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ABSTRACT

The significance of the economic stratification in several highland Guatemalan Indian peasant communities is investigated in terms of its impact on physical growth. Studies are mentioned from more industrialized countries which associate differences in growth with wealth. The question of whether richer people in such poor communities eat significantly better diets and so achieve larger proportions of their potential growth is explored by correlating economic status with the height and weight of children. The lack of a positive association leads to a consideration of local factors which might militate against it.

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Introduction

Most peasant villages look homogenously poor at first glance. After a while, an observer becomes accustomed to the general level of poverty, and variations in wealth become visible. The difference between a house made of mud brick and one made of wattle and daub is significant, even though both may have a thatch roof and a dirt floor. And much ethnographic experience is not needed to perceive the gap between a family who owns two cows, ten pigs, twenty chickens, and three hectares of land and a family who owns nothing at all beyond a few chickens pecking in the yard of a rented house.

My purpose in this brief research report is to examine the effects upon growth of such wealth differences. I want to see whether wealth variations among families of relatively poor Guatemalan Indians are significant enough to have caused differences in height and weight, which are the measures of physical growth used here. The hypothesis to be tested can be put as a simple question: in a relatively poor community, are the richer people so much better fed than the poorer people that the rich grow taller and fatter?

It is well known that nutrition affects growth, particularly height and weight. Various studies have shown that groups who migrate to the United States experience an increase in height which is attributed to the superior diet. Greulich (1957), for example, found that California-born Japanese children were significantly taller, heavier,

and more advanced in skeletal development than comparable children in Japan. In the United States, the height of doorways in early American homes attests that they were built for shorter occupants than present-day Americans. Populations of other countries which have experiences significant economic growth show increases in height as well. In the case of Japan, the average height of 14 year old boys increased 11.4 centimeters (cm) from 1948 to 1963 (Frisch and Revelle, 1969, Mitchell, 1964). These increases have usually been attributed to superior diets, advances in hygiene and control of disease, and in some cases to beneficial effects of genetic hybridization (Tanner, et al., 1965). The quantity of high-quality protein in the diet is directly related to the growth of a population (FAO, 1964; Mitchell, 1964; Stini, 1971). Other things being equal, then, and within the limits set by genetic potentials, a group that eats large quantities of protein will be larger and heavier than other groups who eat much less.

Nutrition should be directly affected by wealth, since food costs money. Poor people may not be able to buy enough food, or they may not be able to afford the more expensive foods which are the sources of high-quality protein, such as meats. If they are subsistence farmers, they may not possess enough land to grow adequate amounts of food. If this is the case, it seems obvious that richer people will be better fed, and as a result grow taller and heavier than poorer people. This result has been found in various studies in the developed countries. In North America, for example, Meredith reviewed the literature relating body size to socioeconomic status in boys seven to

ten years old. In summarizing 12 studies published between 1879 and 1950, he concluded that "North American boys representing the professional and managerial occupational groups average 1 inch taller and 3 pounds heavier than those representing the unskilled and semi-skilled groups" (1951:709). It was interesting to find that one of the studies was done by Franz Boas (1923). Boas analyzed data from Jewish boys in "expensive private schools" and in Jewish orphanages, presumably controlling for genetic differences. He found average differences in height of more than 7 cm. Howe and Schiller (1952) analyzed data collected over a period of 40 years in Stuttgart, Germany, and also found socioeconomic differences in growth. The height and weight of low income children were consistently less than they were for upper income children. Mitchell and Santo (1963) found a similar result in Japan. Heights and weights of children living in orphanages on the Island of Hokkaido were somewhat less than the national average for their ages. In analyzing the protein content of the orphanage diets, they concluded that the intake of protein was "near the borderline of adequacy, and had not caused any chronic signs of deficiency, but may have been responsible for the slower growth of these children" (1963:168). Thus, chronic but small deficiencies in protein intake may inhibit the growth of children without producing clinical signs (Mitchell, 1964; Tanner, 1962).

In Mesoamerican peasant villages, the economic level of the family has been associated with infant weight gain by Cravioto, et al., 1967. Children from wealthier families were found to gain weight faster than

poorer children. In this study, as in many of earlier studies cited above, the independent effects of variables such as sanitation and medical care were not separately analyzed.

