FOOD INSECURITY AND MALNUTRITION IN CENTRAL AMERICA: TRENDS, CAUSES, AND NEEDED ACTION

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ANALYSIS OF THE FOOD AND NUTRITION CONDITIONS IN RURAL POPULATIONS IN EL SALVADOR

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INTRODUCTION

El Salvador is the smallest country in Central America in terms of territory; nevertheless, it has a total population of 5.5 million inhabitants, with an annual growth rate of 2.4 percent. Fifty-two percent of the population live in rural areas. The country has been suffering from a civil war during the last ten years, which has contributed to the impoverishment of the general population, but particularly in rural areas. The Gross National Product (GNP) per capita was estimated at $950/year in 1988; between 1978 and 1988, the per capita GNP lost 25 percent of its purchasing power (Guitia and Abrego 1990). It has been estimated that 20 percent of the poorest population received 2 percent of the national income, while the wealthiest 20 percent received 66 percent in 1980. Nearly 70 percent of the rural population lives in conditions of absolute poverty. Adequate access to arable land is the largest problem in the rural areas; this is evident, since 1 percent of the farms take up 71 percent of the arable land, and 41 percent of the farms take up 10 percent; the Agrarian Reform programme, which was initiated in 1980, has not had the hoped-for effect on land distribution on a national level (UN 1986; Barry 1990). The national infant mortality rate is estimated at 86/1,000 live births, and life expectancy at birth is 58.8 years. The global rate of unemployment and underemployment was estimated between 25 and 33 percent during the 1980s.

The agricultural sector is one of highest economic activity, absorbing 34 percent of the labour force; nevertheless, this sector contributes 21 percent of the GNP, and has shown negative growth rates during the 1980s at an average of -3.5 percent/year. The production of basic grains (corn, beans, rice, and "maicillo") during the last decade showed more marked annual fluctuations than the total agricultural production, with annual growth rates varying between 15 percent (1982) and 29 percent (1988), resulting in a marked fluctuation in the national availability of basic foods.

This study presents a simple analysis with data generated in a national survey in 1988, for the purpose of making recommendations related to strategies that may lead to an improvement in living conditions and reduce food and nutrition insecurity of the rural population in El Salvador. The analysis is partial in the sense that

...e available data do not adequately cover the different aspects of agricultural production, that of employment and income generation, nor of other rural development strategies.

METHODOLOGY

This study is based on data generated by a national survey carried out as part of the Evaluation of the Food and Nutrition Situation in El Salvador (ESANES-88). Such evaluation was carried out by the Salvadoran Demographic Association (ADS) with the participation of the Ministry of Public Health and Social Assistance (MSPAS), with financial support from the Agency for International Development and technical support from the Institute of Nutrition of Central America and Panama (INCAP). The survey planning process was initiated in April 1988 and data collection took place between June and October, 1988. The objectives of ESANES-88 were: (a) to provide current data on the food and nutrition situation, the principal problems and their main causes, and (b) to provide a baseline which permits, over time, evaluation of the impact of policies and programmes to improve health and nutritional status in priority groups of the population. The results presented here are complementary to the analysis included in the final report of the survey (ADS/MSPAS/INCAP 1990).

Sample Selection

The sample selection of ESANES-88 was based on a design of multi-staged conglomerates and a sample framework updated between February 1987 and March 1988. The first stage consisted in the selection of sectors with a probability proportional to the size of the sector, according to the number of households. The second stage consisted in the selection of a segment per sector, with a probability proportional to the number of households in the segment. The concordance between the planned number of households per segment and the observed number was 89 percent, with the size varying between 6 and 48 households, and a median of 22 households per conglomerate. In the third stage, households with one child (or more) of preschool age (0-59 months) were included in each selected segment.

The above mentioned procedure resulted in a first sample of 1,534 households in the rural strata. A subsample of 413 households was selected randomly to be included in the food consumption survey. Later, 27 children (and their households) from 0 to 18 months of age were excluded, because data on the volume of maternal milk consumed was not collected. When the data base with the principal variables was prepared for the analysis according to a predetermined analytical framework, it was found that 4 of the 386 households of the subsample had inconsistent data and 10 did not have complete information in all of the independent

variables. Therefore, the final analysis presented here involves a subsample of 372 households and preschool children for models that do not include agricultural activities and 370 households and children for models with household agricultural activities.[1]

Data Collection

The data of the study were obtained through interviews during home visits and anthropometric studies of preschool age children and adult women. The survey contained information on: (a) family composition and socioeconomic characteristics; (b) agricultural production and access to donated foods; (c) birth and mortality history; (d) morbidity and medical attention to the child; (e) immunization and infant nutrition; and (f) consumption of food by the family and children between 18 and 59 months.

