The geography and causes of food insecurity in developing countries

Lisa C. Smith[a,*], Amani E. El Obeid[b], Helen H. Jensen[b]

[a]International Food Policy Research Institute, 2033 K Street, N.W. Washington, D.C. 20006, USA
[b]Iowa State University, Ames, IA, USA

Abstract

At the 1996 World Food Summit, 186 countries made a commitment to reduce the number of chronically undernourished people by half by 2015. In order to formulate effective policies for reaching this goal, a thorough understanding of the location and causes of food insecurity is needed. This paper provides a broad overview of the current character of food insecurity in developing countries, focusing on two questions: (1) Why are they food insecure? and (2) Why are the food insecure? To answer the latter question data from 58 developing countries with high prevalences of food insecurity are employed to examine the relative importance of two of food insecurity's most basic causes: national food availability and the inability of people to access food due to poverty. Using child malnutrition as a proxy (along with descriptive controls for non-food determinants of malnutrition), the paper finds little correlation between national food availabilities and food insecurity. The group of countries that exhibit the highest severity of food insecurity are those with high poverty and food (dietary energy) surpluses, consistent with the view that poverty is the most widespread cause of food insecurity in the 1990s. The paper concludes by considering the implications of the analysis for appropriate geographical and policy targeting to improve food security for the greatest numbers of people at the fastest pace, now and into the 21st century. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Food insecurity; Poverty; Developing countries

1. Introduction

Global[1] food supply is currently sufficient to meet the food needs of the world's population. It is expected to continue to be sufficient well into the next century (Islam, 1995). Despite such abundance of food, over

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*Corresponding author. Tel.: +1-202-862-8166; fax: +1-202-467-4439.

E-mail address: l.c.smith@cgiar.org (L.C. Smith).

[1] An earlier paper on this issue that used data through 1992/1993 is available in Johnson et al., 1999.

840 million people (20%) in the developing world today are estimated to suffer from chronic undernourishment (FAO, 1996a); many more suffer from deficiencies of protein and essential micronutrients, such as iodine, Vitamin A and iron. Moreover, even those who consume sufficient food to meet their dietary needs can suffer from malnutrition due to poor health and inadequate or inappropriate caring behaviors.

The most vulnerable of the world's citizens are the first to suffer from such food and nutrition insecurity: 167 million developing-country children under age five, or about one in three, are malnourished. It is

estimated that over 50% of child deaths in developing countries are related to malnutrition (Pelletier et al., 1995). As so vividly portrayed by Haddad (1995), p. 93, malnutrition has far-reaching consequences for the ability of those children who survive to contribute to their countries' development as adults:

> For nearly half of the children in the ... least developed countries, being born is a shock from which they will never recover. In these countries, nearly all of which are in South Asia or sub-Saharan Africa, out of every 1000 children born alive, 112 will die before their first birthday. Another 48 will die before their fifth birthday. Of the remaining 840, 300 will be significantly underweight. As school-aged children, they will be less able to learn in school. As adults, they will earn less income and accumulate less wealth. Only the remaining 540 children will emerge relatively unscathed.

In some countries and for some historical periods the inadequate food consumption and malnutrition that are partially responsible for such innocent suffering have been partly due to insufficient supplies of food at a national level. Adequacy of global and national food supplies was the main concern of the first world global summit on food security, the World Food Conference of 1974, which coincided with rising grain prices worldwide (FAO, 1996c).

While food availability is still a problem for some countries, the root cause of food insecurity in developing countries today is believed to be the inability of people to gain access to food due to poverty (Foster, 1992; Von Braun et al., 1992; Alexandratos, 1995; Serageldin, 1995; Maxwell, 1996a). The problems of food access and poverty were, appropriately, a focal point at the second world summit on food security, the World Food Summit of 1996, at which 186 countries adopted a *Plan of Action* with the following commitment[2]:

> We will implement policies aimed at eradicating poverty and inequality and improving physical and economic access by all, at all times, to sufficient, nutritionally adequate and safe food and its effective utilization (FAO, 1996b, p. 13).

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[2] A full list of the World Food Summit commitments can be found in the Appendix.

At the Summit, these countries set a goal of reducing the number of chronically undernourished people by half by the year 2015 (FAO, 1996b).

In order to formulate effective policies directed at improving food security, a thorough understanding of the location and causes of food insecurity is needed. This paper provides a broad overview of the current character of food insecurity in developing countries. Focusing specifically on chronic, rather than transitory, food insecurity, the paper addresses two questions: Where are the food insecure? and Why are they food insecure? We first lay out a conceptual framework for understanding the causes of food insecurity and introduce the empirical measures employed in the paper. We then give an overview of the geographic distribution of food insecurity in the 1990s, broadly consider its basic causes in the developing-country regions, and discuss where it is likely to be located in the early decades of the 21st century. Next we employ data from 58 developing countries with high prevalences of food insecurity to examine the relative importance of national food availability and poverty in determining food insecurity in the 1990s. Finally, we consider the implications of the analysis for appropriate geographical and policy targeting to improve food and nutrition security for the greatest numbers of people at the fastest pace, now and into the 21st-first century.

