. Importing food for sale at subsidized prices.

Some policies such as restrictions on grain dealers or on grain movement within the country can result in price increases in one region of the country and price decreases in another. Such policies may result in a nutritional improvement in one region of the country at the expense of a worsening of nutrition in another region.

⁵⁰ Pinstруп-Anderson, et. al., op. cit., p. 137.

⁵¹ For a fuller discussion of institutional disincentives to agricultural production, see Saleh and Goolsby, op. cit.

A change in demand patterns may
worsen nutrition among the poor

Many things may cause a change in demand patterns for food. Figure 2, page 11, suggests how changes in income affect demand patterns.

— Although the relationship between income and nutritional status of the rural poor is usually positive, special circumstances sometimes alter this relationship. For instance, if an increase in income leads to the substitution of polished for unpolished rice, or the substitution of white for whole grain flour, or an increase in consumption of fats and/or sugar,⁵² this tends to negate the positive nutritional influence of such an increase.

Peter Pellett cites an example of infant marasmus (protein/calorie malnutrition) in Libya, a country which has recently achieved a per capita GNP of \$3,000. Apparently as incomes rise in Libya, mothers substitute bottle feeding for breast feeding. Because of lack of education, however, the bottle feeding takes place under unsanitary conditions leading to repeated gastrointestinal infections. Since these infections are most commonly treated by withholding food, severe infant⁵³ malnutrition persists in spite of the dramatically increased income.

Little is known about the impact of agricultural policies on demand patterns of the rural poor. About all we can say is that the nutritional gains resulting from agricultural policies which improve rural income may be eroded by the perverse demand changes often associated with increased income.

Reducing fertility may improve nutrition

Other things being equal, a low income family will find it easier to feed fewer children than to feed more. A study in Colombia indicated that, in families with several children, those children who were born later were the more likely to be malnourished.⁵⁴ Reduced fertility among low income rural families can be expected to improve nutrition, especially among infants and children.

⁵²For an interesting discussion of some real-world possibilities here see Alan Berg, World Bank Office Memorandum to M. Yudelman, April 11, 1977, "Nutritional Consequences of Introducing Cash Crops," p. 7-9.

⁵³Pellett, Peter L., "Marasmus in a Newly Rich Urbanized Society," in Ecology of Food and Nutrition, Vol. 5, No. 4, 1977, p. 52.

⁵⁴Drake, William D., and Luis F. Fajardo, The Promotora Program in Candelaria: A Colombian Attempt to Control Malnutrition and Disease, 1968-1974, Community Systems Foundation, Cali, Colombia, June 25, 1976, Figure 15.

An agricultural policy which promotes a higher level of skill application in agricultural production (as with the scientific farming associated with the green revolution) simultaneously puts a premium on the education of rural youth. This, in turn, may lead rural people to trade off having more children in exchange for educating better those children they already have. The accompanying reduction in family size would improve nutrition over what it would have been with a larger family size.

CONCLUSIONS

Successful promotion of the green revolution can generally be expected to improve rural nutrition. This is because a successful green revolution can be expected to increase the income of semisubsistence farmers, lower the price of food, and reduce fertility among rural families.⁵⁵

Improving the rural transportation network and improving rural education can be expected to improve rural malnutrition because these two actions will narrow the income gap between the poor and the rich by giving the poor both better skills and better access to employment opportunities.

Policies which result in disincentives to agricultural production may increase rural malnutrition, largely through their tendency to depress rural income and increase food prices. Such policies include:

1. Controlling the producer price of agricultural products.
2. Controlling the retail price of agricultural products.
3. Noncompetitive buying of farm products (procurement policy).
4. Export controls on agricultural products.
5. Export taxes on agricultural products.
6. Importing food for sale at subsidized prices.
7. Foreign exchange rate controls.
8. Restrictions on farm size, land tenure, and credit.
9. Restrictions on domestic movement of agricultural products.

Ironically many of the institutional disincentives to agricultural production are commonly instituted in the first place to lower food prices to the consumer (e.g. 1, 2, 3, 4, 5, and 6 above) yet, in the long run, may end up putting upward pressure on the prices of the commodities whose prices they were designed to lower.

⁵⁵ Desirable as the green revolution appears to be as a means to improve rural nutrition, agricultural policy makers should be warned that it should be noted that policies which successfully promote the green revolution may, in some instances, increase the income gap between the rich and the poor. For example, farmers on good land are usually able to make better use of the new technology than farmers on poor land. To the extent that the green revolution widens the income gap it may lead to an increase in malnutrition among those whose relative income status is worsened.

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Volume IIA, "Data and Methods" is a detailed account of the technical and analytical phases of the project. It commences with sampling design and proceeds through questionnaire design, data collection, data handling technology and the details of data analysis. Included in the latter is the development and illustration of multidimensional displays and models. Volume I and IIA together present the study results in the full application and technical context which can be perceived at this stage of data analysis.

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1. to describe the extent and severity of the malnutrition problem in Nicaragua;
2. to identify some of the most important variables related to the problem;
3. to highlight the Government of Nicaragua's current policy, plans and programs relative to the nutritional status of its population; and
4. to propose some areas where intervention may impact significantly on Nicaragua's nutritional problem.

Nutritional Needs

Burton, Benjamine, Human Nutrition, N.Y.: McGraw Hill, 1976.

The most commonly accepted authoratative textbook on human nutrition.

FAO/WHO ad hoc expert committee, Energy and Protein Requirements, Rome, FAO/WHO, 1973. (Report dated 1971.)

A complete but compact discussion of energy and protein requirements.

Florencio, Cecilia A. and Victor E. Smith, "Toward More Efficient Expenditure for Food Among Colombian Families." Nutrition Reports International, April 1970, Vol. 1, No. 4.

Compares the actual diets of working-class families in Colombia with the least expensive diets of commonly consumed foods that would have provided them with a) the nutrients calculated to be in their actual diets or b) recommended nutritional allowances at two different levels.

Filer, Lloyd J., Jr., Chairman, "Recommended Dietary Allowances." National Academy of Sciences, Eighth Edition, 1974.

Gives RDA's for water, energy, protein, essential fatty acids and fat-soluble vitamins, water-soluable vitamins, and mineral elements. Note pages 2, 3, 44, and 129.

Mata, Leonardo, The Nature of the Nutrition Problem, a paper presented at the International Study Symposium on Policymaking and Planning to Reduce Malnutrition, The University of California, Berkely, Calif., March 29 - April 1, 1977.

Attacks some of the accepted criterion for discussion of malnutrition. (For example, opposes criterion for malnutrition which compares weights of children in LDC's to those in DC's.) Argues that malnutrition is not a purely biochemical and biomedical problem, but one which includes structural and organizational problems of family and society.

Passmore, R., et.al., Handbook on Human Nutritional Requirements, Rome, FAO and WHO, 1974.