With the 24-hour recall methodology and direct measurement of household portions, data on food consumption of the household as a whole and of preschool-aged children were obtained. Food consumption was converted to calories, protein, and various micronutrients with the Table of Food Composition for Central America (INCAP 1989). Energy, proteins, iron, and vitamin A intake adequacies were estimated based on household intake, household composition, meal attendance of different household members, and the age- and sex-specific daily micronutrient intake recommendations (WHO 1985).

The anthropometric measurements which were taken during the home visit are weight and height, using portable equipment. The children's measurements were converted into three indicators expressed in a standardized form: weight-for-age (ZWA), height-for-age (ZHA), and weight-for-height (ZWH), according to the reference pattern of NCHS (NCHS 1976), and recommended by the WHO. In the case of adult women, the Quetelet Body Mass Index (weight (kilograms)/height $(m)^2$) was calculated as an indicator of body composition.

Statistical Procedures

Descriptive statistics (distributions of frequency, means, and standard deviations) were estimated for the key variables. The linkages of the analytical framework were estimated through multiple regression models and probability models, as well as analysis of variance.

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[1] The analysis does not consider an adjustment for the sample design due to the final size of the conglomerates, which were reduced in size on an average of 18 percent of the original size, that is, around 4 children per conglomerate.

In order to identify the best models with the available independent variables, a model selection procedure was utilized, which tests all possible combinations of independent variables to explain the variation in the dependent variable (SAS 1987). The best model is selected based on four criteria: (a) low SBC (Schwarz Bayesian Criterion) (Schwarz 1978), to minimize error sum of squares of the model leading to the selection of the model with the highest maximum likelihood (Judge et al. 1980); (b) low $|C_p - p|$ statistic (Flack and Flores 1991), based on the statistic C_p (Mallows 1973); (c) lowest condition number, minimizing the degree of collinearity among independent variables (Freund and Little 1986) and (d) maximum adjusted R^2. Furthermore, the normality of the distribution of residuals in each case was examined (Shapiro and Wilk 1965).

ANALYTICAL FRAMEWORK

The analytical framework for the analysis of the available data is presented in Figure 1. The model is simple; nevertheless, it can provide important conclusions on strategies to improve food security and nutritional status in the rural, resource-poor population of El Salvador. The model does not include some important relations owing to limitations in the availability of the data.

Nutritional status of preschoolers (the most vulnerable member of the household) is principally conditioned by the state of health and diet quality, evaluated through food consumption. Environmental hygiene and access to basic services are important health determinants: housing conditions, access to and use of water, and garbage and excrement disposal. Furthermore, access to preventive and curative medical attention through formal health programmes and traditional medicine, etc., directly influence health status. The synergistic effects between health status and nutrition are well known, and hence, the need for an integral and multisectoral focus in solving health and nutrition problems.

Food availability at the household level depends on self-production of food, food purchases in the market, and participation in group feeding programmes ("programa de alimentacion a grupos," PAG). In El Salvador, the PAGs are an important source of food for many rural poor households. The consumption of self-produced food and purchasing power of the household depend on access to: (a) economic resources through employment, agricultural, and nonagricultural activities; (b) land and other capital; (c) market food prices, prices of final products and agricultural inputs, and of nonfood consumer goods. The roots of food insecurity problems and of an inadequate health and nutritional status have their origin in the general state of poverty. Long-lasting solutions for the long-term goal of improving food security ought to contribute to the improvement of socioeconomic conditions. The data

base of the current study contains little information to carry out a more general poverty study; on the other hand, some indicators are included that by their nature are often difficult to obtain, such as diet quality and the nutritional deficiency status of preschoolers.

RURAL HOUSEHOLD CHARACTERISTICS

The 372 rural households of the sample were located in five different regions of the country: western (31.9 percent), central (14.1 percent), outer-central (13.1 percent), eastern (32.5 percent), and metropolitan (8.4 percent). Altitude varied from sea level to 1,100 meters above sea level, with 50 percent of the households located at less than 430 meters.