2. The causes of food insecurity

A person is food secure when he or she has access at all times to enough food for an active, healthy life. Accordingly, people are food secure when their consumption of food is sufficient, secure (not vulnerable to consumption shortfalls), and sustainable (Maxwell, 1996). The list of causes of food insecurity is long and multifaceted: they range from political instability, war and civil strife, macroeconomic imbalances and trade dislocations to environmental degradation, poverty, population growth, gender inequality, inadequate education, and poor health. All, however, can be related in some fashion to two basic causes: insufficient national food availability and insufficient access to food by households and individuals. A broad conceptual framework for food security is given in Fig. 1, in which it is seen to be part of an overall process linking global and national food availability, households' and indi-
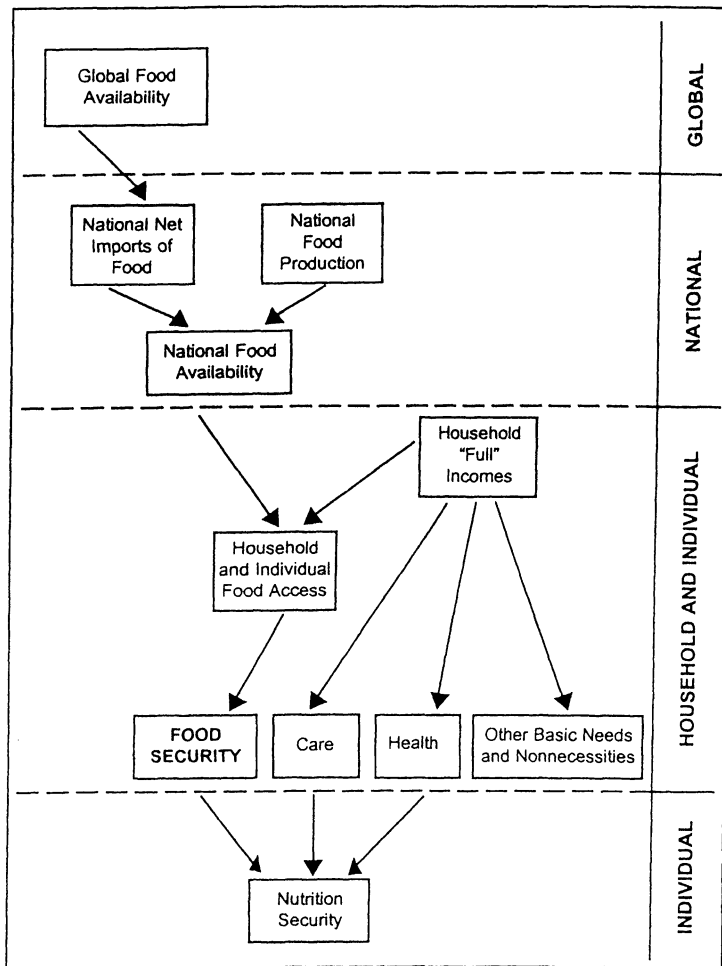
Fig. 1. Conceptual framework for food security: from global food availability to peoples' nutrition security SOURCE: Adapted from UNICEF (1998), Frankenberger et al. (1997a, b).

viduals' access to food, and individuals' nutrition security.[3]

Global and national food availability stand at the most macro level of the food security 'equation'. Global food availability is determined by total world food production. In any given year, national food availability is determined by a country's own food production, its stocks of food, and its net imports of food (imports minus exports), including food aid.

Still closer to food security is household and individual access to food which, in addition to national

food availability, is determined by a household's 'full' income. Along with cash income, full income includes the value of goods produced (such as food) and services provided (such as child care) in households that do not enter the market, as well as in-kind transfers of goods and services. Access to food may be gained through (1) production or gathering of food, (2) purchase of food on the market with cash income, and/or (3) receipts of in-kind transfers of food (whether from other private citizens, national or foreign governments, or international institutions). Within households, individual food access is influenced by intrahousehold food distribution decisions. As shown in Fig. 1, a household's expenditures of full

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[3] Examples of more elaborate conceptual frameworks can be found in UNICEF (1998), Oshaug (1994) and FAO (1996d).

income for achieving food security compete with expenditures on other basic needs (e.g. health care, housing, and basic education) as well as non-necessities. A household or individual unable to meet all basic needs can be considered to be in absolute poverty (Frankenberger, 1996).

Finally, at the most micro level of the food security equation is nutrition security, without which food security is not translated into an active, healthy life. Nutrition security is defined as follows: 'An individual is nutritionally secure when he or she has secure access to a nutritionally adequate diet and the food consumed is biologically utilized such that adequate performance is maintained in growth, resisting or recovering from disease, pregnancy, lactation, and physical work' (Frankenberger et al., 1997a, b, 1). In addition to food security, nutrition security has two other determinants. The first is 'care', or 'the provision in the household and the community of time, attention, and support to meet the physical, mental and social needs of the growing child and other household members' (ICN, 1992, 1). Examples of important child care behaviors are the timing and frequency of breast-feeding, the degree of stimulation and interaction with parents, investments in disease prevention and domestic hygiene, the use of health services and regular growth monitoring. The second non-food determinant of nutrition security is health. Poor health, or illness, affects nutrition security by depressing appetite, inhibiting the absorption of the nutrients in food and consuming calories and other nutrients while fighting off and recovering from illness, leaving less energy and nutrients available for growth and weight maintenance (Ramalingaswami et al., 1996).

3. Indicators of food and nutrition security

In the remainder of the paper, to examine where the food insecure are located and the basic causes of their food insecurity, we rely on three indicators (reported for 93 developing countries in Appendix Table A.1).

The first indicator, daily per capita dietary energy balance (DEB), is a measure of national food availability. It gives the sufficiency of a country's dietary energy supply (DES) for meeting the dietary energy requirement (DER) of its population *if* such dietary energy were distributed among people according to their requirements. Countries with daily per capita

DESs that are greater than their daily per capita DER are classified 'dietary energy surplus'; otherwise they are classified 'dietary energy deficit'. National per capita DESs are derived from the United Nations Food and Agricultural Organization (FAO) food balance sheets and population statistics. Food production and trade (including food aid)[4] data and information on seed rates, wastage, stock changes, and types of food use for each country are used to arrive at the totals of each commodity available for human consumption each year. Estimates of total energy availability for human consumption are then derived by aggregating the energy values (in kilocalories, or 'kcals'). The DER for each country takes into account the country's demographic composition (sex and age distribution) and allowances for physical activity. The DERs employed in this paper correspond to body mass indexes (BMI) observed among healthy, active people.[5]

The second indicator we employ is a measure of income-based absolute poverty, a proxy for people's ability to access food.[6] A country's absolute poverty rate is defined as the proportion of people whose income is less than one dollar per day. Such people

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[4] Note that since food aid is included in per capita DES figures, the figures are not an indicator of national food self-reliance — or the ability of countries to meet their food needs on their own — for all the countries. In the absence of food aid, countries that are classified as dietary energy surplus may fall into the dietary energy deficit category (Ramakrishnan, 1997). In 1994–1995, the developing-country region with the highest percentage of its food supply met through food aid was Latin America (6%), followed by sub-Saharan Africa (5.6%) (USDA, 1995).

[5] The per capita DERs corresponding to BMIs observed among healthy, active people are termed 'average' (rather than 'minimum') per capita DERs (FAO, 1996a). For the developing-country regions these are estimated to be (in kcals): sub-Saharan Africa 2100, near east and north Africa 2150, east and Southeast Asia 2220, South Asia 2110, and Latin America and the Caribbean 2200 (FAO, 1996a, Table 16).