Contains the 1974 FAO/WHO 1974 expert committee recommendations on RDA's for various nutrients. The energy and protein RDA's are from the 1971 report, Energy and Protein Requirements.

Scrimshaw, Nevin, "Myths and Realities in International Health Planning."
August 1974, AJPH, Vol. 64, No. 8.

Some of the myths underlying nutritional and health care programs
are identified and discussed.

Scrimshaw, Nevin S., and Vernon R. Young, "The Requirements of Human Nutrition,"
in Food and Agriculture, San Francisco: Freeman, 1976, p. 27-40.

Environmental, dietary and physiological factors all interact to
set nutritional needs of individuals and populations. Recommended
energy and nutrient allowances are thus statistical approximations.

Watt, Bernice and Annabel L. Merrill, Composition of Foods, Washington, D.C.:
U.S. Department of Agriculture, December, 1963, Revised. Reprinted
in 1975. Agriculture Handbook, No. 8.

Provides extensive information on 2500 foods in terms of their
nutritive value. Values are presented in Table 1 in terms of amount
of nutrient for 100 gms. of edible portion of food and in Table 2
in terms of amount of nutrients in the edible portion of one lb.
of food "as purchased". Tables 1 and 2 includes data for energy,
proximate composition, five vitamins, and minerals. Data for water,
ash and fiber are included in Table 1.

The Quality vs. Quantity Controversy

Abbot, John C., "The efficient use of world protein supplies." [Excerpted from Monthly Bulletin of Agricultural Economics and Statistics. Rome: Food and Agricultural Organization of the United Nations, Vol. 21, No. 6, June 1972, pp. 1-8.]

This paper provides an economic context for appraisal of various protein foods and considers whether the world's protein foods are being used efficiently, and whether new protein foods are being introduced and marketed to the best advantage. Some general suggestions are offered.

Borgstrom, Georg, "Food Production and Human Needs-A Critical Balancing Act." Address to sub-plenary session of XIIIth Congress of the International Federation for Home Economics, held in Ottawa, Canada, July 19-24, 1976.

Current problems on the world scene, 1) unrelenting population growth, 2) an escalating affluence within a privileged minority, and 3) an expanding number of destitute, landless and unemployed. Shortage of water is the chief bottleneck in world food production and ecological abuse intensifies this problem. More equitable distribution of food resources required.

Bressani, Ricardo, J. Edgar Braham and Moises Behar. Nutritional Improvement of Maize. Proceedings of an International Conference held at the Institute of Nutrition of Central America and Panama (INCAP) Guatemala, March 6-8, 1972. Guatemala: INCAP Publication, L-4, October 1972.

Given the importance of cereal grains in the diet of people in the LDC's, it is most important that efforts be directed towards improving those grains, rather than seeking to change diet. This was the theme of the INCAP conference. While it focused primarily on the production and improvement of maize in Latin America (Central America), papers were also given from Africa in regards to maize.

Joy, Leonard, "Food and Nutrition Planning," Journal of Agricultural Economics, Vol. 24, No. 1, January, 1973, p. 166-197.

The conventional policy approaches to nutrition are based on false notions of the nature of the nutrition problem. The problem, is one of calorie rather than protein deficiency, and arises from inadequate effective demand for food rather than insufficient supply. Policies should therefore emphasize generating incomes among the poor.

Ryan, James G., et.al., "Human nutritional needs and crop breeding objectives in the semi-arid tropics." Occasional Paper 4, Economics and Statistics Unit. ICRISAT, Hyderabad-16, India, October 1974.

This paper discusses available evidence on nutritional needs within the semi-arid tropics and considers the implications surrounding the "protein gap" philosophy controversy in terms of ICRISAT's crop improvement strategies.

Presents information that suggests that the need for at least 2/3 of the total population of the semi-arid tropics (SAT), in terms of nutrition, is for more calories.

Ryan, James G., Human Nutritional Needs and Crop Breeding Objectives in the Indian Semi-Arid Tropics, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India, September, 1977.

In India the overriding nutritional deficiencies amongst low-income groups are calories, calcium, copper, iron, zinc, vitamin A and vitamin B complex. Protein and amino-acids do not appear to be limiting factors as had for so long been the conventional wisdom.

Ryan, James G. and M. Asokan, Effect of Green Revolution in Wheat on Production of Pulses and Nutrients in India, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India, October, 1977.

The new high yielding varieties (HYV's) of wheat introduced into India in 1964-65 had, by 1974-75, resulted in a substantial improvement in the production of total food, protein, energy, and all of the essential amino-acids except lysine. Today the production status of protein, energy, and all the essential amino-acids would have been far inferior had it not been for the HYV's of wheat.

Schetz, Lyle P., "World Food: Prices and the Poor." Foreign Affairs, April 1974. Printed in National Nutrition Policy: Nutrition and the International Situation - II, June 1974, pp. 511-37.

Increases in world food prices adversely affect the poor who must compete with other nations for imports (i.e. impact of Russian grain deal on LDC's). In India in 72-73, Indian food grain crop dropped from 105 million to 96 million tons. Per capita calorie available dropped toward the levels of the mid 1960's.

Since 1955, the LDC's have general agricultural increases almost in step with the DC's. However, these increases have been eclipsed by population increases. Trend is one of increasing dependency on the U.S. for food.

Smith, Victor E., "A Diet Model with Protein Quality Variable." Management Science, Vol. 20, No. 6, February 1974.

This paper presents a model, with one nonlinear restraint, that determines a least-cost diet in which the quality and the quantity of the protein are jointly and optimally determined.

Malnutrition, Education and Productivity

Astrand, P. O., and K. Rodahl, Textbook of work physiology. New York: McGraw-Hill Book Co., Inc., 1970.

Barnes, Richard H., "Nutrition and Man's Intellect and Behavior," Federation Proc., Vol. 30, No. 4, July-August 1971, pp. 1429-33. Printed in National Nutrition Policy: Nutrition and Health, May 1974.

Most research in this area is tainted by confusion of causal factors-- inability to separate malnutrition from poverty with its socio-cultural, economic and environmental deficiencies. However, more recent studies (ongoing in 1971) have provided convincing evidence of a relationship between malnutrition and long lasting retardation, if malnutrition occurred in the first year of life. Most convincing evidence comes from animal studies. Another concluded, 1) it is probable that severe protein/calorie malnutrition in the infant can have long lasting effects upon behavioral development. Retarded intellectual development can be one of the characteristics affected by this early, severe malnutrition. 2) It is probable that the behavioral changes that will be most prominent in individuals who were severely malnourished in early life will reflect changes in emotionality and elevated response levels to adverse stimuli. 3) Behavioral changes in animals malnourished in early life appear to be identical to the changes that result from early social isolation.