The median household size was 6 members, and 13 percent of the households had more than 10 members. Sixty-three percent of the households were classified as "agricultural," which is to say that at least one person in the family was dedicated to agricultural activities, whether as a day-labourer (19.5 percent) or on their own (self-employed—43.4 percent) (Table 1). The households that cultivated their land generally reported having one "manzana" (0.7 hectare) of extension. The literacy rates among heads of household (including women) and spouses were 61.5 and 63.6 percent, respectively; an equal percentage among heads of household and spouses had not completed any formal education (38.5 and 39.1 percent, respectively). Only 28.4 percent of the households had electricity, 63 percent had a radio, and 15.8 percent a television set.

The principal source of water was a well (37 percent), the next was public water network (23.3 percent), spring (21.7 percent), or river (9.4 percent); in general, the closest source was at a distance of 2,000 meters. Fifty-seven percent of the households had latrines but 41 percent did not have any sanitary facilities. The use of medical services was infrequent: for example, 45 percent of the preschoolers had not been taken to a medical consultation during the last year, in spite of the fact that 39 percent of the preschoolers had an episode of diarrhea (median duration: 3 days) and 75 percent had a severe respiratory infection (median duration: 6 days), just two weeks prior to the survey. Generally, access to medical services required around 30 minutes to get to the outpatient center or post, although in 38 percent of the cases, these were one or more hours away. Seventy percent of pregnant women reported receiving prenatal care, generally five times during pregnancy. Fifty-five percent of the births were home deliveries and 43 percent took place in a health center; 39.4 percent of the births were attended by a midwife, 40.4 percent by a doctor, and 8.3 percent did not receive any attention. Vaccination coverage in preschoolers was relatively low for BCG (32.7 percent), DPT (30.4 percent), polio (28.5

percent), and measles (28.0 percent); consequently, a significant proportion of the children were unprotected.

Consumed foods that were reported with the highest frequency by the sample households were: corn (99.2 percent), sugar (92.9 percent), fats (82.5 percent), and beans (81.4 percent); other foods were cereals (75.4 percent), milk (65.7 percent), and eggs (61.3 percent). The frequency of reported consumption does not indicate the relative contribution of each food to total intake; therefore, a high frequency of consumption of different foods does not necessarily guarantee an adequate food intake.

Almost half of the households (48.7 percent) showed deficiencies in daily energy intake (<90 percent of recommended intake) and 62.3 percent showed a deficient protein intake (<100 percent of recommended intake). A high percentage of the households (94 percent) had a deficient iron intake (<100 percent recommended), and 95 percent had a deficient vitamin A intake (<100 percent recommended). Sixty-four percent of preschool-age children were at some risk of calorie-deficient intakes, and 70.7 percent of protein deficient intake. In 23 percent of the cases, the household had an adequate caloric intake, but the preschool-age children had an inadequate intake. Children had deficient intakes of iron (80.6 percent) and vitamin A (90.1 percent) with almost the same frequency as that of the household as a whole.

The nutritional status of preschoolers at the time of the survey tended to be more affected by chronic than acute factors: 41.2 percent showed height deficiency (<-2 ZHA), with 13.1 percent with severe stunting (<-3ZHA). Furthermore, 20.2 percent of the children had weight deficiencies (<-2 ZWA) and 1.8 percent of the children had a low weight adjusted for their height, and were wasted (-<2 ZWH).

The body composition of adult women, based on the body mass index, was generally adequate, with a certain tendency toward obesity. On average, women were 23.6 (±3.9) kilograms/m^2, with only 3.3 percent less than 18 kilograms/m^2. However, the body mass index may not be an adequate indicator of chronic energy deficiency status among rural adult populations.

In order to examine if the inclusion in the analysis of a relatively small subsample might have introduced a bias with respect to the households who were excluded from the analysis, a comparison of the two subsamples was made, based on key indicators (Table 1). The results indicate that the included subsample was relatively representative of the total sample.