[6] Nationally representative data on direct measures of food access, such as dietary intakes and food expenditures, are not available for a large number of countries. To give a rough estimate of the numbers of food insecure in each developing country, the FAO uses per capita DES and estimates of the distribution of food intake within countries to calculate the numbers of 'chronically undernourished'. While the FAO measure gives a broad idea of the prevalence and numbers of food insecure in the developing world, because it is methodologically biased toward national food availabilities, it cannot be employed for making accurate cross-country comparisons and in undertaking analyses of the causes of food insecurity (Smith, 1998).

Table 1
Child malnutrition, absolute poverty, and dietary energy availability by developing-country region[a]

Region	Child malnutrition (underweight) (1995)		Absolute poverty (1993)		Dietary energy supply/balance (1996)	
	Prevalence (%)	Number of children (millions)	Prevalence (%)	Number of people (millions)	Dietary energy supply (per capita kcals/day)	Dietary energy balance (per capita kcals/day)
South-Asia	49	86	43	515	2380	+270
Sub-Saharan Africa	31	31	39	219	2156	−55
East and South-East Asia	23	38	26	446	2792	+572
Near East and North Africa	15	6	4	11	2988	+840
Latin America and Caribbean	10	5	24	110	2813	+613
All developing countries	31	167	29	1301	2615	+450

[a] Sources: Data columns 1 and 2: WHO (1997), Table 3. Data columns 3 and 4: Table 5, Ravallion and Chen (1997). Data column 5: Appendix Table A.1, column 5. Data column 6: Appendix Table A.1, column 6.

are unlikely to be able to meet their food needs sustainably. Where possible, the measure is based on (1985) purchasing power parity (PPP) prices to ensure international comparability. It includes the imputed value of non-market goods (including production of food for own consumption, but excluding the value of people's time) (World Bank, 1998).

The third indicator, child malnutrition, is a measure of nutrition security. Specifically, we employ the prevalence of underweight children under 5 years measured anthropometrically by weight-for-age, a summary measure capturing both short stature (stunting) and thinness (wasting) (Martorell and Mason, 1996). Child malnutrition is determined by health and care as well as food security; all three determinants may act independently and interact synergistically in influencing child malnutrition (Haddad et al., 1998). Nevertheless, it is considered a good proxy measure for food insecurity (Maxwell and Frankenberger, 1992; Rogers, 1997). In the analysis below, in order to isolate the influence of food insecurity on child malnutrition from the influence of health, we employ an indicator of the quality of countries' health environments. This is an index composed of the percentage of each country's population with access to health services, safe water and sanitation.

4. The geography of food insecurity in developing countries

Employing child malnutrition, absolute poverty, and dietary energy availability data, it is possible to construct a broad geographic distribution of food insecurity and to identify its basic causes in the developing-country regions. South Asia and sub-Saharan Africa are the regions with the severest food insecurity problems (see Table 1 and Figs. 2 and 3).

South Asia has by far the highest rate of child malnutrition, at 50% of all children under five. It also has the highest numbers of malnourished children (see dashed line in Fig. 2). At 86 million, this is almost one-half of the entire developing-country total, which indicates a massive food and nutrition insecurity problem. Although the region has a dietary energy surplus of 270 kcals per capita per day, nearly one out of every two South Asian people is estimated to be living in absolute poverty. This suggests that South Asia's food insecurity is associated mainly with a food
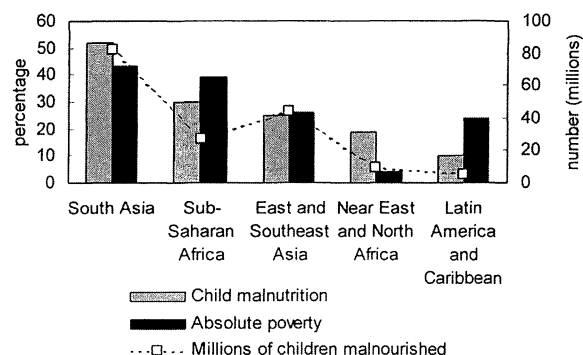

Fig. 2. Child malnutrition and absolute poverty in developing-country regions. Numbers of malnourished children are measured on the right-hand vertical axis. Source: Table 1.
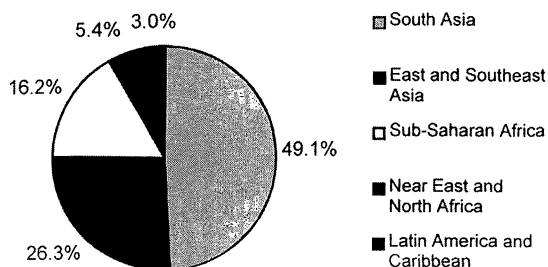
Fig. 3. Regional proportions of total developoing-country child malnutrition, in percent. Source: Table 1.

access, rather than food availability, problem. In addition to food insecurity, South Asian countries' high child malnutrition prevalences are also caused by their poor health environments (only 46% of the population has access to health services, safe water, and sanitation) and inadequate care for women and children, factors that are linked in turn to the very low social and health status of South Asian women (Ramalingaswami et al., 1996; Osmani, 1997). Within the South Asian region, the severest problems are in Bangladesh, which has the highest child malnutrition rate in the world (56%), India (53%) and Nepal (47%). India is the country with the highest number of malnourished children in the world, at 62 million, or 37% of the developing-country total.

Sub-Saharan Africa's child malnutrition rate of 31% is much lower than South Asia's. Due to the region's current low population density, the number of malnourished children in sub-Saharan Africa is also fairly low, at 31 million. Its poverty prevalence, however, is almost as high as South Asia's, suggesting severe food access problems. In addition, it has a major food availability problem, with a dietary energy balance close to zero. Of the 26 developing countries that are dietary energy deficit, 17 are in sub-Saharan Africa. Contributing to child malnutrition is the region's poor health environment (with only 42% of the population having access to health services, safe water, and sanitation). The countries in the region with the highest child malnutrition rates are Ethiopia (48%) and Niger (43%). Somalia has the worst food availability problem of all developing countries, with a dietary energy deficit of 568 kcals per capita per day.

Although the other developing-country regions have less severe food insecurity and much better

health environments than do South Asia and sub-Saharan Africa, [7] some countries within these regions have major food insecurity problems. While the East and Southeast Asia region has a fairly high dietary energy surplus of 572 kcals per capita per day, it maintains relatively high poverty (26%) and child malnutrition rates (23%). It is the home of a large number of malnourished children, 38 million, which is nearly one-quarter of all developing-country malnourished children. Countries with particularly high child malnutrition rates are Vietnam (45%), Myanmar (43%) and Laos (40%).

