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RELATIONSHIP BETWEEN FAMILY LAND AVAILABILITY AND NUTRITIONAL STATUS

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A study of the relationship between occupation, land owned and/or rented by the family and nutritional status of two- and three-year-old children was conducted in four rural Guatemalan villages. Families were divided into three occupational groups: salaried agricultural workers, farmers, and skilled workers and merchants. Nutritional status was defined in terms of weight for age. There was a tendency for the children of skilled workers and merchants to have the lowest prevalence of moderate malnutrition. It was found that 76 percent of families classified as farmers controlled less than five *manzanas* (one manzana = 0.7 hectares). The relative risk of having moderate malnutrition was 2.3 times greater in the two- and three-year-old children of families with access to less than two manzanas than in those with access to more than five manzanas.

INTRODUCTION

The majority of the population of Central America suffers from chronic protein-calorie malnutrition (INCAP/CDC, 1972). This problem is particularly serious in pre-school children from rural and marginal city areas. The public health repercussions of chronic protein-calorie malnutrition are vast. For instance, the high pre-school morbidity and mortality rates reported for most developing nations may be, to a large extent, the result of a deficient nutritional status (Serimshaw, Taylor and Gordon, 1968; Puffer and Serrano, 1973). Moreover, chronic malnutrition may not only retard physical growth, but mental development as well (DDH/INCAP, 1975). Consequently, chronic protein-calorie malnutrition is one of the principal health problems of Central America and possibly an important factor limiting the social and economic development of the area.

The fundamental causes of malnutrition are of a social nature. Due to a lack of and/or inefficient utilization of resources, the majority of the Central American population is unable to achieve good health and nutritional status. It has been hypothesized that one of the most important obstacles limiting the development in rural agricul-

tural societies is the amount of land available to the families (Abercrombie, 1975).

The same author (Abercrombie, 1975) distinguishes two groups in the rural areas: small-scale farmers and landless agricultural workers. One would expect that the latter would have a poorer nutritional status than the former. However, no empirical data have come to our attention to support this statement. The nutritional status of a third group, comprising merchants and skilled workers, usually present in rural communities, has also been ignored. However, this group is believed to be the least deprived. While nearly two thirds of all Central American families are dedicated to agricultural activities, very little is known about the relationship between land availability and nutritional status (Rawson and Valverde, 1976).

This paper therefore attempts to provide preliminary insights into these very important but generally disregarded areas of research. Two hypotheses are tested:

There is a relationship between father's occupation and nutritional status of young children. That is, the prevalence of malnourished children is greatest in landless agricultural workers, intermediate in small-scale farmers and least in merchants and skilled workers.

The greater the amount of land available to small-scale farming families, the better the nutritional status of the young children in the family.

MATERIALS AND METHODS

General Description of the Population

Information on father's occupation, land availability and nutritional status of children was collected in 1974 within the context of a large study presently under way in four poor rural Guatemalan villages (Klein, Habicht and Yarbrough, 1973). These villages are located on the Atlantic slopes of the Guatemalan highlands at altitudes varying between 300 and 1,100 meters. From 650 to 1,100 individuals live in each of these communities, 46 percent of whom are less than 15 years of age. The median family income in these agricultural villages was around U.S. \$400 per year in 1974 and represented both cash income and the value of the home produce. The typical house is built of adobe and generally has only two rooms, a bedroom and a kitchen. Few homes have sanitary facilities, and drinking water is contaminated with enteric bacteria. Morbidity rates are high, particularly due to gastrointestinal and respiratory problems (Martorell *et al.*, 1975a). Corn and beans are the main sources of proteins and energy. Children are severely retarded in physical growth, most of them falling below the 10th percentile of the Denver norms (Hansman, 1970) by seven years of age.

The region is hot and dry, with a measured annual precipitation rate of 600 mm over the last 25 years, which makes this area one of the driest in Guatemala. The terrain is rugged, and arable land is scarce. The main crops cultivated are corn and beans, most of the production being for family consumption. Rudimentary technology is utilized in cleaning and preparing the fields and in the planting and harvesting of the crops. Thus, few implements other than the *machete* and the hoe are utilized (Mejía-Pivaral, 1972).

