HUMAN NUTRITION: THE IMPACT OF FAMILY SIZE AND INCOME ON DIETARY INTAKE

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A survey study in Misamis Oriental Province has shown that reducing family size can be more effective than increasing household real income in preventing protein-calorie malnutrition among the high-risk households. Using a research design that identifies the barangays with the largest mean family size and lowest mean household income as the stratum that has the lowest food and nutrient intake relative to the national actual intake and dietary standards, the study consistently shows that family size variable is the most important factor, even after considering the contributions of other variables, in explaining the variations observed in specific food and nutrient intake indicators. These results are useful because they answer important questions frequently asked in development plans which involves programs to raise family living standards through improved nutrition.

Malnutrition, like the high incidence of anemia, widespread insufficiency of vitamin A, and severe protein-calorie deficiency, has devastating, immeasurable consequences on families (FAO, Nutrition Meetings Rep. No. 47, 1970). Its dramatic effects include growth retardation, weight loss, depression, and weakening while its severest manifestations, for instance in kwashiorkor and marasmus, cause early death. The primary cause of malnutrition is frequently inadequate or sometimes excessive nutrient intake relative to normal body requirements.

Adequate dietary intake is essential to good health which provides full stores in the body of all essential calories and nutrients (Fisher and Bender 1979) required for maintenance, growth and repair of tissues. An individual gets these nutrients from a balanced everyday diet. But what happens if the intake of one or more nutrients fall slightly below a person's needs? The body stores in the first stage will diminish and continue to do so until the stores disapppear. Thus, when the diet is deficient over a long period of time, the normal functioning of the organs and tissues is impaired.

To promote an adequate dietary intake, a development plan to provide a nutrition intervention program needs to know specific target groups of families exposed to the risk of malnutrition. This knowledge, however, is operationally meaningless unless one knows where these families are and what characteristics conditions exist in their community. Furthermore, the plan requires identifying a particular strategy that provides a great impact in improving nutrition status, i.e., the health condition of household members as influenced by dietary intake.

Research Problem

This study seeks to understand the relationship between household's socioeconomic characteristics and dietary intake. Its principal hypothesis states that of all the associated household social characteristics, household real income explains more of the variations observed in household food consumption than such factors as family size and education. This hypothesis assumes that if a household subsists at a low level of food intake, the occupation of any of the eligible household members will help increase its food consumption because of the additional income. Moreover, the household, through its head, will aspire for a higher

standard of living; one indication of this is a desire to consume more and better foods at home. However, improving the dietary intake would fail when additional child enters the household because the new member, *ceteris paribus,* will require additional resources to feed. Hence, family size, as a demographic characteristic, has a direct effect on household diets. This study examines these relationship using stratum and individual household as separate units of analysis.

Previous Research

Different levels of dietary intake are observed in studies on diets among different socioeconomic groups. Studies showing poverty-stricken families as nutritionally worse-off in comparison with wealthier households are replete in the literature (e.g. Adrian 1976; Wray 1969). However, Battad (1978) observed that increases in income are not directly related to improvements in nutrient intake of preschool children because the increase of income by parents may not necessarily be directed to increases in the food consumption of preschoolers. Battad concludes that unless increases in income are directed to preschoolers through specific education, the income effect may largely be lost.

Household members may also suffer from malnutrition when parents have less education. Studies by Wray and Aguirre (1968), Haley and others (1977), Hendel (1965), Adrian and others (1976), Battad (1978), and Valenzuela (1978) have observed significant positive association between education and nutrition.

But mixed results exists in terms of the association between nutrient intake and family size. Large family size may or may not aggrevate the household's poor nutrition condition (MacCorquodale, and others 1977, Ballweg 1972). Related to family size is the timing of child-bearing factor in relation to the nutritional status of children. Bulatao-Jayme (1980) observes that children born of mothers with a 3-year birth intervals have been found less prone to malnutrition than those born at shorter intervals. These inconsistent results prompt this study to examine the magnitude of impact of these factors on household food consumption.

Sample

To determine the impact of social factors on household food consumption, this study assessed results from a multi-focused survey conducted in Misamis Oriental from August 15 to October 31, 1981. To identify the group of households greatly exposed to the risk of malnutrition, the survey design employed stratification and randomization sampling procedures.

Out of the total 491 barangays in the province, the study selected 36 barangays covering 8,095 households by simple random technique. This is equivalent to .065 percent of the entire provincial population. Using census data at the municipal level on mean per capita income and the rate of high school completion, the research proceeded by stratifying the randomly selected barangays according to their ranks. Thirty-six barangays were equally divided into 3 strata: stratum I, the highest; stratum II, the middle; and stratum III, the lowest.

The stratification was based on the assumption that the barangays could be categorized according to the extent each has experienced social and economic improvements. If a barangay was found to have households with lower mean income per capita and a lower rate of high school completion, such group of households was considered to represent a community lacking in socioeconomic improvements; if the opposite conditions were found, such a barangay represented a community where households possess improved levels of living.

Finally, a survey was conducted in each stratum. By using systematic sampling pro-

cedures with a random start, 532 households from the randomly selected barangay provided data for the study. The following results examine data at the provincial level.