It thus seems clear that in many societies richer people have grown larger than poorer people, and that a large part of the cause of this difference is dietary. But does the relation between wealth and growth hold in all cases? This seems unlikely, even though the underlying causality is well verified. Variation in wealth will cause variation in growth only if a) the richer people actually consume much more high-quality protein than the poorer people; b) the "baseline" of the poorer people's diet is insufficient for them to achieve their genetic potential in growth; and c) if "other things," such as sanitation and disease "are equal." If the entire population's growth is impeded due to environmental causes, the additional protein that the rich consume may not be sufficient to produce observable differences in growth. For example, diarrhea is endemic in many areas. In highland Guatemala, the locus of the present study, diarrheal disease was the attributed cause of 27 percent of all deaths in a sample of three villages (Gordon, et al., 1964). If the consumer of a superior diet is unable to keep the nutrients within his system, then the foods cannot help him.[1] In the same way, the intestinal parasites that many

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[1] It is important to note that there is a positive interaction between diet and disease, as well. Superior foods have been shown to contribute to a reduction in the prevalence of diarrhea. See Gordon, et al., 1964 or Scrimshaw, et al., (1968).

peasants suffer from compete with their hosts for the available protein. Thus, the hypothesis that differences in wealth will be reflected by variations in growth, in a particular society, deserves empirical study.

The Setting of the Research

The people studied live in four relatively poor, endogamous villages and towns on the shores of Lake Atitlan, Guatemala. The lake is situated in a semi-tropical environment at an altitude of 1562 meters above sea level, and enjoys a mild climate intermediate between the warm lowlands and cool highlands surrounding it. There are 13 settlements on the shores of the lake, whose populations range from 500 to about 13,000 (Seminario, 1968). The economy of the region is based on semi-subsistence agriculture and trade. Most families attempt to be self sufficient in the staples, corn and beans; and many also grow specialty crops such as onions, garlic, coffee, tomatoes, oranges, anis avocados, and other items grown mainly for sale. Poorer men also serve as migrant laborers on the coffee, sugar, and cotton plantations in the Pacific coastal zone.

Between 1967 and 1970, the Stanford-Atitlan medical research project was situated on the lakeshore, studying six of the villages in turn. A medical clinic staffed by two M.D.s was established in each settlement for six months. The clinic gave free medical service and provided free medicines for all villagers who cared to use the facilities, the major stipulation being that patients be members of that village and that whole family groups submit to an intensive physical examination.

During the examination, samples of blood were taken and many anthropometric measures, including total weight and standing height were accurately recorded.[2]

Two anthropologists, a Guatemalan and a North American, were continuously in residence with the project.[3] They did a complete census of each village in addition to surveys of socio-economic information. Village assistants who were bilingual in Tzutujil/Cakchiquel and Spanish were employed at all stages of the research, as the proportion of men who spoke Spanish varied from less than ten to more than 50% in each village, while women were most always monolingual in Mayan. The researchers spoke Spanish, and the assistants served as translators when necessary.

Wealth

In this study, data will be used from the villages of Santa Cruz La Laguna (population 445), San Juan La Laguna (population 1326), Tzununá (population 544), and Jaibalito (population 133).[4]

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[2] See Nammacher, et al., 1972, Nammacher, et al., n.d.

[3] The present author was there from July, 1969 to March, 1970. The Guatemalan anthropologist, Don Juan de Dios Rosales, was associated with the project for the entire term of the research.

[4] Because of problems in data processing the data from the two other villages could not be used for this study.

Wealth in these villages is primarily based on land ownership. There are few or no opportunities for profitable long-term labor or manufacture. The local average daily wage for field hands is $0.50 per day, which rises to as much as $0.65 during short periods of peak seasonal labor demands. The main alternative to local wager labor is plantation wage labor on the Pacific coast, which pays slightly more than the local wage. Migrant laborers to the coast usually suffer from the separation from their families and communities, as well as from the dangers to health inherent in leaving their highland temperate climate for the tropical lowlands, and so migration is a last alternative. The average wages available to the highland farmers can be appreciated by noting that the price of beef is $0.50 per pound (lb), eggs cost about $0.54 per dozen (doz), and corn (the staple) can reach $0.05 per lb of shelled, dried grain in preharvest seasons.[5] Thus, the average daily wage is extremely low in relation to food costs.