Variables

Nutritional Status

Weight is used as an indicator of nutritional status in the present study. Since the greatest portion of growth retardation in pre-school children occurs in the first two or three years of life (Yarbrough *et al.*, 1975) only those families with two-

and three-year-old children in 1974 were selected for study. These families had 229 two- and three-year-old children and represented 28 percent of the total number of families living in these communities.

Weight was measured on a beam balance following standard procedures and adequate methods of quality control (Martorell *et al.*, 1975b). Children were measured within seven days of their second or third birthday.

Children were divided into two groups according to the percent weight for age. The first group included normal children and children with first degree malnutrition. The second group included children with second or third degree malnutrition. In other words the top two categories of the "Gómez classification" (Gómez *et al.*, (1956) made up the first group while the bottom two made up the second group. More specifically, the two groups were as follows:

Normal children (Gómez, normals) and children with mild malnutrition (Gómez, grade 1): more than 75 percent of the standard weight for age.

Children with moderate (Gómez, grade 2) or severe malnutrition (Gómez, grade 3): less than or equal to 75 percent of the normal weight for age. This will be called the moderately malnourished group because only three out of the 62 children that formed it fell within the Gómez grade 3 category.

While the above division may seem arbitrary, it does reflect current pediatric practice in Central America. Thus, generally speaking, physicians become concerned only when a child falls into what was defined here as the second group. Moreover, field studies in Latin America suggest that the mortality risk for children whose weights are above 75 percent of normal is minor compared to that for children whose weights are below that value (Puffer and Serrano, 1973).

Lastly, the use of weight for age requires a definition of what is the normal weight at a specific age. Previous studies suggest that there are no important ethnic differences in growth prior to adolescence between the mixed Spanish-Indian population here studied and children from Western European origin (Habicht, *et al.*, 1973; Martorell *et al.*, 1975c; Johnston, Borden and MacVean, 1973; Johnston *et al.*, 1976). Consequently, values for U.S.A. children, as reported by Jelliffe (1966), are utilized as the standard given that no data are available for two- and three-year-old well-nourished Guatemalan children.

LAND AVAILABILITY

TABLE I

Land availability and nutritional status of 2-and 3-year-old children of Guatemalan families of various occupations

Occupation	n	% of total	Land owned ($\bar{X} \pm S.D.$) ^a	Land owned and/or rented ($\bar{X} \pm S.D.$) ^a	Weight/age ^b ($\bar{X} \pm S.D.$)
I Farmers	147	64.3	2.75 \pm 5.67	4.56 \pm 5.48	80.2 \pm 8.7
II Salaried agricultural workers	43	18.7	1.09 \pm 2.24	2.13 \pm 2.54	78.8 \pm 8.0
III Skilled workers and merchants	39	17.0	2.25 \pm 3.22	2.83 \pm 3.30	83.1 \pm 11.3
Total	229	100.0	2.36 \pm 4.86	3.81 \pm 4.83	80.4 \pm 9.1

^aGiven in *manzanas*; 1 manzana = 0.7 hectares.

^bActual weight expressed as percent of the standard age-specific weight (Jelliffe, 1966).

Land Availability

Information on the amount of land owned and rented was collected in 1974 through direct interviews with heads of the households. Utilizing data on income collected at the same time, the sample was divided into "farmers" and "non-farmers." A farmer was arbitrarily defined as one deriving more than a third of his annual income from his own agricultural production. Non-farmers, therefore, were those deriving more than two-thirds of their income from sources other than their own agricultural production. The group of non-farmers was then subdivided into two groups: unskilled salaried agricultural workers and skilled workers or merchants. The salaried agricultural workers were employed locally, or temporarily migrated to the coast to work in large plantations. The group of skilled workers and merchants was very heterogeneous, and included masons, industrial workers, civil servants, shop owners and buyers and sellers of corn and other products.