Results

Relative to the recommended household food allowance per day, families in Misamis Oriental consume higher intake than required of cereals and cereal products as well as fish, meat, and poultry (see Table 1). They have enough intake in fats and oils and other fruits and vegetables. However, they consume insufficient amounts of starchy roots and tubers, sugar and syrups, eggs, dried beans, green, leafy and yellow vegetables and vitamin C-rich foods. Their most inadequate intake lies in milk and milk products, the food items which provide the important calcium, vitamin A and complex carbohydrates (fiber).

Relative to all Philippine households, families in Misamis Oriental consume higher intake in fats and oils, and fish, meats and poultry. They consume about the same amount of cereals and cereal products, eggs, and green, leafy and yellow vegetables. But they are grossly insufficient in intake of sugars and syrups, milk and milk products, dried beans and vitamin C-rich foods. Generally, Misamis Oriental households do not fare well when related to their food requirements and to the nation's households.

These conclusion are corroborated in nutrient data analysis. The results show that household consumption per day of food

Table 1. *Mean One Day Per Household Food Consumption, Misamis Oriental, August 1981*

Food groups	*Food consumption (cm/day)*	*Recommended dietary allowance (gm/day)*	*Percent sufficiency*	*Philippines*
Energy foods:				
Cereals and cereal products	2,130.1	2,020.5	105.4	102.8
Starchy roots & tubers	65.9	366.7	17.9	49.8
Sugars and syrups	29.2	143.7	20.3	113.8
Fats and oils	147.6	172.6	85.5	45.2
Body-building foods:				
Fish, meat & poultry	747.7	561.8	133.1	85.5
Eggs	27.8	125.2	22.2	29.6
Milk and milk products	21.5	496.8	4.3	34.4
Dried beans	29.2	101.9	28.7	46.00
Regulating foods:				
Green leafy & yellow vegetables	126.4	333.6	37.9	38.3
Vitamin C-rich foods	98.1	337.5	29.1	56.8
Other fruits & vegetables	453.3	532.7	85.1	116.8

Source: Data from the 1978 Philippine First Nationwide Survey Summary Report by Food and Nutrition Research Institute (FNRI), Manila, Philippines, 2nd Rev., January 1981, p. 1.

energy is 6,241 kilo calories an amount which represents 51 percent of the recommended intake. The protein intake is 216 grams and is 72 percent adequate; and the iron intake is 69 mgs. and meets 76 percent of the recommended nutrient allowance. Indeed, the families consume a little more than one-half of their recommended calorie intake per day. Furthermore, they consume lesser nutrient intake than the entire country's households (see Table 2).

Dietary Intake Condition By Stratum

When household social characteristics are analyzed, the results show that stratum I differs in all categories from strata II and III. While these outcomes are expected, the interesting question is whether or not there is a concommitant increase in average food and nutrient intake in stratum I than in other strata. Indeed, this is the most basic question to ask. Since the results show that improvements have occured in stratum I relative to other strata, could they also expect an increase in mean food and nutrient intake? If the study's findings show an association between household dietary intake and stratum variable, it can be concluded that the household social factors, such as real income and family size, are associated with dietary intake.

Table 2 *Mean One-Day Per Household Nutrient Intake Misamis Oriental, August 1981*

Categories	*Nutrient intake*	*Recommended dietary allowance*	*Percent adequacy*	*Philippines*
a) Calories *(kcal)*	6,241.1	12,114.0	51.5	86.6
b) Proteim *(gm)*	216.6	298.3	92.6	109.9
c) Iron *(mg)*	52.4	69.2	75.7	81.7

In fact, the results of the stratum data analysis show that household in stratum III have much lower mean intake in the aggregated food items as well as in most of the individual foods compound to households in Stratum I. Stratum III households consume an average of 3,000 grams per day of aggregated food intake as compared to an average of 4,500 grams per day intake in stratum I households. In fish, meat, and poultry, households in stratum III consumes about 41 per cent of the total consumption of households in stratum I (see Table 3).

Furthermore, when data on household distribution are analyzed by stratum, the results show that stratum III households have a much lower mean nutrition intake than stratum I households. If households are to be identified as greatly exposed to the risk of malnutrition when they have less than the minimum nutrient standards established by the Food and Nutrition Research Institute (Manila),[1] the data show that households in stratum III have extreme deprivation of nutrients: only 11 percent of the total minimum allowance recommended in calories are met, 25 percent in protein, and 26 percent in iron. In contrast, stratum I households appear to utilize nutrients above the minimum: 41 percent in calories: 72 percent in protein, and 63 percent in iron (see Table 4). When the mean one-day per household nutrient intake data are analyzed, the results show that stratum III households have much less nutrient intake than those in stratum I: 41 percent in

Table 3 *Mean One-Day Household Food Intake Per Household By Stratum (N=523)*

Categories	*Stratum*			
	I	*II*	*III*	*p*
Total food intake *(gm)*	4,494	4,007	3,505	.01
Fish, meat & poultry *(gm)*	969	729	448	.001
N	305	181	137	–

calorie and 50 percent in both protein and iron (See Table 5).