The informants working on the wealth rankings said that ownership of land (including corn-land, tree-crop acreage, and irrigated vegetable plots), cattle, and houses were their primary denotata of wealth. Corn-land ownership varied from zero to 15 acres per household, but people with as little as six or seven acres are considered wealthy if they also have a few cows, some acres of tree-crops or perhaps some plots of irrigated vegetable land. The poorest families

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[5] An average family of two adults and three children consumes about four or five lb of corn per day.

may own no land at all or less than half an acre, have no productive animals beyond a few chickens, and may not even own their own house, living with relatives or in a rented house. Thus, the variation in wealth in the villages is not as extreme as in cities, where the rich own resources thousands of times more valuable than the resources of the poor. The "rich" in this study have resources only ten or twenty times as valuable as the poor. It remains to be seen whether this difference is significant.

Information on the wealth standing of each family in each village was obtained with the help of informants who knew the project and did not fear our motives. People had confidence in us because the medical clinic had already been present in their village and so had demonstrated our good will and interest in helping them. In addition, the Guatemalan anthropologist was a native of the area who at one time had served as the head of the Guatemalan Indian Institute, and was known and trusted in all Indian communities. The purpose of ranking people by wealth was explained in relation to the medical clinic, since we said that we wanted to see whether disease was related to wealth.

A deck of cards with the names of each adult man and his wife, their ages, the location of their home, and a project-assigned identification number was constructed. This deck of cards was presented to two adult male villagers, who together were asked to sort the people into as many groups of equal wealth as they thought existed in their village. The wealth scores pertain to men as heads of families, since women could not be independently ranked in this male-dominated society. When the

informants were literate, they read the names from the cards themselves; when they could not read, the researcher read out the relevant information. The informants then would quietly discuss the status of each subject with each other, and add the card to the relevant pile. In some cases the researcher suggested that people could be divided into "richer" (más rico), "average" (mediano), and "poorer" (más pobre) categories. After running through all the names once, or before if the idea came up, each category was subdivided into groups of more equal standing. Thus, for each ranking trial the villagers were categorized into as few as six or as many as nine classes. After completing the ranking, which never took more than six hours, the two informants were asked to return the next day and perform the same task again. After the pair of informants did two rankings on two separate days, another pair of informants was hired to do the same task. In all, four rankings were done by four informants in each village, with each pair of informants doing two rankings. The samples ranked were composed of 90 men in Santa Cruz, 232 men in San Juan, 109 men in Tzununá, and 25 men in Jaibalito.

The scores from the four rankings were averaged together to minimize random error, and each adult male was given a percentile wealth rank score. This roughly indicates the proportion of families in the community who are richer than the subject. A score of 25 means that the subject is in the richest quarter of the village; likewise a score of 75 means that three-quarters of the village is richer than him. The proportions are imprecise because they are averages of differently

shaped distributions, and because of the inherent error in every sociometric ranking analysis, so that a small difference in wealth score could easily be due to sampling error. But a large difference would be unlikely to have come about by chance.

One difficulty with informant-based wealth rankings is evaluation. Since intensive fieldwork was not done in each village, it is not possible for us to evaluate the accuracy of each ranking. On the other hand, the internal consistency between rankings done by the same informants, and between rankings done by different informants, is impressive. In San Juan, for example, the correlation between the averages of each pair of informant's rankings is .87. We will concentrate on large differences in wealth rank scores by dealing with a subsample of the extremes of the wealth distribution. This will insure that the effects of sampling errors or inaccuracies of other sorts will be minimized in our final conclusions.

Height, Weight, and Wealth

It would not be a valid test of the hypothesis to simply compare an adult's wealth with his height and weight. Insofar as height is affected by environmental factors, these must play their part early in life; weight is also determined by early conditions, although weight is sensitive to temporary extremes in diet. Thus, adult height and weight are functions of previous diet. But if present growth is a function of childhood diet, then the relevant wealth rank is really the parents'. If we presume that wealth has an effect on growth through diet, the causality flows from a parent's wealth through the diet he

provides for his children to his children's final height and weight. It cannot be assumed that an adult's wealth, at the time of the study, is a valid indicator of his parent's wealth when he was a child. This would imply a completely rigid economic stratification that has probably never existed anywhere. Certainly peasant villages may be said to be stratified, in that there are some families in each generation who are richer or poorer than others and who have kept their wealth status from the previous generation, but this is an empirical observation that must be demonstrated. The analysis will be performed on a sample limited to children whose parent's wealth rank score is known. In this way we can be reasonably certain that the wealth score used (i.e., the wealth of the subject's father) is the most relevant to the child's present diet.