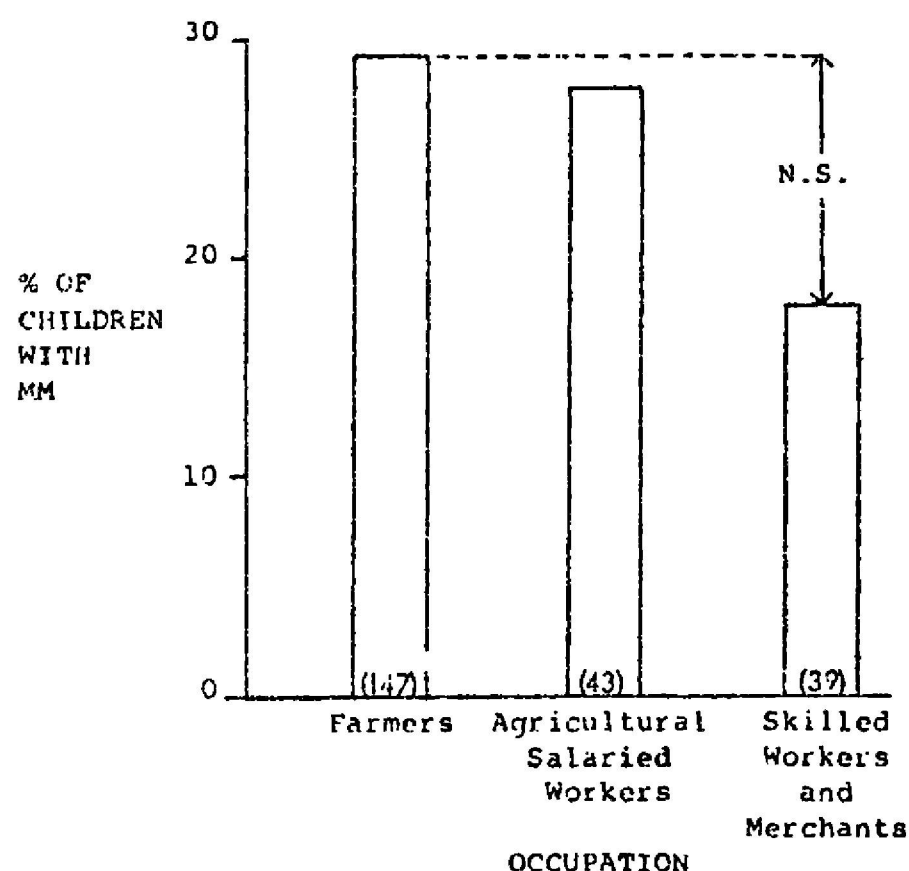
For purposes of analyses with discrete variables, three categories of land size were defined: 0 to 1.9, 2.0 to 4.9 and equal to or greater than five *manzanas*. (One manzana equals 0.7 hectares.) The cut off point of two manzanas had been utilized in a previous study in Costa Rica (Rawson and Valverde, 1976). The upper category, greater than five manzanas, was added here simply to explore the association between relatively larger land holdings and nutritional status.

RESULTS

Occupation and Nutritional Status

The distribution of family heads according to occupation is shown in Table I. The most

common group is that of farmers, constituting 64.3 percent of the total sample studied. Farmers controlled more land (owned and/or rented) than either agricultural salaried workers ($p < 0.05$) or skilled workers and merchants ($p < 0.05$). Though there was a tendency for the children of skilled



In parenthesis, number of cases in denominator.

Incup 76-47

FIGURE 1 Percentage of Guatemalan children with moderate malnutrition (MM) by type of occupation.

workers and merchants to have a higher mean weight/age, this was not statistically significant ($p > 0.05$).

Figure 1 presents the percentage of children with moderate malnutrition (MM) by type of occupation. As the graph shows, the prevalence

TABLE II

Relationship between land owned* and nutritional status of 2-and 3-year-old children of families of Guatemalan farmers

Categories of land owned	n	% of total	Land owned ($\bar{X} \pm S.D.$)	Weight/age ($\bar{X} \pm S.D.$)
0 - 1.9	98	66.7	0.26 \pm 0.46	79.3 \pm 8.8
2.0 - 4.9	25	17.0	3.40 \pm 0.86	82.4 \pm 9.7
> 5.0	24	16.3	12.54 \pm 9.06	81.5 \pm 6.9
Total	147	100.0	2.76 \pm 5.67	80.2 \pm 8.7

*Given in *manzanas*; 1 manzana = 0.7 hectares. Correlation (land owned and/or rented vs. weight/age) = 0.14; $p > 0.05$.