FOOD AVAILABILITY AND CONSUMPTION

We will examine how the different sources of food acquisition relate to the availability and consumption of food on the part of the household as a whole and of preschool-age children. Three food acquisition sources were considered: purchase, self-production, and participation in a group feeding programme (PAG). The data indicate in a qualitative form whether or not the household consumed food from different food groups, and the means of acquisition. Food availability was expressed in terms of calorie, protein, iron, and vitamin A (equivalent to retinol) adequacy levels.

The consumption of specific foods was significantly associated with the adequacy levels of caloric intake among the households of the subsample. These foods were: fats (82.5 percent), sugar (92.9 percent), beans (81.4 percent), meat (31.9 percent), and eggs (61.3 percent). The percentage of households that reported consuming these foods is indicated in parentheses. Milk consumption (65.7 percent), meat, beans, and eggs were positively associated with the adequacy level of household protein intake. The percentage of households that reported consuming donated oil and powdered milk were 12 percent and 14 percent, respectively. Corn was self-produced by 40 percent of the households, beans by 15 percent, milk by 11 percent, and eggs by 24 percent.

A simple analysis of variance indicated that the average consumption of milk and beans, both on a household level as well as a preschooler level, was significantly higher when the household produced these foods for their own consumption. This is also true in the case of corn, but only at household level. Self-production of eggs is not associated with a higher average consumption of eggs. Self-production of corn, beans, eggs, or milk does not lead to an improvement in the household energy-protein adequacy intake levels or of micronutrients. Neither donated oil nor powdered milk consumption have a significant impact on adequacy levels. That is to say that the source of food per se does not appear to influence the adequacy levels of household intake.

A regression model ("best subset model") was formulated to examine whether the adequacy intake levels of preschool-age children increased when the food sources include self-production and/or food donations, aside from the total food availability. In general, the adequacy of caloric and protein intake of the child increased less than proportionally with increases in the household adequacy levels (.72 and .78, respectively), and more than proportionally in the case of iron and vitamin A intake (1.24 and 1.29, respectively). Children of households that produce corn, beans, eggs, and/or milk for self-consumption or those that receive donations of oil and/or powdered milk are not at lower risk of deficient caloric-protein intakes or of micronutrient

deficiencies than children of other households, when adjusted for household intake adequacy.

Diet diversity of preschoolers is positively related to their adequacy intake levels. Total consumption of food by preschoolers out of a group of ten foods resulted in: corn (96.6 percent)[2], beans (73.0 percent), vegetables (80.9 percent), fruit (40.1 percent), eggs (55.5 percent), milk and dairy products (61.3 percent), bread (54.5 percent), cereal (70.7 percent), fats (76.4 percent), and sugar (90.3 percent). The correlations between the total sum of foods consumed (diversity) and adequacy levels were: calories ($r=.42$; $p<.01$), protein ($r=.34$; $p<.01$), iron ($r=.32$; $p<.01$), and vitamin A ($r=.26$; $p<.01$). Children on diets that included corn, beans, vegetables, and milk and/or eggs (48 percent of the cases) generally had an adequacy level higher in calories ($F=6.97$; $p<.01$), protein ($F=6.20$; $p<.02$), iron ($F=9.41$; $p<.01$), and vitamin A ($F=5.73$; $p<.02$) than the rest of the children.

In addition, probability regression models were formulated which considered as dependent variables the adequacy levels of child intake of energy and protein ($\geq$80 percent), iron ($\geq$50 percent), and vitamin A ($\geq$30 percent), as a function of adequacy levels of the household of the same nutrients, main type of agricultural activity (self-employment, agricultural day-labourer), and nonagricultural work, as well as other variables related to food availability, as previously enumerated (Table 2). The results indicate that after adjusting for the positive effect of the household adequacy level of energy and protein, the nonagricultural activities (ActNA) or self-employed agricultural activity (ActCP) turned out to be associated with higher energy and protein intake in children in comparison with children of agricultural day-labourers. A less inadequate level of vitamin A intake in children ($\geq$30 percent) turned out to be associated with a better adequacy level of household vitamin A intake, and when the main activity is nonagricultural (ActNA) rather than agricultural, whether self-employment or as day-labourer; also, the consumption of self-produced corn and eggs turned out to be positively associated, and the consumption of self-produced beans turned out to be negatively associated, with the vitamin A adequacy status.

Finally, a more adequate level of iron intake ($\geq$50 percent) turned out to be associated with a more adequate level of household iron intake and when the household consumes self-produced eggs, independent of the type of economic activity, whether agricultural or nonagricultural.