Battad, Josephine R., Determinants of Nutritional Status in Rural Philippines Households, Institute of Economic Development and Research, School of Economics, University of the Philippines, Discussion Paper No. 76-16, July 29, 1976.

Investigates income and education issues related to nutritional status of children. Seeks to determine the relative importance of income and education by age group and how different the affects of income are in different levels of education and vice versa.

Beaudry-Darisme, M. N., Lesly C. Hayes-Blend and A. G. Van Veen, "The Application of Sociological Research Methods to Food and Nutrition Problems on a Caribbean Island," Ecology of Food and Nutrition, Vol. 1, No. 2, (March 1972).

Research done on St. Vincent. The survey was done to identify ecological areas on a household basis, investigate patterns of food consumption, their socio-economic correlates and their relationship to the incidence of malnutrition in pre-school children evaluated by the Caribbean Food and Nutrition Institute in the Fall of 1967. Concluded that an increase in the complexity of life was significantly associated with 1) a lower incidence of malnutrition in children between 1 and 5, 2) a lower child mortality rate and 3) a shorter period of breast feeding.

Call, David L., Longhurst, Richard, "Evaluation of the Economic Consequences of Malnutrition." Cornell Ag. Econ. Staff-Paper, September 1971.

The authors wish to examine each of the following hypotheses and their underlying assumptions in some depth and then discuss them in terms of what appears to be the major nutrition research needs in developing countries. First is the hypothesis that malnutrition is in and of itself a major deterrent to economic development. The second hypothesis is that malnutrition in a society results in a degradation of the human being which in and of itself is a social problem that cries for a solution.

Correa, H., "Nutrition, working capacity, productivity and economic growth." In: Proceedings of Western Hemisphere, Congress II. Chicago: American Medical Association, 1966, p. 188.

Correa, Hector, Population, Health, Nutrition, and Development. Lexington, Massachusetts: Lexington Books, DC Heath and Company. (HB871/C785/1975). 1975

Coursin, David B., "The Relationship of Nutrition to Brain Development and Behavior." National Academy of Sciences, National Research Council, June 1973.

This statement--prepared for the Food and Nutrition Board by the Subcommittee on Nutrition, Brain Development, and Behavior of the Board's Committee on International Nutrition Programs--assesses present knowledge of the relationship of nutrition to brain development and behavior in the perspective of the many factors that influence that process.

De Guzman, M. P., et. al., "A Study of the Energy Expenditure, Dietary Intake and Pattern of Daily Activity Among Various Occupational Groups: Laguna Rice Farmers." The Philippine Journal of Science, 102, No. 1, (March 1974), pp. 53-65.

Purposes of the study were 1) to assess the energy expenditures of Laguna rice farmers during the peak of the farming season and measure the energy cost of their agricultural and nonfarming activities; 2) to determine the percentage of time spent by the farmers in the activities performed during the day; 3) to contribute data on the

energy cost of activities which later on could serve as a basis for determining specific caloric allowances for various occupational groups of Filipino adults. Outgrowth of FAO's contention that "the degree of physical activity is the most important factor influencing calorie requirement."

Kamel, Wadie Wanies, "Vitamin A, Xerophthalmia, and Blindness, A Status Report in Three Volumes. Vol. 1, A Global Survey of Mass Vitamin A Programs Office of Nutrition, TAB USAID, July 1973.

This compilation should be considered a first step in an improved and expanded inter-agency program to combat Vitamin A deficiency worldwide. This comprehensive review can serve as a guide to A.I.D. and others interested in Vitamin A programming.

Dalrymple, Dana G., "Economic aspects of nutrition improvement in Tunisia." Foreign Economic Development Service, USDA cooperating with U.S. AID, July 1970, Washington D.C. 20250.

Report seeks to provide a framework for analyzing the nutritional problem of a relatively poor country like Tunisia given very limited resources.

Keys, A., J. Brozek, A. Henschel, et. al., The Biology of Human Starvation, Minneapolis: University of Minnesota Press, 1950.

Levinson, F. James, Morinda: an economic analysis of malnutrition among young children in rural India. Cambridge, Massachusetts: Cornell-M.I.T. International Nutrition Policy series, 1974.

McCay, Clive M., et. al., "Growth, Ageing, Chronic Diseases, and Life Span of Rats," Archives of Biochemistry, Vol. 2, 1943, p. 469.

Ploeman, Thomas T., ed., Freebairn, Donald K., ed., "Food, Population, and Employment, The Impact of the Green Revolution." Published for the Cornell University Program on Science, Technology, and Society, 1973.

To trace some of the more clear-cut social, political, and economic consequences of the Green Revolution, a Workshop was held at Cornell University in June, 1971. This volume is one of its products. The book follows closely the organization of the Workshop.

Selowsky, Marcelo and Lance Taylor, "The Economics of Malnourished Children: A Study of Disinvestment in Human Capital." Discussion Paper No. 13, Center for Economic Research, Department of Economics, University of Minnesota, Minneapolis, December 1971.

The authors propose a somewhat modified version of the standard human capital model, to spell out in formal terms some of the microeconomic implications of infant deprivation. The theory suggests ways to measure the private and social benefit of alleviating the problem, and much of this paper is devoted to making initial estimates of these benefits for lower class populations in Santiago, Chile.

Sen Gupta, P. N., "Nutrition and National Development", Cajanus, 8, No. 2 (1975).

Malnutrition impedes productivity and as such nutritional upliftment must be considered a part of overall economic development of a nation. "However, increased production even coupled with rises in purchasing power will not in a decade or two bring about a solution of the problem of protein calorie undernutrition."

Argues that nutrition is more closely linked with economic growth than formerly realized and cannot await the achievement of a satisfactory level of economic growth. Further, that economic growth as an objective obscures other human needs.

Spurr, G. B., M. Barac-Nieto, and M. G. Maksud, "Clinical and Subclinical Malnutrition: Their influence on the capacity to do work." Final Progress Report to AID. Medical College of Wisconsin and Research Service, May 1976.

The project objectives were to measure the increase of productivity that can result from alleviating chronic malnutrition, to determine the physical work capacity and cardiovascular reactivity in chronically malnourished patients in various stages of malnutrition, and to quantify the changes in work capacity and relate them to the initial severity of malnutrition.

Results of trials on undernourished and normal agricultural workers in Colombia and Wisconsin showed that physical work capacity is directly related to nutritional status, and that productivity is directly related to maximum oxygen consumption capacity as well as to other nutritionally related parameters.

Viteri, F. E., and B. Torun. Ingestion caloric y trabajo fisico de obreros agricolas en Guatemala. Efecto de la suplementacion alimentaria y su lugar en los programas de salud. Blo. Ofic. Sanit. Panam. 78:58, 1975.

Nutrition and Demographic Variables

Bhatia, A., Influence of family size and parity on the nutritional status of children belonging to low socio-economic groups. Unpublished M. Sc. Thesis, Department of Foods and Nutrition, College of Home Science, Andhra Pradesh Agricultural University, Hyderabad, India, 1974.