TABLE III

Relationship between land owned and/or rented* and weight for age of 2-and 3-year-old children of families of Guatemalan farmers

Category of land owned and/or rented	n	% of total	Land owned and/or rented ($\bar{X} \pm S.D.$)	Weight/age ($\bar{X} \pm S.D.$)
0 - 1.9	37	25.2	1.32 \pm 0.46	79.0 \pm 9.7
2.0 - 5.0	74	50.3	2.87 \pm 0.82	79.7 \pm 8.6
> 5.0	36	24.5	11.39 \pm 7.85	82.6 \pm 7.7
Total	147	100.0	4.56 \pm 5.48	80.2 \pm 8.7

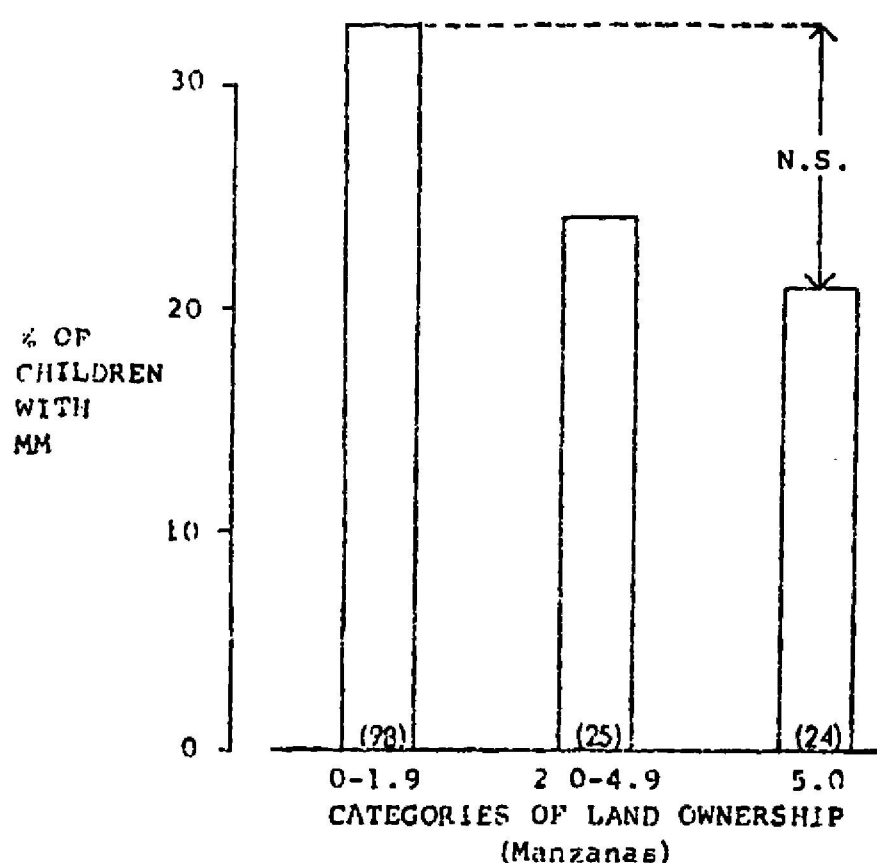
*Given in *manzanas*; 1 manzana = 0.7 hectares. Correlation (land owned and/or rented vs. weight/age) = 0.13; $p > 0.05$.

of moderate malnutrition in the two- and three-year-old children of farmers and of agricultural salaried workers was 29 and 28 percent, respectively. The group of skilled workers and merchants had fewer children with moderate malnutrition (18 percent). None of the groups, however, differed significantly from the others ($p > 0.05$) with respect to the prevalence of moderately malnourished children.†

Land Availability and Nutritional Status

The results that follow deal exclusively with the farmers group, that is, with those families who derived more than 33 percent of the total income from agricultural production.