The Near East and North Africa region has the highest dietary energy surplus of the developing-country regions, at 840 kcals. It also has a low poverty prevalence, at 4%, suggesting that food insecurity is not a major problem. Nevertheless, the region's child malnutrition rate is 15%, suggesting that nutrition insecurity remains a problem due to poor health or care. Within the region, Afghanistan has an extremely high dietary energy deficit of 475 kcals and a 40% child malnutrition rate.

The Latin America and Caribbean region has the lowest child malnutrition rate of all the developing-country regions. Although it has a high dietary energy surplus (at 613 kcals), its poverty rate (24%) is almost on par with that of East and Southeast Asia. This suggests that the main problem underlying food and nutrition insecurity in Latin American and Caribbean countries is probably one of food access. Compared to other countries in the region, Haiti and Guatemala, for which over one-quarter of all children under five are estimated to be malnourished, have the severest food insecurity problems.

Some developing countries have relatively low overall prevalences of food insecurity but nevertheless contain large numbers of food insecure people, due either to large populations or in-country regional differences that cancel each other out (Von Braun et al., 1992). For example, Brazil and Mexico, with dietary energy surpluses and child malnutrition rates of 6 and 14%, respectively, nevertheless contain pockets

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[7] The approximate percent of people having access to health services, safe water, and sanitation in east Asia is 76. For the near east and north Africa region the percentage is 78. For the Latin American and Caribbean region the percentage is 80.

of extreme absolute poverty and food insecurity. China has a dietary energy surplus and a child malnutrition rate of 17%, which is low compared to other developing countries. Yet it is the home of the second largest number of developing-country malnourished children, at 18 million, or 11% of the total.

Across developing countries, the prevalence of food insecurity is generally higher in rural areas than in urban areas (Von Braun et al., 1992). An International Food Policy Research Institute (IFPRI) study has found that the prevalence of children's (preschoolers') malnutrition is consistently lower in urban samples compared to rural samples (see Appendix Table A.2). In Peru, for example, only 6.4% of children living in urban areas are malnourished, compared to 17.7% of children living in rural areas (Ruel et al., 1998). However, urban food insecurity and malnutrition will become increasingly important problems in the future as rates of urbanization increase and urban sanitation, diet quality, and food safety problems grow (FAO, 1996d).

Of course future food insecurity is dependent on what actions are taken now to avert it. Nevertheless, current regional trends can give us some idea of where food insecurity may be located in the early decades of the 21st century. By most projections, both food and nutrition insecurity are on the decline in developing countries as a whole. Child malnutrition in Southeast Asia is falling rapidly, at around one percentage point per year. It is declining more slowly in South Asia (by one-half a percentage point per year), where it is expected to remain high relative to other regions well into the 21st century. Without accelerated preventative action, the region's poverty, poor health conditions, and poor quality of care could persist for some time. Despite a declining child malnutrition rate, the Latin American region is also likely, without accelerated action, to experience a persistence of absolute poverty, and thus problems of food access, into the 21st century (ACC/SCN, 1992; IFPRI, 1995).

The only region in which food insecurity is expected to *increase* over the next 20 years is sub-Saharan Africa. Trends show that child malnutrition has either increased or remained static for most countries. Absolute poverty is expected to rise; predictions show the region will face continued food availability problems and probably will be unable to import the difference between its food needs and production

without increased investment (ACC/SCN, 1992; IFPRI, 1995).

5. National food availability, poverty, and food security

We have seen that inadequate food availability at a national level and inadequate access to food due to poverty are the two most basic causes of food insecurity. Although both are crucial factors, for policy purposes it is important to know *which* is relatively more important in determining food insecurity in each developing country. In this section we give some quantitative evidence on this issue for the developing world as a whole using data from the early 1990s.

As noted in Fig. 1, enough food available in a country to meet the food needs of all of its population is a necessary — but not sufficient — condition for food security. This point is made clear by the fact that in many countries food supply is ample to meet the needs of all people but food insecurity nevertheless remains high. Using child malnutrition as a proxy for food insecurity, Fig. 4 illustrates how the severity of food insecurity changes across six groups of devel-
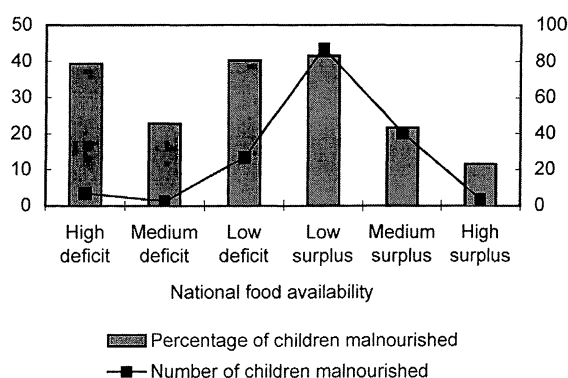
Fig. 4. Child malnutrition by dietary energy availability country groupings. Note: The horizontal axis gives six groups of countries differentiated by their dietary energy balances. Countries are defined as dietary energy deficit if their daily per capita dietary energy supply is insufficient to meet their per capita ;dietary energy requirement; otherwise they are dietary energy surplus. The dietary energy balance cut-offs for each group are given in footnote 8. The percentage of child malnutrition is measured on the left-hand vertical axis. The percentages are calculated as the total number of malnourished children is measured on the right-hand vertical axis. Source: calculated from data in Appendix Table A.1.

oping countries differentiated by their food availability positions. The groups range from one containing high dietary energy-deficit countries through one made up of high dietary energy-surplus countries.[8]

We find that the probability that a child will suffer from malnutrition, rather than decreasing steadily with increasing food availability, is likely to be higher in countries with low dietary energy surpluses than in those with high dietary energy deficits. Only for the medium and high surplus groups do child malnutrition rates show a declining trend with increased food availability. Overall, the dietary energy-surplus countries have a lower incidence of child malnutrition (30%) than the dietary energy-deficit countries (37%). However, the difference is small. Fig. 4 suggests a weak relationship between national food availabilities and people's food security in developing countries.[9]

Fig. 4 also shows the *numbers* of malnourished children for the same six groupings. It is apparent that in any given year a larger number of malnourished children may live in dietary energy-surplus countries than in dietary energy-deficit countries. In fact, in 1995 approximately 131 million of the 167 million children under five who were estimated to be malnourished (78%, or about three in four) lived in countries with dietary energy surpluses. This suggests that in the 1990s, for the large majority of food insecure people, the underlying problem probably

is not one of insufficient food availability in their countries.