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[2] Reported frequency of food consumption in parentheses.

HEALTH DETERMINANTS

The two health indicators included in the study are the incidence of diarrhea and of acute respiratory infection (ARI) in preschoolers in the two-week period prior to the survey. These indicators provide a very incomplete picture of the health status of the children. The dependent variable, whether the child did or did not have one (or more) episodes of diarrhea or ARI in the two-week period was related to a number of indicators which represent: (a) access to medical attention (history of immunizations and times per year that the child had been taken to a clinic); (b) basic services (water source and presence of latrine); (c) adequacy level of calorie, protein, and micronutrient intake; (d) housing conditions (living density and location of the kitchen); and (e) the household's socioeconomic status (mother's educational level and household size). Cross tabulations were computed to examine these associations.

It was found that those children who had been appropriately vaccinated against polio had a lower frequency of episodes of diarrhea: 35.9 percent versus 46.8 percent among children without adequate vaccinations (x^2=3.88; p<.05). A similar result was found comparing children with adequate vaccination against DPT with children without adequate protection. These associations are statistically weak and no other association reached a statistically significant level, with the exception of children with diarrhea, who more often had been taken to an outpatient consultation during the last year (x^2=8.32, p<.02); this is to say that those children who fell ill more frequently tended to be taken more frequently to outpatient consultations.

In order to find the best model to explain (with the available variables) the variation in the number of days of diarrhea and ARI during the last two-week period, the best model regression techniques were applied. Following the analytical framework, the following independent variables were included: water source, presence of sanitary facilities, household size, number of people per room (living density), kitchen location, educational level of the mother, and adequacy levels of the child's calorie, protein, iron, and vitamin intake. The "best" models that were generated in both cases resulted with a coefficient of determination of less than 1 percent, and with regression coefficients statistically not different from zero. Consequently, no variable explained any part of the variation in the number of days with diarrhea or ARI. Neither the incidence nor the duration of episodes of diarrhea or of ARI were related to the indicated factors.

NUTRITIONAL STATUS OF PRESCHOOL CHILDREN

Following the analytical framework, the principal determinants of the nutritional status of children are (a) health status and (b) dietary

intake in relation to requirements. The socioeconomic status may have an additional influence. With the available data, a model to examine the determinants of the nutritional status of the child was formulated:

$$NS = f(HEALTH, INTAKE, SES)$$

Three indicators of nutritional status (NS) were utilized as dependent variables to capture different dimensions of the physical growth process in children. Normalized values of the days of diarrhea and acute respiratory infection (ARI) were the health indicators. The adequacy level of caloric, protein, iron, and vitamin A (<, ≥90 percent) intakes represent food consumption (INTAKE). As indicated before, significant associations were not found between the indicators of basic services and health indicators. Here such indicators were included as potable water source and presence of latrine, together with educational level of the mother and household size, as socioeconomic indicators (SES). In order to identify the best models for each NS indicator, the best subset regression technique was applied. The results are presented in Table 3.

Firstly, it can be seen that the models explain very little of the variation in the nutritional status indicators. Weight deficiency seems to be conditioned, among other things, by the adequacy level in daily energy intake (VAR 1) and by the incidence of diarrhea (VAR 2): children with an adequate daily caloric intake, and/or with episodes of diarrhea of short duration, are at less risk of weight deficiency. Potable water source was previously shown not to be associated with the incidence of diarrhea. Nevertheless, when the household depends on a river, spring, or rain water as the source of water (VAR 4), the child is at greater risk of weight deficiency, and also of growth stunting, than when the household has access to a public water network or a well. Access to water from a well (VAR 3) also represents a risk factor associated with weight deficiency. Perhaps here the source of water is an indicator of the general state of poverty, and/or of the use of low quality water which has pathological effects on the growth of the child, effects that are not captured by the health indicators of the present study. An adequate daily caloric intake has a positive effect on the physical growth process in the long term (height-for-age). Nevertheless, children with acute respiratory infections of long duration are at greater risk of growth stunting than children with ARI episodes of short duration; the duration of episodes of diarrhea did not turn out to be associated with growth stunting. To the extent that the two-week period prior to the survey was representative, both the incidence as well as the median duration of episodes of ARI were higher than the median duration of the diarrhea episodes (ARI: 75.1 percent, 6 days duration; diarrhea: 39 percent, 3 days duration). Consequently, ARI in children possibly has a more marked effect on the cumulative growth process in this population. When the mother had completed more than three grades of formal education (VAR 6), the child was at less

risk of growth stunting according to the estimated model, capturing in this way another effect of socioeconomic status.