The relationship between land owned and nutritional status is shown in Table II, and similar data on total land controlled (land owned and/or rented) are presented in Table III. Neither comparisons of the group means, nor correlation analyses, yielded statistically significant relationships between the amount of land available to the

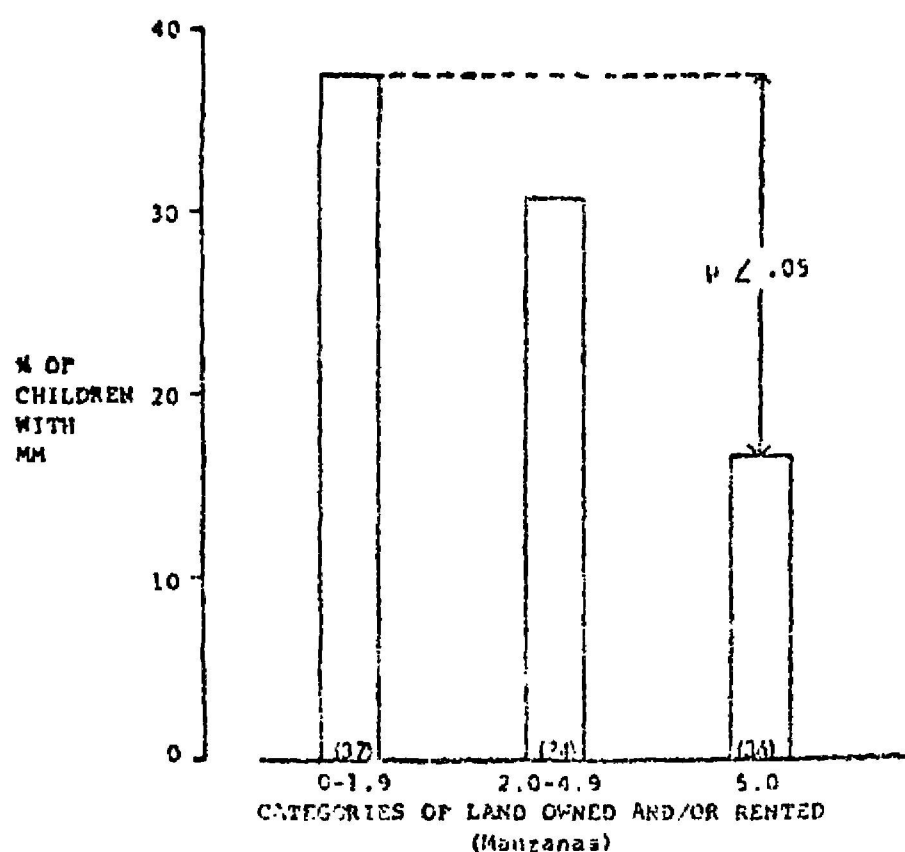


In parenthesis, number of cases in denominator.

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† The statistical test utilized for all comparisons of proportions was the t-test of arcsin transformation for proportions. (Snedecor and Cochran, 1967, p. 327.)

FIGURE 2 Percentage of Guatemalan children (families of farmers) with moderate malnutrition (MM) by category of land ownership.



In parenthesis, number of cases in denominator.

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FIGURE 3 Percentage of Guatemalan children (families of farmers) with moderate malnutrition (MM) by category of land owned and/or rented.

family and the nutritional status of the two- and three-year-old children ($p > 0.05$).

The relationship between the amount of land owned and the prevalence of two- and three-year-old children with moderate malnutrition is illustrated in Figure 2. As may be observed, the greater the amount of land the family owned, the lesser the prevalence of children with moderate malnutrition. Although the average risk of having children with moderate malnutrition was 1.6 times greater in families owning less than two manzanas than in those with more than five manzanas, this difference was not statistically significant ($p > 0.05$).

The total amount of land controlled by the family is also associated with the nutritional status of children in the family, as shown in Figure 3. Thirty-eight percent of the children in the low category had moderate malnutrition in contrast to only 17 percent in the high category. The relative risk of having children with moderate malnutrition was 2.3 times greater in farming families owning and/or renting less than 2 manzanas than in those with a total access to more than five manzanas, and this was statistically significant ($p < 0.05$).