To examine the relative extent to which poverty and national food availability are sources of food insecurity, we focus on a subset of 58 developing countries with high degrees of food insecurity. This group includes all countries with dietary energy deficits and/or prevalences of child malnutrition of at least 15%. To differentiate them by their food availability positions, the countries are first grouped into dietary energy deficit and surplus groups. To differentiate them by their poverty positions, within each of these groups are embedded a 'high poverty' group and a 'low poverty' group. The criteria for falling into the high poverty group are that the country has either a poverty rate of 35% or higher and/or an estimated 1995 per capita gross national product (GNP) of less than $1000.[10]

Table 2 lists the countries in each group, giving a snapshot of their food security situations. The columns of the table represent the countries' food availability positions. The rows represent their (absolute) poverty positions. Each country's child malnutrition rate is given in parentheses. In addition, at the bottom of each quadrant is the total number of malnourished children in the group. The highest number fall into the food surplus/high poverty quadrant (75 million), mainly due to the presence of India. Overall, as was the case for the entire sample of 99 developing countries (see Fig. 4), the majority of the malnourished children living in these highly food-insecure countries (81%) live in food-surplus countries. In addition, a majority (83%) fall into the high poverty category.

To see how the severity of food insecurity differs across the groups, Table 3 gives estimates of the prevalences of child malnutrition for each. The prevalence is the greatest for the dietary energy-surplus/ high poverty group, at 49%. Consider the differences in the child malnutrition rates across the dietary energy-deficit and surplus groups. The incidence of child malnutrition is slightly lower in the dietary energy-surplus group than in the deficit group for

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[8] The six groups are defined by upper and lower bounds on the countries' per capita dietary energy balances as follows:

Category	Daily per capita dietary energy balance bounds (kcals)		Number of countries
	Lower	Upper	
High deficit		−300	5
Medium deficit	−299	−100	10
Low deficit	−99	0	11
Low surplus	1	450	38
Medium surplus	451	900	18
High surplus	901		11

[9] Note that the quality of countries' health environments generally improves over the six groups. The percentages of the groups' total populations with access to health services, safe water, and sanitation (presented in the order given in Fig. 4) are 33, 33, 56, 50, 76, and 83. This indicates that the child malnutrition prevalence differences across the groups are more likely to be driven by variations in food security than by variations in health.

[10] Where possible, all poverty rates and GNPs are based on PPP-converted international dollars (see Appendix Table 1). The countries for whom 1995 estimated per capita GNPs alone classify them as high poverty are those listed in Table 2 but for which poverty rates are not given in Appendix Table A.1.

Table 2
Classification of highly food-insecure countries into national food availability and poverty groups[a]

	National food availability	
	Dietary energy deficit	Dietary energy surplus
High poverty	Bangladesh (56)	India (53)
	Ethiopia (48)	Vietnam (45)
	Afghanistan (40)	Myanmar (43)
	Laos (40)	Niger (43)
	Madagascar (40)	Sudan (34)
	Somalia (39)	Burkina Faso (33)
	Chad (39)	Rwanda (29)
	Cambodia (38)	Uganda (26)
	Congo, Dem. Rep. (34)	Gambia (26)
	Mali (34)	Senegal (22)
	Malawi (30)	Liberia (20)
	Burundi (29)	Honduras (18)
	Sierra Leone (29)	Lesotho (16)
	Haiti (28)	Cameroon (15)
	Guatemala (27)	
	Mozambique (26)	
	Zambia (24)	
	Kenya (23)	
	Zimbabwe (13)	
	Mongolia (12)	
	(25 million children)	(75 million children)
Low poverty	Angola (35)	Nigeria (39)
	Tanzania (31)	Pakistan (38)
	Yemen (29)	Sri Lanka (38)
	Guinea (24)	Indonesia (34)
	Central Afr. Rep. (23)	Philippines (30)
	Bolivia (8)	Congo (28)
		Botswana (27)
		Namibia (26)
		Benin (25)
		Mauritania (23)
		Ghana (23)
		Malaysia (20)
		Côte d'Ivoire (20)
		Togo (19)
		Guyana (18)
		China (17)
		Gabon (15)
	(4 million children)	(46 million children)

[a] Notes and source: after each country name, the percentage of children malnourished (Appendix Table A.1, column 1) is given in parentheses. A country is dietary energy deficit if its per capita dietary energy supply is insufficient to meet its average per capita dietary energy requirement; otherwise it is dietary energy surplus. Countries with either poverty prevalences of greater than 35% or per capita GNPs less than $1000 (both measured in PPP-adjusted dollars) are classified into the high poverty group; otherwise they are in the low poverty group.

Table 3
Prevalence of child malnutrition by national food availability and poverty positions of highly food-insecure countries, in percent[a]

	National food availability	
	Dietary energy deficit	Dietary energy surplus
High poverty	39	49
Low poverty	28	25

[a] Notes and source: The countries in each group are given in Table 2. Child malnutrition data are from Appendix Table A.1, columns 1 and 2. Malnutrition rates are calculated as the total number of underweight children in the countries falling into each quadrant divided by the total number of children. See Table 2 notes for classification criteria.

the low poverty group; for the high poverty group, however, the incidence is *higher* in the dietary energy-surplus group than in the deficit group by ten percentage points.[11]

Next consider the differences in the prevalences of child malnutrition across the high and low poverty groups. The prevalence is greater in the high poverty group than in the low poverty group across both dietary energy-surplus and -deficit groups, consistent with the widely held view that poverty is the most widespread cause of food insecurity. The difference is particularly pronounced within the dietary energy-surplus group, with the prevalence in the high poverty group being almost double that of the low poverty group.[12] This difference may partially reflect large differences in the groups' health environment.[13] Overall, the numbers suggest that for most countries with high food and nutrition insecurity and for most people who are food and nutrition insecure, the underlying

[11] The health environment index of the surplus group is higher than the deficit group (77 versus 57). The groups' child malnutrition prevalence difference may also be due to this difference. Note that when India is excluded from the high poverty/surplus group the group's prevalence of child malnutrition falls to 35%, a number which is still not much lower than that of the high poverty/deficit group and 10 percentage-points higher than the low poverty/surplus group.

[12] A two-tailed test for the difference in the unweighted means of the child malnutrition prevalences of the dietary energy-deficit group (31%) and the dietary energy-surplus group (28%) reveals no significant statistical difference ($t=0.84$). The difference between the unweighted means of the high poverty group (32%) and the low poverty group (26%) is statistically significant at the 5% level ($t=2.4$).