Gonzalo, Susan Y., Major Factors Affecting Rural Household Food Consumption, Institute of Economic Development and Research, School of Economics, University of the Philippines, Discussion Paper No. 76-13, July 26, 1976.

Examines demographic variables (household size and age consumption, and mother related variables, mother's educational level and labor force participation) as they impact on diet. Argues that increased income does not always lead to improved diet. Analyzes consumption in terms of expenditures and quantities and also nutritional value.

Leibenstein, Harvey, "An Interpretation of The Economic Theory of Fertility: Promising Path or Blind Alley?", Journal of Economic Literature, Vol. XII, March 1974.

This is not a detailed review and analysis of the attempts to develop an "economic" theory of human fertility. It considers some important highlights of the problem. Included, in particular, are the Theory of the Demographic Transition, the Leiberstein Theory 1957 and discussion of the Chicago School.

Marshall, Carter L., et. al., "Improved Nutrition vs. Public Health Services as Major Determinants of World Population Growth." Clinical Pediatrics, July 1971, Vol. 10, No. 7.

This paper discusses the influence of antibiotics and improved sanitation and nutritional change on death rates.

Scrimshaw, Nevin S., "Nutrition and Fertility Interrelationships, Implications for Policy and Action". Subcommittee on Nutrition and Fertility, Committee on International Nutrition Programs, Food and Nutrition Board, National Research Council, National Academy of Sciences, Washington, D.C., 1975.

Booklet offers conclusions and recommendations which focus on aspects of policy, program development, and research that stem from common considerations of malnutrition and excess fertility.

United Nations, Department of Economics and Social Affairs, The Determinants and Consequences of Population Trends, Population Studies, No. 50, Vol. 1, New York, United Nations, 1973.

Summary of findings on Interaction of Demographic, Economic and Social Factors, 661 pages.

Nutritional Planning and Policies

Agency for International Development, "AID Nutrition Strategy", Issues Paper for the Administrator's Advisory Council.

Reviews AID nutrition related activities and identifies two primary areas for Agency action. 1) determining and then improving the consumption/nutrition effects of development policies, particularly those in the agricultural sector. 2) broad based development of services designed to meet the basic needs of the poor.

Agency for International Development, "AID's Responsibilities in Nutrition", Discussion Paper for the Administrator's Advisory Council, (Revised, February 22, 1977)

Examines nutrition and nutrition related programs within the agency, examines needs and priorities in the field and explores possible program choices for AID.

Agency for International Development, Planning National Nutrition Programs: A Suggested Approach, Volume II, Case Study. Office of Nutrition, Agency for International Development, March 30, 1973.

A continuation of Vol. I on nutrition in Ecuador. This volume illustrates the methodology outlined in the first volume, describes the Ecuadorian nutrition system, identifies some points of intervention and selects six possible courses of action for analyses.

The nutrition system of Ecuador is described in terms of the consumer, producer, marketing and processing subsystems.

Balis, John, Appropriate Technology for Agricultural Development, AID/W Staff Discussion Paper prepared for Appropriate Technology Committee, June, 1976.

An appropriate agricultural machinery technology should include hand tools, improved animal tools and small tractors.

Berg, Alan, Nevin S. Scrimshaw, David L. Call, Nutrition, National Development, and Planning. Proceedings of an international conference held at Cambridge, Massachusetts, October 19-21, 1971. Cambridge: The MIT Press. (TX345/.I 56/1971) 1973.

Berg, Alan, "A National Role in International Research to Combat the Effects of Malnutrition". World Food and Nutrition Study, National Academy of Sciences, December 1, 1976.

Program proposed in this report includes research profiles on:

- I. The Functional Significance of Nutritional Status
- II. Ensuring the Quality, Safety, and Adequacy of Diets
- III. Intervening to Improve the Nutritional Status of Selected Groups
- IV. Nutritional Impact of Government Policies

Burkhalter, Barton R., "A Critical Review of Nutrition Planning Models and Experience." Prepared for the USAID, December 1974.

Nutrition planning will be more successful if it is explicitly designed to be a learning process, in which each activity is perceived as a discrete step in a learning sequence. As such, each activity should grow out of past theory, and in turn contribute factual data which can modify the theory and future actions.

Cline, William R., "Policy Instruments for Rural Income Redistribution." Prepared for the Princeton/Brookings Income Distribution Project, Brookings, undated.

Surveys the recent literature regarding redistribution effects of principal policy instruments affecting the agricultural sector in developing countries. Specific attention is given to a model of land reform with compensation to owners.

Cooke, Thomas M., et. al., "An Overview of the Nutrition System of the Philippines." Office of Nutrition, Bureau of Technical Assistance, USAID, August, 1973.

A study team of specialists from the American Technical Assistance Corporation visited the Philippines in June and July 1973 to gather data for preparation of an intersectoral nutritional analysis. ATAC was asked to evaluate in particular alternatives to PL480 Title II programs, and the ability and willingness of the Government of the Philippines to assume an increasing amount of the burden for supplying and administering nutrition programs.

Cooke, T. M., Planning national nutrition programs, a suggested approach, Vol. II, Case Study, [1973, 165 p.] ATAC CSD-2978 GTS PN-AAC-205.

FAO/WHO Expert Committee on Nutrition, "Food and Nutrition Strategies in National Development." An Interdisciplinary Report published by FAO and WHO, Ninth Session, Rome, Italy, 11-20 December 1974.

This report gives the Committee's views on the scope and objectives of a national food and nutrition policy, methodologic approaches in food and nutrition planning and recommends a workable mechanism for integrating nutrition into national development plans. Another objective is to identify areas of training and research, particularly those calling for action by FAO and WHO for the improvement of the methodology of national food and nutrition policy formulation.

Forman, Martin J., Planning national nutrition programs: a suggested approach. Vol. I-Summary of the methodology. Office of Nutrition, Bureau for Technical Assistance, Agency for International Development, January 1973.

A guide to national nutritional planning intended to be used by existing planning staffs using existing country data. "It should be adapted to any planning situation and should help to make the planning of a malnutrition reduction program more orderly and efficient."

Goering, George O., et. al., Integrating Nutrition Planning Concerns into Agriculture and Health Sector Analysis. A Report Prepared for the Agency for International Development under Contract No. AID Ta-c-1115, Silver Spring, Maryland: Intech Inc., Sept. 1976.

Uses sector analysis to determine ways in which agriculture and health sector analysis can be used to further nutrition planning objectives. Conceptual framework analyzes 1) factors which affect the quantity and quality of food ingested; and 2) factors which affect the biological utilization of nutrients.

Harberger, Arnold C., "Fiscal Policy and Income Redistribution." Prepared for the Princeton/Brookings Income Distribution Project, September 1974.