The best models obtained with logistical regression show similar results to those obtained using OLS regression, as is described in Table 4. In these analyses, cutoff points for low weight were children with <-1 ZWA, and with small size children with <-2 ZHA. Risks of low weight and height were associated with low daily protein intake. Among children from households which use a river, spring, or rainwater as their source of water, risks of low weight and height were also higher. In the same way, episodes of diarrhea of longer duration increase the risk of low weight, while longer episodes of ARI are associated with higher risk of growth stunting.

The results of these analyses can be summarized in the following manner. Malnutrition in children of preschool age, as manifested in growth stunting and weight deficiency, is associated with inadequate food intake of the child, a higher incidence of diarrhea and ARI, lack of access to piped water, and mother's low formal educational levels. All these factors simultaneously represent different dimensions of the state of poverty in the rural household.

CONCLUSIONS AND DISCUSSION

The subsample of rural households involved in the study is small, and the degree of generalization of the results is reduced in spite of the fact that this subsample is representative of the sample of 1,534 rural households who were originally included. Because of the subsample size, a stratification by geographic location was not possible but would have identified more clearly the local conditions and their effects on food security, health, and nutrition of rural households. It is exactly the local diversity in ecological, social, cultural, and economic conditions that make a generalization of development strategies (and their operationalization through programmes and projects) inappropriate. In this sense, it is also important to have in mind that a third of the subsample was located in the western region (Departments of Ahuachapan, Santa Ana, and Sonsonate) and another third in the eastern region (Departments of San Miguel, Usulatan, Morazan, and La Union).

The rural household in El Salvador is generally characterized by a dedication to agricultural activities, whether as a salaried worker or on a self-employed basis. In the latter case, household agricultural production is undertaken on small parcels. Infrastructure in rural areas, in terms of electrification, access to potable water, and sanitation facilities, in general, is inadequate; access to, and utilization of medical services also seem to be inadequate.

The daily diet of the rural household with limited resources seems to be more diversified in comparison with diets reported for other rural populations in Central America. Nevertheless, marked deficiencies in daily caloric, protein, and micronutrient intakes are found, and the preschool-age child appears to be at higher risk of a deficient diet than the total household. Two observations at this point are important. First, caloric intake adequacy is measured against the *recommended* daily allowance and not against the *required* daily allowance which is unknown; due to high morbidity, particularly of diarrheal and respiratory illnesses, most likely the energy requirements are notably higher than the recommended intake. If the requirements exceed the recommendations, the adequacy level of daily energy intake is overestimated. Second, both the energy requirements as well as dietary intake are subject to a seasonal variation in the rural area. For example, it is likely that the nutritional pattern that is reflected by the data is not necessarily representative of the pattern that corresponds to other seasons of the year.

In relation to the body composition of adult women, the result, in general, indicated better adequacy in comparison with data reported for rural areas of Guatemala (X:22.5 ± 2.7 kilograms/m^2). For women in India, Ethiopia, and Papua New Guinea, Norgan (1990) reported average values of 17.8 (± 2.2), 19.2 (± 2.1), and 20.9 (± 2.3) kilograms/m^2, respectively. The body mass index as a valid indicator of the chronic energy deficiency status of adults in developing countries has been questioned, among others by Norgan.

Chronic malnutrition in preschool-age children is a serious problem and reflects the state of poverty in the rural area. In comparison with adult women, preschoolers seem to be at higher risk of malnutrition. The high incidences of diarrhea and ARI contribute, without a doubt, to the deficient nutritional status. The lack of association in the current study among the morbidity indicators and the sanitary variables that lend themselves to improvement may be due to the fact that the morbidity indicators do not provide adequate information about the morbidity pattern throughout the year, because of seasonal variations. It is also possible that there are measurement errors and the data do not permit a distinction between various episodes of short duration and one of long duration.