[13] The health environment index for the high poverty/surplus group is 77; that for the low poverty/surplus group is 43.

cause is likely to be poverty rather than national food availability.

6. Policy to improve food security

The causes of food insecurity are complex and interrelated. A myriad of interventions could be useful in reducing or eliminating it. The key policy goal, however, is not simply to improve food security, but to improve it in a sustainable fashion for the *most* people at the *fastest* pace. To reach this goal, given financial and institutional capabilities, policies should be targeted at the underlying causes that pose the most limiting or 'binding' constraint to improve food security in each specific context.

The above analysis suggests that, in the 1990s, poverty is the most binding constraint to improving people's food security in developing countries. In most settings, policies that improve people's access to food by reducing poverty are likely to have the greatest gain in food security improvements. A powerful means of reducing poverty is through equitable economic growth. In order for growth to benefit poor people as well as those better off, special efforts are often needed to enable the poor to participate in the growth process, such as efforts to enhance their access to financial and productive resources, information and training, and physical and market infrastructure. A second and complementary means of reducing poverty is investment in the human capital of the poor, mainly their health and educational attainment. Developing people's skills and capacities equips them to take advantage of new opportunities placed before them by economic growth (World Bank, 1991). A final means of reducing poverty is investing in the social capital of the poor. Social capital is the networks, norms, and trust among members of communities that enable them to coordinate and cooperate for their members' mutual benefit (Moser, 1996). It is thus a further means of enabling poor people to take advantage of economic opportunities and gain access to services that enhance their human capital.

In addition to poverty, many countries still face problems of national food availability (particularly sub-Saharan African countries). Most countries also face nutrition security problems linked to problems of health and care (particularly South Asia and sub-

Saharan Africa). To make good the gains of food security in terms of actual human physical well-being, attention to these problems must continue as well.

How then do governments and international organizations committed to reducing food insecurity go about choosing appropriate interventions? Choice of priority interventions requires, above all, identification of the people who are food and/or nutrition insecure and of the primary causes of their insecurity. In this way, interventions that are appropriate for the given context can be chosen to alleviate the constraints posed by these causes (FAO, 1996d; Frankenberger, 1997). Because there are many factors that are necessary but not sufficient for bringing about food and nutrition security, all possible causes — whether related to problems of food availability, food access, or the non-food determinants of nutrition security (care and health) — must be considered simultaneously for an optimal choice and sequencing of interventions. Beyond identification alone, priority setting requires knowledge of the *relative* importance of each cause in determining food and nutrition insecurity. Emphasis can then be placed first on those causes that pose the most binding constraint.

In general, when more than one cause is being addressed at a time, policy objectives should be linked so that multiple causes can be tackled with single interventions and synergies can be obtained from multiple interventions (Frankenberger, 1997). In countries where food production is the main income source of the poor, policies that increase agricultural productivity can, when appropriately formulated, improve food access at the same time as they improve food availability because they can raise incomes and, in the long run, lower real food prices. Similarly, productivity-enhancing plant breeding that enriches staple foods with scarce micronutrients ameliorates not only food availability problems but micronutrient malnutrition as well (Bouis, 1996). An example of a case where multiple interventions can have a synergistic effect is combining income generation (especially of women) with nutrition education (Von Braun et al., 1993). Combining human capital development and food assistance in low-potential agricultural areas where high food insecurity exists with investments in increased food production in adjacent high-potential areas is another example. In this case, jobs that are created in the high-potential areas through increased

productivity can be filled by people from the low-potential areas, both food availability and food access problems are addressed (Frankenberger, 1997).

With an eye both to solving immediate problems and reaching long-term goals, choice of an optimal mix of interventions should consider interventions that have an impact in the long run as well as those having an impact only in the short run (Von Braun et al., 1992). The benefits of investments in agricultural research, population stabilization, basic education, and economy-wide economic growth may only accrue after several years. Yet they can have powerful positive impacts on a large number of people's food and nutrition security. To avert or respond to crisis situations, some interventions are needed to tackle immediate problems. Examples of interventions that have their impact mainly in the short run are supplementary feeding, food stamp and food rationing programs. Sometimes it is possible to contribute to both short- and long-term goals simultaneously. For example, programs to combine supplementary feeding with nutrition education, as well as food-for-work with investment in rural transport and health infrastructure, can improve food and nutrition security both immediately and in the future.

In many cases there will likely be trade-offs in reaching policy goals directed at different problems, and an optimal balance between competing goals must be achieved. For example, a focus on food availability leads in the direction of investment in new technologies to increase food (or export crops) production in high-potential areas. A focus on poverty reduction, on the other hand, leads in the direction of investment in programs to raise incomes of poor people who often live in resource-poor, low-potential areas where obtaining large food surpluses may not be possible (Maxwell, 1996b). Beyond cost considerations, the optimal investment balance should ultimately depend on the relative importance of food availability and food access in determining food and nutrition insecurity in the particular context.

Finally, in formulating efficient food security policies targeted at the underlying causal problems, care must be taken to account for possible negative side effects so that new problems are not created. Actions that focus on improving food availability and/or access may have negative consequences for nutrition security by affecting its non-food determinants. For example, interventions that lead to increases in household members' time in income-generating activities may lead to a decrease in the time they spend in child care or health enhancement, slowing down improvements in children's nutrition that accompany increases in food access (Smith, 1995). Macroeconomic and trade policies that are designed to promote food-security-enhancing economic growth may have harmful impacts on some people's food security. For example, reductions in food subsidies raise food costs for net food consumers, reductions in public expenditures on health services can lead to a deterioration in health environments, and currency devaluations can reduce the incomes of those relying on imported productive inputs. Increased food production that takes place through expansion onto marginal lands (or through shorter fallow periods) causes soil degradation, compromising future food production and income. As a final example, influxes of food aid, without precautions, can lead to dependence and production disincentives, undermining long-term food production and poverty-reduction efforts. Such possible adverse consequences should be taken into account in policy formulation and either averted or compensated for through complementary interventions.

7. Conclusions

To improve food security for the greatest numbers of people at the fastest pace, policies must be targeted, first, on the regions, countries, and people who are most food insecure. Second, they must be targeted on alleviating the underlying problems causing food insecurity. To ensure that food security results in actual improvements in human physical well-being, nutrition security must be improved as well. Thus, it is not only food itself that is important in efforts to improve people's food security, but also health and care (especially of children), both of which are necessary for nutrition security.