Possibilities for poor countries to use their fiscal systems for redistributive purposes. The discussion centers on the taxation side of the fiscal equation. It concludes that a major assault on the problem of inequality cannot be effectuated by fiscal means.

Hayami, Yujiro and Robert Herdt, "Market Price Effects of Technological Change on Income Distribution in Semisubsistence Agriculture." American Journal of Agricultural Economics, May 1977, p. 245-256.

Impact of a technologically induced rightward shift in the supply function of a commodity grown and partly consumed by semisubsistence farmers is examined.

Johnston, Bruce F., "Strategies for the Reduction of Malnutrition." Presented at a Workshop on Food and Nutrition Policy Analysis, University of California, Berkeley, September 20-24, 1976.

Considers the issues that must be confronted in designing and implementing strategies capable of reducing malnutrition. Section II addresses, in particular, the elimination of malnutrition and other aspects of poverty in rural areas. Sections III and IV deal with policies and programs to be included in "production-oriented strategies" and "consumption-oriented strategies."

Joy, Leonard, "The Concept of Nutrition Planning," International Study Symposium on Policy Making and Planning to Reduce Malnutrition, University of California, Berkeley, March 29 to April 1, 1977.

Reviews procedures followed, or advocated, for defining social actions appropriate to reducing malnutrition and provides a conceptual framework for the analysis of these various approaches.

Krowitz, Edward, "Activity Paper - Impact of Agricultural Policies on Food Consumption and Nutrition of Small Farm Households." Winter 1976/1977.

Proposes a project is to improve the capacity of policy planners and government officials in developing countries to analyze the impact of agricultural development policies and programs on the food consumption and nutritional intake of poor small farm households.

Lewis, John P., "Designing the Public-Works Mode of Antipoverty Policy." Paper for Princeton-Brookings, Study of Developing Countries' Income Distribution, September 1974 Draft.

Policy suggestions for a particular set of developing country's governments. These are governments whose economic conditions, including access or potential access to resources, seem to invite major resort to "the public works approach."

Merrill, William C., "The Impact of Agricultural Mechanization of Employment and on Food Production," AID/TA/AGR/ESP, Occasional Paper No. 1, September 1975.

Horsepower per hectare available to the agricultural sector is extremely low in most LDC's. Mechanization is the only viable means of increasing agricultural horsepower per hectare over the long run. Fossil fuels are likely to be the main energy source for the next 20 to 30 years. Mechanization which replaces animal power usually results in a reduction in labor inputs. Tractorization programs may result in an increase in the size of holdings.

USAID, "Proposal and Recommendations for the Review of the Development Loan Committee." Unclassified Project Paper, USAID Washington, D.C., December, 1975.

The project's purpose is to develop and apply a systematic, integrated and multi-sectoral approach in planning, implementing and evaluating the Costa Rican National Nutrition Program.

Rogers, Beatrice Lorge and F. James Levinson, "Subsidized Food Consumption Systems in Low-Income Countries: The Pakistan Experience." MIT International Nutrition Planning Program, Discussion Paper No. 6, April 1976.

Economic and political feasibility of subsidized consumption systems, their potential effectiveness in achieving nutritional and income distributional ends, the preconditions under which they might be effective, and the forms which would be most appropriate for particular sets of preconditions.

Smith, Victor E. and Hossein Yoghooobi-Rahmatabadi, "The Nutritional Efficiency of Improved Methods in Nigerian Agriculture." Workshop Paper No. 7302, October 1973, Michigan State University Econometrics Workshop Papers.

To replace traditional practices of certain of the recommended or prospective practices would raise the cost of nutrition for the nation, not lower it.

Thiesenhusen, William C., "Peasant Prospects: Growth and Development in the Rural Sector," Madison: University of Wisconsin, Land Tenure Center, 1974.

Agrarian policy strategy makers in Latin America need to consider the equity-production-energy-protein crisis. Agrarian reform and prevention of reconcentration of property should be postponed until other sectors of the economy are ready to employ farm people productively.

Trivkovic, Vidosai, "Nutrition in Socio-Economic Planning in LDC's", Food Policy, August 1976.

Examines long-term determinants of food consumption in LDC's and argues that progress in improving nutrition is closely related to raising productivity and efficiency in the national economy; places particular emphasis on regional levels of development.

University of California, Berkeley, International Study Symposium, "Policy Making and Planning to Reduce Malnutrition." March 29 - April 1, 1977.

Folder includes information from the symposium, in particular, the keynote address, and a paper entitled, "The Politics of Food and Nutrition Planning: A Preliminary Working Paper on its Socioeconomic Context."

Elasticity of Demand (Direct, Cross, and Income) for Food

Abdel-Ghany, Mohamed and Gordon E. Bivens, "Influence of U.S. Urban Household Characteristics on Nutritive Intakes and Quality of Food Consumption." Mohamed Abdel-Ghany, University of North Carolina-Greensboro, Gordon E. Bivens, University of Missouri-Columbia, August 8, 1976.

The objectives of this study were to: 1) specify the income-consumption relationships and estimate the income elasticities for energy and nine individual nutrients, and 2) estimate the effects of selected socio-demographic factors upon the nutritive intakes and quality of food consumption (the ratio of calories from nonstarchy foods to calories from starchy foods).

Clark, Faith, "Food Consumption of Households in the United States, seasons and year 1965-66," U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C., March 1972.

Report presents averages for 12 income groups and all households for the year 1965-66 and averages for all households for the spring, summer, and fall of 1965 and the winter of 1966. This is the first time USDA has obtained data on the seasonal variations in food consumption from a nationwide sample of households.

Clark, Faith, "Food and Nutrient Intake of Individuals in the United States," Spring 1965. U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C., January 1972.

Report supersedes and enlarges preliminary report ARS 62-18, "Food Intake and Nutritive Value of Diets of Men, Women, and Children in the United States, Spring 1965," published March 1969.

Among the additional information provided: distributions of the individuals by family income, family size, and other characteristics of the households of which the individuals were members.

Desai, B. M., Analysis of Consumption Expenditure Patterns in India, Department of Agriculture Economics, Cornell University, USAID Employment and Income Distribution Project, Occasional Paper No. 54, August 1972.

Examines the differences in the marginal rate of consumption and the elasticity, both with respect to income between income groups and corresponding land holding groups done by comparing (1) the differences in rural and urban consumption functions for food grains, milk and milk products and (2) 18 consumption functions for 18 commodity categories.

Ferroni, Marco A., "The Effect of Income on Food Consumption in Lima: Some Preliminary Findings of the Peruvian National Food Consumption Survey (ENCA)." Cornell Agricultural Economics Staff Paper, January 1974.