Some researchers have used weight/height, corrected for age, as a measure of undernourishment, on the assumption that there is a "normal" range of weight associated with every height at every age (e.g., McLaren and Read, 1972). Weight is a more flexible reflector of diet than height, since it is more sensitive to short-term conditions. Although under-nourished children are thin, mal-nourished children may be fatter than well-nourished children. Stunkard, et al. (1972) found a negative correlation between weight and class among white, urban children in the United States, with the poorer children being more obese than the richer ones. Since my interest is on the significance of nutritional differences for long-term growth I will focus on height, although data will be presented on weight as well.

The Data

A subsample of children whose father's wealth was ranked was drawn from the sample for which we had height and weight data. Since the villages are essentially the same in history and present conditions, the data was aggreated into one sample of 332 boys and 372 girls, ranging in age from a few months to 20 years. Regressions of height and weight on age are given in Table I. Each child was given a score representing his height (and weight) as a percentage of the height (and weight) of a U.S. child of the same age.[6] This score is normally distributed and serves as a relative measure of extreme bigness or smallness in the Guatemalan population. It also allows us to compare children of different ages with each other, since the percentage measure is corrected for age.[7]

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[6] The figures for U.S. height and weight are taken from Stoudt, Damon, and McFarland (1960).

[7] The aim here is to identify those people in the sample who are shorter or taller than their age-peers. The U.S.-based measure was used because it accomplishes this identification task and also provides some information about the relative growth of the population. An alternative procedure would have been to give each person a score with respect to the mean value of the cohort he belongs to; for example, to give each person a Z-score for his height and weight. This would have provided the same information as to the individual's height with respect to his peers, but would not have afforded the information about the entire population's relative growth.

Boys averaged 86% of the U.S. height (standard deviation (SD)= .07) and 71% of U.S. weights (SD = .16); girls averaged 87% of U.S. heights (SD = .07) and 73% of U.S. weights (SD = .17). The children are somewhat shorter than U.S. children, quite a bit thinner, and vary more in weight than in height, as is to be expected. The differences between boys and girls are not significant.

All of the data is now in hand to test the hypothesis that the economic differentiation in some Guatemalan Indian peasant villages is significant enough to have caused differences in growth. The wealth rank score of the parent is the independent variable, and the percentage of U.S. height score of the child is the dependent variable. These data are plotted in Figure 1. Regressions calculated from these data have slopes which are not significantly different than zero, as is obvious from visual inspection of the data. This means that height is not related to the variation in wealth.[8]

In order to check for the possibility that a relation exists, but is masked by random variations in the bulk of the data, the sample was divided into children whose parents were a standard deviation above and below the mean of wealth. This insures that the two groups are as

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[8] When the sample is broken down by village and similar regressions calculated, the slopes are not significantly different from zero in any village's data, as well. The data for weight are not plotted, as they are not different in any way from the data for height. See Table II for comparisons of height and weight.

different in wealth as they could be. Average height and weight for the two extremes in wealth are exactly the same, however; these values are given in Table II. It is possible that the effect only occurs in very young children; however, when the subsample of younger children was selected for analysis, the same result was obtained. (See Table II). Thus, we can conclude with confidence that there is no relation between the wealth of the parent and the growth of the child in these communities.

Discussion of the Findings

The finding of no correlation seems counterintuitive and against the grain of previously reported research. The alternative logical explanations are:

1. It is possible that there is no real difference in income and that the wealth rankings merely reflect the condition of forced choice which the informants may have perceived. This possibility is discounted since income differentials with a factor of 10 or 20 were obvious to myself, other observers, and the informants. There is no question that differences in income existed; the question is whether the difference was translated into differences in food consumption.

2. It is possible that the differences in income do not produce differences in food consumption. This possibility has two aspects: first, that the richer people do not eat as well as their relative wealth would allow; and second, that the poorer people eat better than their relative poverty implies.

While it is conceivable that the richer people in these peasant villages do not spend their resources on greater amounts of high-quality foods, it is not likely. In spite of the tax-collector's myth of the miserly but well-supplied peasant, living in rags while he buries pots of gold, most peasant farmers are like other people and enjoy consuming the fruits of their labor. Peasants everywhere continually work at improving their houses, substituting adobe brick for wattle and daub, fired brick for adobe, and tile for thatch, and presumably they are no different with respect to food habits.