DISCUSSION

The families of four poor rural Guatemalan villages who had two- and three-year-old children in 1974 were selected for study. Three occupational groups were defined in terms of the family's main source of income: farmers, salaried agricultural workers, and skilled workers and merchants. This division is crude and arbitrary. Abercrombie (1975) rightly points out that the distinction between small-scale farmers and salaried agricultural workers cannot be precise, because salaried agricultural workers do have access to land, albeit to much smaller plots. Moreover, merchants and skilled workers also engage in agricultural activities. Nonetheless, however crude this categorization may be, the data demonstrate occupational diversity in rural communities. The most numerous group was that of farmers (64.3 percent) followed by salaried agricultural workers (18.7 percent) and merchants and skilled workers (17.0 percent). Rural development programs must take this diversity of occupation into account since it is most likely that the needs and expectations of each of the three groups differ.

The amount of land available to the families included in our study was small. Eighty-four percent of the families classified as farmers owned less than five manzanas (3.5 hectares) and 76 percent owned and/or rented less than five manzanas. This is well below the minimum recommended by most agrarian reform laws. For instance, the Honduran Law calls for a minimum of five hectares per family of potentially irrigable land or its equivalent in other types (Decreto Ley, 1975). The present analysis has not taken into account the quality and topography of the soil nor the availability of water, factors which are not optimal in these communities. Hence, the problem of land availability is much more serious than the data presented suggest.

Two questions were asked of the data. The first dealt with the relationship between occupation of the family and nutritional status of the two- and three-year-old children; the second focussed on the relationship between land availability for farmers and nutritional status of children two and three years old. Because land quality and topography as well as availability of water and of other agricultural resources were not taken into account, the results have a limited value. Nonetheless, land availability was significantly associated with nutritional status of young

children and may thus be used as an indicator of health and nutritional status of the family.

The prevalence of moderately malnourished children varied by occupation of the father: 28 percent in families of salaried agricultural workers, 29 percent in farmers, and 18 percent in merchants and skilled workers. However, the differences between the last and the first two groups were not statistically significant.

The amount of land owned as well as the total amount of land controlled was related to nutritional status in the manner hypothesized. Thus, the prevalence of children with moderate malnutrition was 38 percent, 30 percent and 17 percent, respectively, in farmers classified into three groups according to the total amount of land controlled: 0 to 1.9, 2.0 to 4.9, and 5.0 manzanas or more. The difference between the upper and the lower category was statistically significant ($p < 0.05$).

The above results are in agreement with those of Rawson and Valverde (1976) who found similar relationships when comparing the nutritional status of children in Costa Rican families with less than two manzanas of land, to those having more than two manzanas.

As the data in Table IV reveal, three distinct groups from the viewpoint of prevalence of moderately malnourished children are evident in the communities studied. The group at highest risk is that of farmers having access to less than two manzanas. The group with the least risk is that of skilled workers and merchants, and of

farmers with a land availability greater than five manzanas. However, it should be pointed out that this is a relative comparison, for *all groups* have high prevalences of children with moderate malnutrition. If the population were well-nourished, prevalences of around 0 percent would be expected.

The planning and policy implications of this relationship are as follows. Mortality rate has been shown to be associated with weight for age (Puffer and Serrano, 1973). Therefore, a prevalence of moderately malnourished children of 38 percent in one group (namely owning and/or renting less than two manzanas) and 18 percent in another (namely owning and/or renting more than five manzanas) implies substantial differences in mortality rates. Retardation in weight for age may also signal retardation in mental development (DDH/INCAP, 1975) and enhance the risk of becoming ill or developing severe malnutrition (Scrimshaw, Taylor and Gordon, 1968).

It has been said that national land redistribution programs do not modify the living conditions of the affected families. However, the present study suggests that the simple allotment of land to needy families may improve the nutritional status of the coming generation. Of course, better results could be expected if land distribution formed part of an agrarian reform program where technical and financial assistance were provided as well. Given the lack of information on this subject, it is essential that the impact of agrarian reform programs on nutrition and health status be evaluated.

TABLE IV

Rank order of Guatemalan families according to the prevalence of moderately malnourished 2- and 3-year-old children in the family

Rank order	Group	Prevalence of moderate malnutrition in 2- and 3-year-old children	
		n	%
1	Farmers controlling less than 2 manzanas of land	37	37.8
2	Farmers controlling between 2.0 and 4.9 manzanas	74	31.1
3	Salaried agricultural workers	43	27.9
4	Skilled workers and merchants	39	17.9
5	Farmers controlling more than 5 manzanas of land	36	16.7

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