The Peruvian National Food Consumption Survey (ENCA), its methodology and analysis. Based on preliminary data that became available in 1973, an attempt is made, with reference to the Peruvian capital, to sort out the variability in food consumption among various social groups defined on the basis of income. A brief overview of income distribution patterns in the Lima metropolitan area is presented at the outset as a background to the work of the survey analysis.

Frank, Charles R., Jr. and Richard Webb, "Income Distribution and Growth in Less Developed Countries: Some Reflections on Theory and Policy." Prepared for the Princeton/Brookings Income Distribution Project. Draft: July 26, 1974. Not for quotation.

The main focus of this volume is on policies which affect income distribution. Section II considers some simple theoretical models of income distribution and growth in less developed countries with emphasis on the distinction between the traditional (or informal) sector and the modern sector. Section III discusses the case of extreme dualism in which incomes in the modern and traditional sectors diverge very significantly and the divergence seems to grow. There are seven sections in total.

Goldman, Heather W. and Chandrashekhar G. Ranode, Food Consumption Behavior by Income Class in Rural and Urban Philippines. Department of Agriculture Economics, Cornell University, Ithaca, New York. Occasional Paper No. 90, November 1976.

Examines the effect of income on rural and urban household consumption in the Philippines using the expenditure elasticity of demand and marginal propensity to expend for food as the criteria of change in consumption. Estimates the demand functions for food items and chooses the most appropriate demand function on the basis of statistical and economic criteria.

Hsu, Wen-Fu, "The Effect of Income on Family Food Consumption in Taiwan". Paper written in Chinese.

Includes one-page summary. Purposes of this study are: to find out the present level of family food consumption both in quantity and expenditure, to measure the income effect on family food consumption among the different localities and groups of population, and to predict the changing pattern of family food consumption in the course of economic development.

Keller, W., et. al., "Some Observations Regarding Economy, Diet and Nutritional Status of Kikuyu Farmers in Kenya," ed. H. Krand and H. D. Cremer, Munich: I.F.O. Institute for Wirtschaftsforschung, 1969.

Calorie adequacy of the diet is positively correlated to total cash income and income from sale of agricultural produce as well as land size and expenditure on food and clothes.

Lele, Uma, "The green revolution: income distribution and nutrition." Proceedings, Western Hemisphere Nutrition Congress III.

Oftedal, Olav T. and F. James Levinson, "Health, nutrition and income distribution, International Nutrition Planning Program," M.I.T., Cambridge, Massachusetts, August 1974.

This paper attempts to evaluate the redistributive impact of nutrition and health programs in low-income countries.

Pellett, Peter L., "Marasmus in a Newly Rich Urbanized Society," Ecology of Food and Nutrition, in press.

Marasmus continues as a problem in Lybia among infants in spite of a per capita GNP of \$3,000. Evidently it results from a switch from breast to bottle feeding under unsanitary conditions. The lack of sanitation results in frequent diarrhea. The standard way of treating this is by withholding food. Thus marasmus.

Perera, L. N., et. al., "The Effect of Income on Food Habits in Ceylon: The Findings of the Socio-Economic Survey." Reprinted from MARGA, Vol. 1, No. 4, 1972.

Presents, in largely graphic form, a summary of the key findings of "The 1969/70 Socio-Economic Survey".

Pinstrup-Andersen, Per, et. al., "The Impact of Increasing Food Supply on Human Nutrition: Implications for Commodity Priorities in Agricultural Research and Policy." American Journal of Agricultural Economics, May 1976.

Develops a procedure to estimate the nutritional implications of alternative commodity priorities in agricultural research and policy. The model estimates the distribution of supply increases among consumer groups, the related adjustments in total food consumption, and implications for calorie and protein nutrition. Field work from Cali, Colombia.

Thimmayamma, B. V. S., K. Satyanarayana, Parvati K. Rao and M. C. Swaminathan. "The Effect of Socio-Economic Differences on the Dietary Intake of Urban Population in Hyderabad," The Indian Journal of Nutrition and Dietetics, Vol. 10, No. 1, (January 1973) pp. 8-13.

The dietary and nutritional status of families drawn from different socio-economic groups in the city of Hyderabad. Relation between economic status and dietary patterns.

Tolley, G. S., et. al., "Reexamination of the Time Series Evidence on Food Demand." Econometrica, Vol. 37, No. 4 (October 1969).

Investigates a variety of procedures, including new methods for analyzing deflation bias. The supply elasticity of food is found to be identifiable and to have a greater value than many have believed, providing a basis for deciding whether to favor demand estimates based on consumption-dependent or price-dependent regressions. Estimates are developed of three types of bias due to improper deflation. The six elasticity tables included are noteworthy.

Household Surveys and Household Modeling

Adelson, Sadye F. and Betty Peterkin, "Dietary levels of households in the United States, Spring 1965," U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C., July 1969.

From the results of this survey, it is possible to appraise and compare the dietary situation among various population groups in the United States. The findings identify by region, urbanization, and income the groups of households that had a large percentage of good and poor diets as defined for this study.

Andrews, Margaret S., "Food Economics of the Small Farm Household: A Programming Methodology Applied to the Dominican Republic." Unpublished Master's Thesis, Department of Agriculture Economics, University of Maryland, College Park, Maryland, 1975.

Household decision making for a representative small farm in the Dominican Republic. Concludes that the observed high market involvement of the smallest farmers is rational when both consumption and production factors are considered.

Andrews, Margaret S., Two Decision Models of Household Food Behavior, Silver Spring: Intech, Inc., Paper 76-1, n.d.

Provides an optimization framework for decision making behavior in households using two diet models: 1) household not producing food, and 2) households producing food. Food budget and prices are considered to play the determining role in food selection. Model applied to Dominican Republic.

Andrews, Margaret S. and John R. Moore, "An Integrated Production-Consumption Farm Model for the Dominican Republic." Agricultural Experiment Station University of Maryland, College Park, Maryland, August 1976

This study examines household decision making for a representative small farm in the Dominican Republic. Attention is given to both production and consumption aspects of farm behavior. A dynamic, recursive programming methodology is developed for integrated analysis of both aspects of the farm operation.

Caughlin, Michael, A Microanalytical Simulation of Eight East Indian Villages Ph.D. Dissertation, University of Maryland, 1973.

Includes economic, social and demographic variables in a simulation which can be easily affected by arbitrary changes in fertility and mortality rates.

DePass, Rudolph, A Microanalytical Simulation of the U.S. Economy, 1961-1970,
Ph.D. Dissertation, University of Maryland, 1970.

Developes a marriage model more extensively than previous simulations.

Poyner, George V. and Margaret S. Andrews, Development of Household Food Behavior Models, a Report prepared for the Agency for International Development under Contract No. AID/Ta-C-1318 by Poyner International Inc., Silver Spring, Maryland, December 1976.

Investigates and evaluates methods for analyzing economic factors which influence family food consumption. Linear programming models used, one for urban household food consumption and another for rural households. Field work done in Bolivia, Columbia, the Dominican Republic and Guatemala.