Geographically, South Asia and sub-Saharan Africa are the developing country regions with the most severe food and nutrition insecurity. These regions, as well as countries in other regions with dietary energy deficits and high levels of poverty and malnutrition, should be the focus of international efforts to improve food and nutrition security. Whereas poverty

is the leading cause of food insecurity for most developing countries, including those that are dietary energy *surplus*, many countries also have problems related to national food availability (especially sub-Saharan African countries) and to health and care (especially South Asian and sub-Saharan African countries) that must be resolved as well.

In general, policy combinations that improve food and nutrition security for the greatest number of people at the fastest pace have the following qualities. First, they focus on the most binding constraint to their improvement. Second, they are based on linked policy objectives so that single interventions can be used to solve multiple problems and synergistic impacts can be obtained from multiple interventions. Third, they contain, as needed, both long-run and short-run instruments. Fourth, they achieve an optimal balance between competing policy goals. Finally, they avoid or compensate for any possible negative side effects of interventions.

Improving people's physical well-being through improving their food and nutrition security will have

two beneficial effects that enhance the long-run sustainability of interventions. The first is to increase the capacity of the poor to pull themselves out of poverty, thus improving their access to food in a sustainable manner. The second is to provide the human capital basis for accelerated economic growth and national development (Behrman, 1992; Martorell, 1996), in turn enabling countries as a whole to obtain sufficient food for their populations over time, whether through domestic production or imports.

Appendix A. Commitments made at the 1996 world food summit

1. We will ensure an enabling political, social, and economic environment designed to create the best conditions for the eradication of poverty and for durable peace, based on full and equal participation of women and men, which is most conducive to achieving sustainable food security for all;

Table A.1
Food and nutrition security data for developing countries[a]

Country	Prevalence of child malnutrition (underweight) (1990s) (%)[b]	Number of children malnourished (underweight) (1990s) (thousands)[c]	Health environment (access to health services, safe water, and sanitation) (%)[d]	Prevalence of absolute poverty (1988-96) (%)[e]	Dietary energy supply (1996) (per capita kcals/day)[f]	Dietary energy balance (1996) (per capita kcals/day)[g]
Sub-Saharan Africa						
Angola	35.3[c]	768	28	[a]	1983	−117
Benin	24.5[b]	238	47	33.0	2415	315
Botswana	26.8[c]	63	60	[a]	2272	172
Burkina Faso	32.7	653	49	[a]	2137	37
Burundi	29.1[c]	330	58	36.2	1708	−392
Cameroon	15.1	340	24	[a]	2175	75
Central Afr. Rep.	23.2	125	15	[a]	1938	−162
Chad	38.8	480	26	[a]	1972	−128
Congo	27.5[c]	130	20	[a]	2107	7
Congo, Dem. Rep.	34.4	3049	36	[a]	1815	−285
Côte d'Ivoire	20.0	437	60	17.7	2421	321
Ethiopia	47.7	4864	30	[a]	1845	−255
Gabon	15.1[c]	25	79	[a]	2517	417
Gambia	26.2	48	83	64.0	2332	232
Ghana	22.9[c]	691	54	31.4	2560	460
Guinea	24.0[c]	296	32	26.3	2099	−1
Kenya	22.5	989	37	50.2	1971	−129
Lesotho	16.0	47	49	[a]	2209	109
Liberia	20.1[c]	74	32	[a]	2161	61

Table A.1 (*Continued*)

Madagascar	40.0	1039	65	72.3	2001	−99
Malawi	29.9	555	66	54.0	2097	−3
Mali	33.6[b]	628	36	a	2027	−73
Mauritania	23.0	93	48	31.4	2653	553
Mauritius	14.9	16	69	a	2952	852
Mozambique	26.1	690	24	a	1799	−301
Namibia	26.2	65	a	a	2168	68
Niger	42.6	796	33	61.5	2116	16
Nigeria	39.1	6587	42	31.1	2609	509
Rwanda	29.4	277	62	a	2142	42
Senegal	22.3	332	46	54.0	2394	294
Sierra Leone	28.7	215	41	68	2002	−98
Somalia	38.8[c]	614	29	a	1532	−568
Sudan	33.9	1338	41	a	2391	291
Swaziland	8.8[c]	13	39	a	2529	429
Tanzania	30.6	1643	74	10.5	2028	−72
Togo	19.0	142	47	32.3	2155	55
Uganda	25.5	976	33	69.3	2110	10
Zambia	23.5	352	63	84.6	1939	−161
Zimbabwe	13.0[b]	219	50	41.0	2083	−17
Near East and North Africa						
Afghanistan	40.3[c]	1390	35	a	1676	−474
Algeria	12.8	491	64	a	3020	870
Egypt	12.4	987	80	a	3289	1139
Iran	15.7	1309	78	a	2824	674
Iraq	11.9	370	88	a	2252	102
Jordan	6.4	59	96	a	2681	531
Kuwait	1.7	3	99	a	3075	925
Lebanon	3.0	11	90	a	3279	1129
Libya	4.7	31	98	a	3132	982
Morocco	9.5	278	93	a	3244	1094
Saudi Arabia	12.6[c]	272	93	a	2735	585
Syria	12.9	255	80		3339	1189
Tunisia	9.0	86	67	a	3250	1100
Turkey	10.4	662	92	a	3568	1418
United Arab Em.	7.0[c]	15	95	a	3366	1216
Yemen	29.0	854	a	19.1	2041	−109
Latin America and Caribbean						
Argentina	1.9	65	89	a	3136	936
Bolivia	8.4	96	40	a	2170	−30
Brazil	5.7	925	87	a	2938	738
Chile	0.8	12	88	a	2810	610
Colombia	8.4	399	82	a	2800	600
Costa Rica	5.1	21	96	a	2822	622
Cuba	1.5	12	100	a	2357	157
Dom. Republic	5.9	56	61	a	2316	116
Ecuador	13.0[c]	188	65	a	2592	392
El Salvador	11.2	85	51	48.3	2515	315
Guatemala	26.6	450	59	53.3	2191	−9
Guyana	18.3	17	89	a	2392	192
Haiti	27.5	305	36	a	1855	−345
Honduras	18.3	170	49	46.9	2368	168
Jamaica	10.2	29	81	a	2575	375
Mexico	13.9[c]	1559	81	a	3137	937
Nicaragua	11.9	90	40	a	2328	128

Table A.1 (*Continued*)