The results of the study do not allow us to identify specific strategies to improve the health status of preschoolers. However, the state of the child's health is related to physical growth, and, furthermore, preventive medicine more than curative medicine has greater potential to lower morbidity rates in preschool children. Similarly, the results suggest that an improvement in access to piped water may lower the risk of chronic or acute malnutrition.

On the other hand, the results suggest that an adequate energy-protein intake for the child has a positive effect on the physical growth process, and, thus, strategies that increase household food availability are important even though, in general, the increase in children's food consumption is less than proportional to the increase in household food consumption. Apart from the total household food availability, the source of the food per se does not seem to specifically influence the adequacy of the child's energy-protein intake. This is to say that the child shares the available food in a proportion that does not change according to the food source(s). This finding is important because it suggests that complementary feeding through donated oil and milk does not nutritionally benefit the young child more than the entire household. Similarly, whether the foods are self-produced or not does not additionally affect the adequacy level of the child's intake. Furthermore, the adequacy level of household intake does not vary whether the household has access to donated foods and/or self-produces part of the consumed foods. The lack of a significant association between the consumption of donated foods and adequacy levels of household intake can be interpreted in the following manner: (a) the donated foods do not reach the households at greatest risk of deficiency in food intake, and/or (b) donated foods substitute for other foods normally consumed, and/or lower the consumption of such foods, and/or are sold by the receiving households. On the other hand, the effect of donated foods on child nutrition may be conditioned by the size and content of the food rations and the total quantity of available foods at the time of the survey. The findings of this national study do not coincide with those obtained in a study of households participating in complementary food programmes (MSPAS/INCAP 1990), which may be due to the fact that in the latter study a specific, high risk population group was included.

In the long term, the best strategy to diminish child malnutrition is to reduce rural poverty and improve general living conditions, which no doubt depends, first, on the cessation of armed conflict in the rural areas, an urgent precondition. Of more immediate policy concern should be the finding that complementary feeding programmes not necessarily increase total household food supplies. The resources which are absorbed now by these programmes should perhaps be redirected towards programmes which generate employment and income as well as raise the productivity of corn, bean, and milk production by smallholder farmers. These strategies could improve household food security as well as child nutritional security by increasing in a self-sustaining way total household food supplies and diminishing the dependency on externally donated foods.

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Table 1—Comparison of subsamples of households with preschool-age children, rural areas, El Salvador, 1988

Characteristic	Families Included in the Analysis (n=372)	Families Not Included in the Analysis (n=693)
	(percent)	
Head of household knows how to read and write	61.5	60.2
Spouse knows how to read and write	63.6	64.0
Male-headed households	83.2	81.5
Households with electricity	28.4	31.9
Households with radio	63.0	63.6
Water source		
Public network or other piped source	31.3	30.4
Well	37.0	34.8
Spring, river, lake, rainwater	31.6	34.7
Sanitary facilities		
None	41.0	43.7
Latrine	56.8	53.6
Toilet	2.2	2.6
Principal economic activity		
Agricultural day-labourer	19.5	21.0
Agricultural self-employed	43.4	42.4
Nonagricultural	37.1	36.7
Consumption of donated foods		
Powdered milk	13.6	10.9
Oil	11.8	10.9
Preschooler children with BCG vaccination	32.7	36.9
Preschool children with		
Diarrhea-past two-week period	39.0	44.9
ARI-past two-week period	75.1	70.1

Table 2—Logistical models to examine variables associated with adequacy levels of calorie, protein, iron, and vitamin A intake in preschool children, rural areas, El Salvador, 1988

Adequacy of:	Independent Variables		
	Coefficient	Z-Score	Risk Ratio
Caloric intake ("1":≥80 percent; "0":<80 percent)			
VAR1	2.03	8.40*	7.59
VAR2	0.65	2.01*	1.91
VAR3	0.77	2.32*	2.17
Intercept	-1.68	-5.36*	0.19
Goodness of Fit: $X^2(4) = 707$			
P = .70			
Protein intake ("1":≥80 percent; "0":<80 percent)			
VAR4	2.18	8.82*	8.85
VAR2	0.64	1.93**	1.89
VAR3	1.01	2.92*	2.74
Intercept	-1.93	-5.94*	0.15
Goodness of Fit: $X^2(4) = .085$			
P = .96			
Iron intake ("1":≥50 percent; "0":<50 percent)			
VAR5	2.03	8.28*	7.59
VAR6	0.50	1.70**	1.66
Intercept	-0.61	-3.54*	0.55
Goodness of Fit: $X^2(1) = 0.14$			
P = .71			
Vitamin A intake ("1":≥30 percent; "0":<30 percent)			
VAR7	3.59	11.40*	36.10
VAR8	-0.75	-1.65**	0.47
VAR9	0.65	1.87**	1.92
VAR6	0.64	1.76**	1.89
VAR3	0.78	2.32*	2.18
Intercept	-2.66	-7.60*	0.07
Goodness of Fit: $X^2(23) = 28.56$			
P = .20			