Desai, B. M., "Relationship of consumption and production in changing agriculture—a study in Surat District, India," Occasional Paper No. 80, Technological Change in Agriculture Project, Department of Agricultural Economics, Cornell University, February 1975.

This study examines short-run interrelation of the aggregate consumption and working capital investment decisions of farmers. It also examines expenditure patterns that are related to the aggregate consumption of farmers.

Doly, J., "Applications of Mathematical Programming to Problems of Malnutrition, Capsule Description." Memo (Cornell University), April 9, 1976.

Brief, and informal outline of some approaches to modelling the malnutrition problem.

Florencio, Cecilia A. and Victor E. Smith, "Efficiency of Food Purchasing Among Working-Class Families in Colombia." Journal of The American Dietetic Association, Vol. 55, No. 3, September 1969.

Measures the efficiency of food selection for each of some forty Colombian working-class families.

Foster, Phillips, and Larry Yost, "A Simulation Study of Population, Education, and Income Growth in Uganda," American Journal of Agricultural Economics, Vol. 51, No. 3, August 1969, p. 576-591.

An example of a stochastic simulation using a combination of Monte Carlo and Markoff Chain techniques.

Freedman, Deborah, et. al., "Standard Package of Economic and Demographic Questions." Population Studies Center, University of Michigan, December 1976.

This questionnaire was designed as an add-on to more specialized economic, fertility, health, nutrition or other human resources surveys in LDC. Its purpose is to enhance the usefulness of specialized economic surveys to economists interested in testing hypotheses relating to the economics of human resource development in LDC.

Goreux, Louis and Allen Mann, Editors, Multi-Level Planning Case Studies in Mexico.

Interdepartmental Committee on Nutrition for National Defense, Manual for Nutrition Surveys, 2nd ed., Washington, D.C., 1963.

Laurie, Annie, Household Surveys, A Description of Household and Micro Data Surveys, Washington, D.C.: Agency for International Development, January 1975.

An outgrowth of AID conducted micro-data surveys in LDC's. This pamphlet provides a convenient reference to these surveys. Each entry contains a short description of the survey, the size of the sample, and the complete address of the location of the data.

McCarthy, F. Desmond, "Nutrition, Food and Prices in Pakistan." Discussion Paper No. 4, M.I.T. International Nutrition Planning Program, June 1975.

Analyzes some of the issues involved in determining nutritional status. The empirical work relates to West Pakistan and is largely based on the household surveys conducted by the government of that country.

Nerlove, Mark, "Household and Economy: Toward a New Theory of Population and Economic Growth." Journal of Political Economy 82, supplement March/April 1974, pp. 200-218.

Part of the "New home economics" framework developed in the economics profession which explores the variables affecting household demand and production by assuming each household has a utility function which has as components the flows over time of the series of a variety of consumption goods, referred to as commodities. These commodity flows are produced by combinations of the time of household members, market-purchased consumer goods, and household physical and human capital. The nutritional status of any member is an example of a component of the utility function and is subject to a production process which depends on the available household resources. (Above abstract from Barry Popkin proposal to AID Nutrition dated May 25, 1977.)

Ono, Mitsuo, "A feasible method for collecting labor utilization, earnings and other social and economic data in southeast Asian countries Social and Economics Statistics Administration," Bureau of the Census: Washington, D.C.

Orcutt, Guy H., et. al., Microanalysis of Socioeconomic Systems: A Simulation Study, New York: Harper, 1961.

The pioneering work in the field of microanalytic simulation of population growth.

Ridker, Ronald, ed., Population and Development--The Search for Selective Interventions, Baltimore: Johns Hopkins Press, 1976.

A review of what is known about linkages between fertility and those determinants of fertility that might be subject to policy manipulation, policies that might move these determinants favorably, and appropriate related research.

Schultz, Theodore, ed., Economics of the Family: Marriage, Children and Human Capital, Chicago: University of Chicago Press, 1974.

Part of "New Home Economics" framework.

Smith, Victor E., "Linear Programming Models for the Determination of Palatable Human Diets." Journal of Farm Economics, Vol. XLI, No. 2, May 1959.

Smith, Victor E., "Agricultural Planning and Nutrient Availability." Nutrition Reviews, Vol. 28, No. 6, June 1970.

Shows how a computer model of the agricultural economy can identify aspects of the nutritional problem that have their origin in the limitations of productive capacity and techniques, can determine patterns of agricultural production that meet nutritional needs efficiently and can suggest extension or research activities that contribute effectively to providing nutrition for those who must eat economically if they are to eat well.

Thodey, Alan R., "Food and nutrition in Korea, 1965-1974." Korean Agricultural Sector Study, Special Report 11.

Presents the food and nutrition data used as the basis for the Korean Agricultural Sector Model which simulates the future behavior of the Korean agricultural sector using data for the most recent year as its departure point. 1970 was used as the base year with the simulated performance of the sector being compared to the actual performance during 1971-74.

The Model disaggregates the supply and utilization of agricultural commodities into 19 commodity groups and adjusts the initial income elasticity in proportion to the difference between (1) the projected and 1970 per capita consumption and the (2) "target" and 1970 per capita consumption.

General and Miscellaneous

Agency for International Development, "An Initial Inventory of AID Information Science Projects and Activities in Food and Nutrition Areas," Washington, D.C.: Technical Assistance Bureau, AID, August 23, 1976.

This inventory is divided into four parts: Section I presents AID information science projects, bureau-by-bureau which are concerned wholly or in part with the food and nutrition developmental areas. Section II contains AID food and nutrition contracts within which various information controls are implemented as sub-components. Section III contains AID funded contracts and grants which support development of international agricultural research centers and their programs. Section IV presents AID funded food and nutrition grants under Section 211(d) of the Foreign Assistance Acts of 1966, as amended.

Agency for International Development, "Socio-Economic Performance Criteria for Development." A Report on the Assessment of Commitment and Progress Submitted by the U.S.A.I.D. Pursuant to Section 102(d) of the Foreign Assistance Act, February 1977.

Includes several criteria new used by AID for allocating development assistance. Discusses some fundamental measurement issues, and offers findings and recommendations on the five categories of Section 102(d) which are agricultural productivity, infant mortality, population growth, income distribution, and employment. Includes 4 annexes.

Berg, Alan. The Nutrition Factor, Its Role in National Development, Brookings Institution, Washington, D.C., 1973.

Focuses on the effect of malnutrition on nations and ways in which the problem can be addressed. It assumes that man is the key to development and that the quality of life is the best measure of development. Nutritional adequacy is seen as "perhaps" the major determinant among the factors affecting the human condition. Therefore nutrition is deserving of more attention in the development effort.