Country	Prevalence of child malnutrition (underweight) (1990s) (%)[b]	Number of children malnourished (underweight) (1990s) (thousands)[c]	Health environment (access to health services, safe water, and sanitation) (%)[d]	Prevalence of absolute poverty (1988-96) (%)[e]	Dietary energy supply (1996) (per capita kcals/day)[f]	Dietary energy balance (1996) (per capita kcals/day)[g]
Panama	6.1	19	83	a	2556	356
Paraguay	3.7	27	45	a	2485	285
Peru	7.8	226	53	a	2310	110
Trin. & Tobago	9.0[c]	10	98	a	2751	551
Uruguay	4.4	12	84	a	2830	630
Venezuela	5.1	141	90	a	2398	198
South Asia						
Bangladesh	56.3	7963	55	35.6	2105	−5
India	53.4	62,313	44	52.5	2415	305
Nepal	39.4[b]	1322	21	50.3	2339	229
Pakistan	38.2	8583	52	11.6	2408	298
Sri Lanka	37.7	601	67	4.0	2263	153
East and South-East Asia						
Cambodia	37.7[c]	591	13	a	1974	−246
China	17.4	18,036	83.5	22.2	2844	624
Indonesia	34.0	7411	43	11.8	2930	710
Laos	40.0	339	35	46.1	2143	−77
Malaysia	20.1	543	87	5.6	2899	679
Mongolia	12.3	37	81	36.3	2098	−122
Myanmar	42.9	1771	39	a	2752	532
Philippines	29.6	2762	75	28.6	2356	136
Thailand	13.0[c]	646	64	a	2334	114
Vietnam	44.9	4263	67	50.9	2502	282

[a] Notes and sources (Table A.1): The superscript 'a' means data are not available or (for poverty) not necessary for the paper's analysis. The superscript 'b' is explained in the following footnote.

[b] *Prevalence of children under five underweight*: A child is considered underweight when his or her weight falls below −2 -standard deviations of the expected weight of healthy children of her or his age using National Center for Health Statistics/WHO norms. The majority of the data are from WHO (1999) and are based on nationally-representative surveys. Among these some of the underweight rates are reported for 0–3 year olds rather than 0–5. We have adjusted these downward using the average adjustment factor employed in ACC/SCN (1993). The superscript 'b' denotes these cases. The underweight rates with superscript 'c' are 1990 predicted rates from (ACC/SCN, 1993) Table 2.6. These are estimated using data from nationally representative surveys that took place from 1975 to 1991 using two multivariate regression models: (1) a global model estimated with data from 100 surveys in 66 countries; and (2) a sub-Saharan Africa model using data from 20 surveys in 20 countries. The independent variables employed were per capita dietary energy supply, infant mortality rates, percent government fiscal expenditures on health, education, and social security, education of females, and the under five child population. The global and sub-Saharan African models had (adjusted) R^2s of 0.9 and 0.82, respectively. See ACC/SCN (1993) Chapter 2 for further explanation.

[c] *Number of children under five underweight*: Calculated from column (1) and data on the numbers of children under five found in United Nations (1998).

[d] *Health environment*: This is an average of three indicators: the percentage of the population with access to health services, safe water, and sanitation (each indicator is given equal weight). Note that data on all three indicators are not available for a small number of countries. Source: UNDP (1993), Table 12.

[e] *Prevalence of absolute poverty*: Data are only given for countries defined to be 'highly food insecure' (see Table 2). The majority of the data are from the World Bank (1998) Table 2.7. They are derived from nationally representative surveys. For Benin, Burundi, Gambia, Ghana, Togo, Yemen, Bangladesh, Laos, Mongolia, Vietnam, and Malawi, nationally defined poverty lines were employed. For the rest, an 'international poverty line' of one dollar per day in 1985 international prices was employed. Most surveys included the imputed value of income earned from non-market goods (including production of food for own consumption).

[f] *Per capita dietary energy supply (daily)*: Source: FAO (1998).

[g] *Per capita dietary energy balance (daily)*: Calculated as per capita DES (using the data in Table A.1, column 5) minus average per capita dietary energy requirements. A negative national food energy deficit indicates that a country's DES is insufficient for meeting the requirements of its population. A positive national food energy deficit indicates sufficiency. Regional requirements, which are used as proxies for national requirements, are given in FAO (1996a) Table 16.

Table A.2
Urban-rural differences in prevalences of underweight children under five[a]

Country	Underweight children		Percent difference (%)
	Urban (%)	Rural (%)	
Sub-Saharan Africa			
Burkina Faso	20.0	31.3	−36.10
Burundi	20.2	38.9	−48.07
Ghana	17.5	31.4	−44.27
Kenya	12.6	23.5	−46.38
Madagascar	33.4	40.0	−16.50
Malawi	15.4	28.6	−46.15
Namibia	17.8	29.8	−40.27
Rwanda	17.8	29.8	−40.27
Senegal	13.3	24.4	−45.49
Tanzania	19.9	29.2	−31.85
Togo	11.9	20.9	−43.06
Uganda	12.8	24.3	−47.33
Zambia	20.8	29.0	−28.28
Zimbabwe	12.5	16.6	−24.70
Latin America and the Caribbean			
Bolivia	11.6	20.4	−43.14
Brazil	9.8	15.5	−36.77
Dom. Repub.	7.7	14.3	−46.15
Guatemala	25.7	36.5	−29.59
Paraguay	2.8	4.3	−34.88
Peru	6.4	17.7	−63.84
Trinidad and Tobago	5.0	8.2	−39.02
South Asia			
Pakistan	32.5	44.6	−27.13

[a] Source: Table 3 in Ruel et al., 1998.

2. We will implement policies aimed at eradicating poverty and inequality and improving physical and economic access by all, at all times, to sufficient, nutritionally adequate and safe food and its effective utilization;

3. We will pursue participatory and sustainable food, agriculture, fisheries, forestry, and rural development policies and practices in high- and low-potential areas, which are essential to adequate and reliable food supplies at the household, national, regional, and global levels, and combat pests, drought, and desertification, considering the multifunctional character of agriculture;

4. We will strive to ensure that food, agricultural trade, and overall trade policies are conducive to fostering food security for all through a fair and market-oriented world trade system;

5. We will endeavor to prevent and be prepared for natural disasters and man-made emergencies and to meet transitory and emergency food requirements in ways that encourage recovery, rehabilitation, development, and a capacity to satisfy future needs;

6. We will promote optimal allocation and use of public and private investments to foster human resources, sustainable food, agriculture, fisheries and forestry systems, and rural development in high and low-potential areas;

7. We will implement, monitor, and follow up this *Plan of Action* at all levels in cooperation with the international community. Source: FAO (1996b).

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