Notes:

VAR1 : Household caloric intake adequacy: "1"; ≥ 80; "0": <80 percent.
VAR2 : ActCP: "1" self-employed agricultural work; "0": other.
VAR3 : ActNA: "1" non-agricultural work; "0" other.
VAR4 : Household protein intake adequacy: "1": ≥80 percent; "0": <80 percent.
VAR5 : Household iron intake adequacy: "1": ≥40 percent; "0": <40 percent.
VAR6 : Consumption of self-produced eggs: "1" yes; "0": no.
VAR7 : Household vitamin A intake adequacy; "1" ≥20 percent; "0"; <20 percent.
VAR8 : Consumption of self-produced beans: "1": yes, "0": no.
VAR9 : Consumption of self-produced corn: "1" yes, "0": no.

* p < .05
** < .05<p< .10.

Table 3—Multivariable models identified to examine associated variables with weight-for-age, height-for-age, and weight-for-height of preschool children, rural areas, El Salvador, 1988

Independent Variables	Dependent Variables		
	Weight-for-Age[a]	Height-for-Age	Weight-for-Height
VAR 1	0.25 (2.65)*	0.25 (2.09)**	
VAR 2	-0.10 (2.07)**		-0.13 (2.95)*
VAR 3	-0.19 (1.68)***		-0.27 (2.54)**
VAR 4	-0.44 (3.71)*	-0.39 (3.21)*	-0.24 (2.19)**
VAR 5		-0.13 (2.22)**	
VAR 6		0.34 (2.71)*	
Constant	-1.10 (12.05)*	-1.85 (20.17)*	0.01 (0.09)
R^2 adjusted	.053	.061	.033
F (p<F)	6.30 (.0001)	6.92 (.000)	5.21 (.002)

Notes:

VAR 1 = Adequacy of energetic intake of the child: "0":<90 percent; "1":≥90 percent.

VAR 2 = Z-scores of number of days with diarrhea/latest two-week period.

VAR 3 = Water source: "1":well; "0":other.

VAR 4 = Water source: "1":spring, river, rainwater; "0":other.

VAR 5 = Z-scores of number of days with ARI/latest two-week period.

VAR 6 = Formal education of mother: "1": 4+ grade primary; "0":other.

[a] Regression coefficient (t).

* p<.01.

** p<.05.

*** <.05<p<.10.

Table 4--Logistical models to examine variables associated with low weight and growth stunting in preschool children, rural areas, El Salvador 1988

Dependent Variable	Independent Variable	Coefficient	Z	Risk Ratio
Low weight				
"1": < - 1 ZWA	VAR1	.411	1.72**	1.51
"0": ≥ - 1 ZWA	VAR2	.387	1.64**	1.47
	VAR3	-.547	-2.51*	0.58
	Intercept	.508	2.79*	4.66
Goodness of Fit: $X^2(4) = .99$ P = .91				
Growth stunting				
"1": < - 2 ZHA	VAR1	.663	2.86*	1.94
"0": ≥ - 2 ZHA	VAR4	.623	2.81*	1.87
	VAR3	-.362	-1.64**	0.69
	Intercept	-.741	-3.83*	0.48
Goodness of Fit: $X^2(4) = 2.26$ P = .69.				

Notes:

VAR1 : Source of water: "1": spring, river, rainwater; "0": other.
VAR2 : Incidence of diarrhea in last two-week period: "1": yes; "0": no.
VAR3 : Adequacy of child protein intake: "1": ≥80 percent; "0": <80 percent.
VAR4 : Incidence of ARI in last two-week period: "1": yes; "0": no.

* p < .05.
** < .05 < p < .10.

Figure 1—Analytical framework of the rural study of El Salvador