Contains 12 chapters plus appendixes. The effect of malnutrition on the individual projected to national dimensions is examined in the first two chapters. Populations, income and agriculture are discussed in the following three. The approach taken is to examine some of the limitations of the increased income/better nutrition argument.

Chapter 6 concentrates on means of changing food practices as a means of improving nutrition. Chapter 7 analyzes the decline in breast feeding and its affect on nutrition. Chapter 8 looks at technological innovations which provide more nutritional foods at low costs. Chapter 9 focuses on the role of the marketplace as a distribution center and Chapter 10 turns its attention to government feeding programs. Chapter 11 focuses on India as a case study and Chapter 12 draws general conclusions about nutrition programs and policies needed.

Berg, Alan, "Nutritional Consequences of Introducing Cash Crops," World Bank Office Memorandum to M. Yudelman, April 11, 1977, p. 7-9.

Outlines some adverse nutritional impacts resulting from the introduction of cash crops in various parts of Papua-New Guinea.

Bernstein, Joel, et. al., World Food and Nutrition Study--The Potential Contributions of Research, Washington, D.C.: National Academy of Sciences, 1977.

The report is in three parts:

1. Analysis of world food and nutrition situation, the special role that accelerated research and development can play in the resolution of problems.
2. A listing of the most promising areas of research and development, based on studies made by 12 teams of experts.
3. Recommendations concerning the mechanisms for getting the job done.

In addition to the above mentioned report, five volumes containing the full reports of the study teams which undertook the detailed analyses and evaluations are to be published.

Dalrymple, Dana G., Development and Spread of High-Yielding Varieties of Wheat and Rice in the Less Developed Nations, USDA, Foreign Agricultural Economic Report No. 95, July 1976.

Drake, William D. and Luis F. Fajardo, The Promotora Program in Candelaria: A Colombian Attempt to Control Malnutrition and Disease, 1968-1974, Cali, Columbia, Community Systems Foundation, July 25, 1976.

Report of a nutrition/health education program. "A function describing the relationship between infectious diseases and food consumption was formulated. To attain the same level of nourishment, a diarrhetic child must consume considerably more nutrients. Conversely, for a given consumption, a child's level of nourishment will change by up to 15%." Quoted in League for International Food Education (LIFE) newsletter, March 1977. "Birth order was shown to affect sibling malnourishment rates." Ibid.

Food and Agricultural Organization, "Methodology of Nutritional Surveillance," Report of a Joint FAO/UNICEF/WHO Expert Committee, Geneva: World Health Organization, 1976, Technical Report Series, 593.

An outgrowth of World Food Conference in Rome in 1974. It considers information essential for the design of a nutrition surveillance system (who, where, when, and why) and the data sources already available for nutritional surveillance. It then considers the indicators for nutritional surveillance. Some are predictive, others are indicators of nutritional outcome. The basic practical principles for the planning and development of the nutritional surveillance system are presented. Recommendations for future research and for implementation of national and international nutrition surveillance systems are then presented.

Magleby, Richard, Robert Niehaus and Sandra Rowland. Poverty and Malnutrition in Developing Countries and Regions, Prepared by Foreign Development Division, Economic Research Service, U.S. Department of Agriculture for the Agency for International Development, Office of Agriculture, June 1975.

Part of a larger AID project. Objective was to develop and maintain a data and analysis system for rural development, planning, programming and evaluation with particular emphasis on food production, nutrition, employment and income distribution problems.

Pellett, Peter L., "Marasmus in a Newly Rich Urbanized Society," in Ecology of Food and Nutrition, Vol. 5, No. 4, 1977, p. 52.

Pettifor, Andrew Hayward, "Predicting Local Responses to Development Plans." Ph.D. Dissertation, Department of Industrial Engineering, Stanford University, August 1972. Chapter 4: The Conceptual Application of the Methodology to Nutritional Improvement.

Formulates in general terms the problem of improving nutrition in order to show the application of the methodology to a real problem of some complexity.

Rao, N. Pralhad, "The determinants of nutritional status." Paper presented at Agricultural Development Council Workshop on Household Studies at Singapore, August 3-7, 1976, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.

A general discussion of the determinants which affect the nutritional status of the target group (Indian population) is presented. Includes 5 pages of tables concerning nutritional status. Table 1 shows the relation between income and calorie/protein intake by status.

Saleh, Abdullah A., and O. Halbert Goolsby, "Institutional Disincentives to Agricultural Production in Developing Countries," Foreign Agriculture, Supplement, August, 1977.

A cogent discussion of institutional disincentives to farmers. Agricultural production disincentives, in such forms as price and export controls, and restrictions on credit and the domestic movement of agricultural products "have the potential for widespread and serious harm." An appendix surveys potential disincentives to agricultural production in 44 countries by country and by commodity for 1976.

Timmer, C. Peter, "The Scope for Nutritional Change Via Agricultural and Development Policies," Discussion Paper prepared for the Conference on the Economics of Nutrition Oriented Food Policies and Programs sponsored by the Rockefeller Foundation, Bellagio, Italy, August 25-27, 1977.

Builds on the Reutlinger and Selowsky book, *Malnutrition and Poverty*, and "attempts to demonstrate with a simple but plausible model that the total nutritional impact of small per dollar effects multiplied by very large dollar programs may be as important or more so as large per dollar effects multiplied by small dollar programs aimed at target groups."

U.S. Department of Health, Education and Welfare, "Proceedings of the Third African Conference on Nutrition and Child Feeding," Tunis, Tunisia, May 25-29, 1970.

Papers given at the conference include country by country reports on nutrition from Algeria, Burundi, Cameroon, the Central African Republic, Chad, Congo (Kinshasa), Gabon, Morocco, Rwanda, Tunisia and the United States as well as nutrition and other development areas such as health, agriculture, and education.

ABOUT THE AUTHOR

Phillips Foster is a professor of agricultural and resource economics at the University of Maryland where he is engaged in teaching and research in international agricultural development. From time to time over a 20 year period, Dr. Foster has engaged in both teaching and research at the Allahabad Agricultural Institute near Allahabad, India under the auspices of the Fulbright program. During repeated visits there he has observed change in a Hindu village which he has been studying longitudinally. A grant from Rockefeller Foundation has sponsored his research in Colombia, and grants from the Agricultural Development Council have sponsored his research in North and East Africa. He has served as a visiting professor at the University of New England, Armidale, Australia.

OCCASIONAL PAPERS SERIES

- Occasional Paper No. 1 Merrill, William C. The Impacts of Agricultural Mechanization on Employment and Food Production. September, 1975.
- Occasional Paper No. 2 Mellor, John W. The Impacts of New Agricultural Technology on Employment and Income Distribution Concepts and Policy. May, 1975.
- Occasional Paper No. 3 Kearl, Bryan, ed. Recueil de données sur le terrain dans le domaine des sciences sociales: Experiences réalisées en Afrique et au Moyen Orient. Novembre, 1975. (In French)
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