Foods with a high protein content, such as beef and chicken, are expensive, highly valued, and usually eaten at ceremonies. The wealthier people in the community frequently conduct such ceremonies, for the simple reason that they are the ones who can afford it (cf. Cancian, 1965). While it is true that these ceremonies can be seen as redistributive mechanisms (Nash, 1966) it is most likely that the rich consume more prestigious foods than the poor; and these foods will tend to contain more protein than less-valued foods. On the other hand, it is certainly possible that the poorer people in the villages have diets that are adequate for "normal" growth. These assumptions are open to empirical test.

A student of nutrition, Mrs. Kathryn Shack, studied the diets of 13 families in Santa Cruz La Laguna and kindly provided me with her data. Unfortunately, Mrs. Shack obtained data on the food intake of the families for only a two-day period. The average per capita family consumption of calories (cal) in her data is 3655, and the average

protein intake is 97.6. Since these figures are much higher than those derived from a four-year-long study of three highland Indian villages in Guatemala (Flores, et al., 1964), where the average figures are 2088 for cal and 59.5 for protein, Mrs. Shack's data can only be taken as suggestive of the possibility that the "average" diet is adequate.[9]

Thus, the most likely explanation is that the poor people in the sample may be well enough fed to attain "normal" growth. In other words, while the level of housing and health may be poor, the level of food intake may be adequate for growth, or at least not so inadequate, compared with the rest of the population, as to produce nutritional dwarfism.[10]

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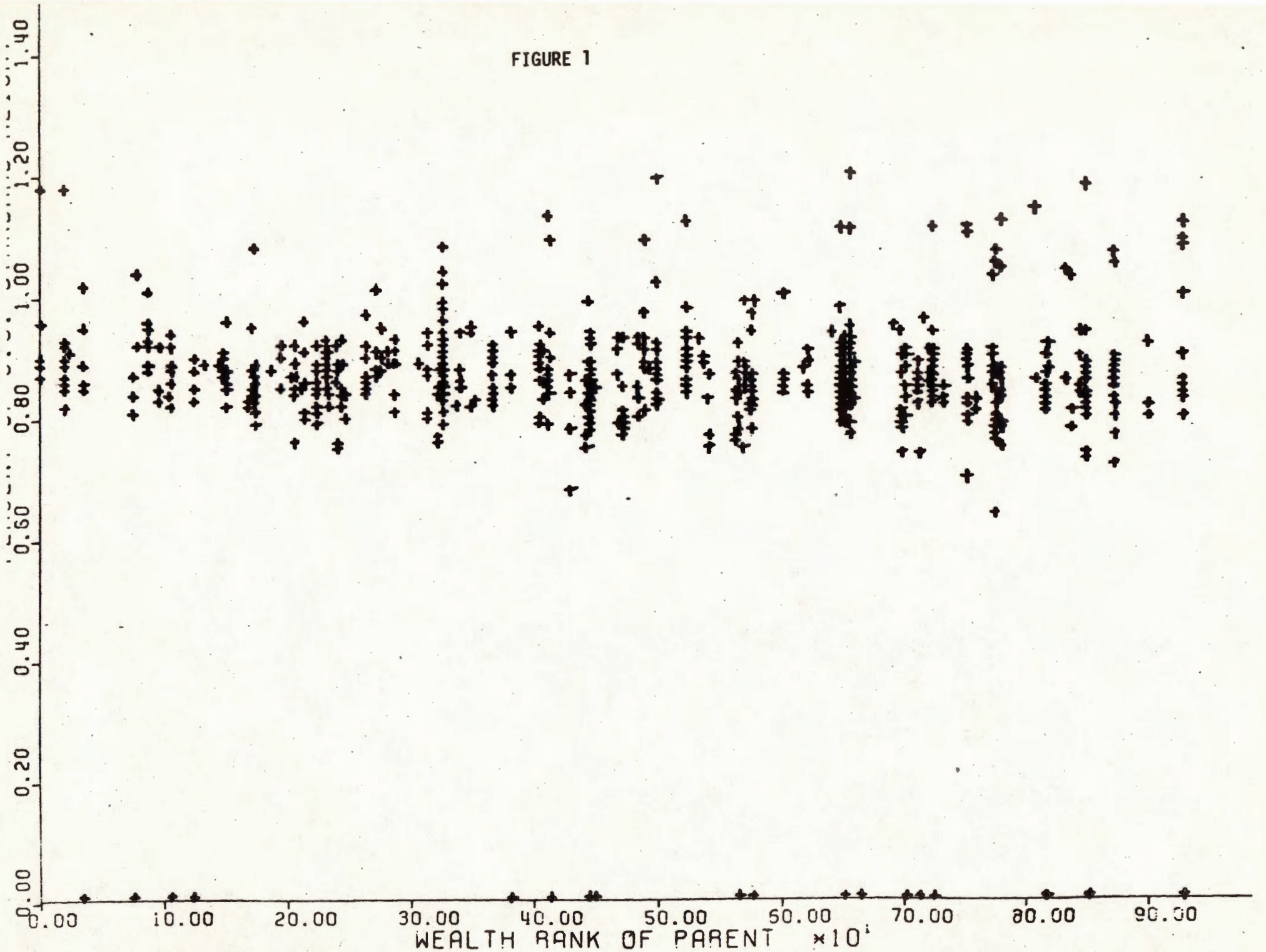
[9] Twelve of the thirteen families studied by Mrs. Shack were also wealth ranked (the thirteenth was headed by a widowed woman who was not ranked). The correlation between per capital protein intake and wealth rank is .46, which is not sufficiently different from zero at the .05 probability level.

[10] In this regard note that it is likely that the diets of peasants are frequently better than nutritionists report. The standard nutritive analyses of many foods are carried out on related North American varieties, which have been subjected to intensive breeding for market-related qualities such as color and bruise-resistance. Corresponding foods in peasant societies have been found to be more nutritious (c.f. Cravioto, et al., 1945: Table I). Peasants may also hide the consumption of certain low-valued foods such as wild plants and insects from visiting nutritionists, if not from friends and neighbors. Thus, poor families in rural environments have the opportunity of supplementing their diets with "cheap," but nutritious foods.

3. Finally, it is possible that differences in income and consumption exist and are significant, but that their clinical effects are masked by endemic conditions of disease. Gordon, et al., (1964) present data from three similar Guatemalan villages which show that diarrheal deaths over a ten year period accounted for over 40% of all deaths of children under fifteen. Only 16% of deaths are attributed to diarrhea for people 15 and over. The Stanford Clinic found a 24% average rate of "acute or chronic" diarrhea in a sample of 144 children from San Juan and 35 children from Santa Cruz, all from two to six years of age. Since the younger members of the population suffer more from the disease than older people, and because the richer people in the village have the same sanitary practices as the poorer families, there is reason to suspect that all children suffer equally from diarrheal diseases. The effects of severe diarrhea can dampen the potential effect of differences in protein ingestion, because the protein eaten will not be used.

In conclusion, the analysis of the data presented shows that the economic stratification in these peasant villages is not significant enough to cause differences in growth. This finding has interest in light of the continuing anthropological attention paid to the nature of stratification and solidarity in peasant villages (e.g., Wolf, 1957, Cancian, 1964). However, the present conclusion is only tentative, until further research evaluates the possibility that specific diseases mask the clinical effect of dietary differences.

FIGURE 1



WEALTH AND HEIGHT FOR TOTAL SAMPLE. N=704

TABLE I

Age and Growth of Guatemalan Indian Children, ages 3 months - 20 years

BOYS (N=328)	R^2	F
Height (cm) = 66.70 + 5.06 (AGE in years)	.91	3677
Weight (pound) = 8.95 + 4.67 (AGE in years)	.92	4186
GIRLS (N=372)		
Height (cm) = 67.04 + 4.78 (AGE in years)	.89	1734
Weight (pound) = 8.36 + 4.60 (AGE in years)	.95	6235

TABLE II

Relationship Between Height, Weight, and Wealth Among Extreme Categories in Sample

2.1 Average Height and Weight Scores* of Children One Standard Deviation (S.D.) Above and One S.D. Below the Mean Wealth Score (N=131 Boys, 139 Girls)

	Height		Weight	
	Boys	Girls	Boys	Girls
Richest	.87	.87	.71	.72
Poorest	.86	.87	.71	.75

2.2 Children 10 Years Old or Younger: Average Height and Weight Scores* of Children One S.D. Above and One S.D. Below the Mean Wealth Score (N=84 Boys, 87 Girls)

	Height		Weight	
	Boys	Girls	Boys	Girls
Richest	.86	.86	.73	.72
Poorest	.87	.87	.73	.77

*Scores denote sex- and age-corrected percentage of U.S. value.

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