At the .05 level of significance, a hypothesis of no real difference among strata is presented. If the null hypothesis is actually incorrect, the value is expected to be larger than unity. In these sets of data, the likelihood of obtaining a result that is greatest in stratum I and greater in stratum II than stratum III is highly significant. Indeed, the results must be more than the common outcome in sampling. From these sets of data, one is led to conclude with some assurance that the group of households found in stratum III is greatly exposed to the risk of malnutrition.

These low levels of food consumption make it increasingly difficult for many fami-

Table 4 *Percentage Distribution of Household Nutrient Intake By Stratum, Misamis Oriental August 1981 (N=523)*

Categories	*Stratum I*	*Stratum II*	*Stratum III*
Calories:			
Less than 80%	58.5	80.5	89.4
80-109%	20.5	10.8	5.7
greater than 109%	20.9	8.7	4.9
Protein:			
Less than 70%	27.3	57.3	75.2
70-119%	41.5	30.3	13.5
greater than 119%	31.2	12.4	11.4
Iron:			
Less than 70%	36.6	61.6	73.8
70-119%	32.7	21.1	14.2
greater than 119%	30.7	17.3	12.1
N	205	181	137

Table 5 *Mean One-Day Per Household Nutrient Intake (N=523)*

Categories	*Stratum I*	*Stratum II*	*Stratum III*	*p*
Calorie	8,462	5,793	3,598	.001
Protein	279	202	143	.001
Iron	68	46	36	.001
N	205	181	137	–

lies in Misamis Oriental to achieve the rather generous levels of nutrients specified in the recommended dietary allowances (RDA). Grreater likelihood of dietary inadequacies is observed among households located in Stratum III because they have lower real income and big family size relative to the other households. Note, however, that these figures adopt the recommended nutrient allowance as the amount considered sufficient for the maintenance of food health that actually exceeds the normal physical requirements of most household members. As such, the raw data on proportions of the population that are deficient should not be interpreted as the real nutrient deficiency, but only as statistical probalities of risk to malnutrition.

Dietary Intake Condition By Household

While the study using stratum analysis describes community characteristics, this design does not allow anyone to make individual household inferences (Robinson 1967). To avoid this bias and to elaborate the findings observed at stratum level, the study takes the individual households as the unit of analysis.

The technique used for analysis is multiple regression, "which views the association of variables by stating the amount of change in the dependent variable associated with the amount of change per unit of the specific independent variable while other independent variables are controlled (Madigan 1981). The association is estimated using two measures: (1) the unstandardized (or original) slope coefficient, and (2) the standardized (beta) coefficient.

In using multiple regression, the problem of multicollinearity needs to be resolved. If the explanatory variables are highly correlated, the variances of the original and beta coefficient may be large and thus affect the precision of the estimate. However, in the present regression, multicollinearity is not a concern because none of the explanatory variables intercorrelate highly with each other.

The results of these sets of regression equations of social characteristics variables with major dietary intake indicators are all significant. The high regression coefficients explain large percentages of the variations of dietary intake variables. (For the regression equation on protein intake, see Table 6).

The dietary intake is now measured by different food items consumed, using as indicators total food intake, fish, meat and poultry and cereals products. The sets of multiple regressions of the six variables of social characteristics with each of these variables show that household size remains the most important predictor of food intake.[2] For instance, in fish, meat, and poultry, all variables are important predictors of food intake with family size as the most significant while the household real income is not (see Table 7).

Table 6 *Regression Coefficients of Protein Intake With Social Factors Correlates*

Categories	*b*	*Beta*	*p*
Male employment rate	20.66	.128	.0010
H.S. completion rate	18.23	.120	.0054
Female employment rate	15.51	.131	.0013
Household real income	.09	.169	.0024
Household size	−896.56	−.430	.0015
Total living children	−73.97	−.089	.0218

Table 7. *Multiple Regression Coefficients of Fish, Meat and Poultry With Social Characteristics Correlates*

Categories	*r*	*b*	*B*	*p*
Male employment rate	.017	36.55	.083	.045
H. S. completion rate	.122	37.92	.092	.047
Female employment rate	.081	23.18	.071	.097
Household real income	.068	.09	.065	ns
Household size	−.332	−1,972.33	−.347	.001
Living live births	−.168	−269.92	−.120	.004

Dietary intake indicators that may be examined with these social characteristics could be the food expenditures of families. Families have different spending habits. This study assumes that the way they spend money for food varies with income. Those with more money tend to spend more on food. Thus, the next step is to regress the same set of independent variables upon food costs in the same manner as to the regression carried out for food and nutrient intake. Food cost is operationalized as the total peso cost per day for food consumption per household.

The first important information about food cost is that the mean one-day food expenses is ₱16.29 ($2.07)[3]. Under the hypothesis of no difference , Table 8 shows that the probability of obtaining a result that is different among strata is highly significant (beyond .001 level). Further, the multiple regression coefficent of these indepen-

Table 8 *Multiple Regression Coefficients of Food Costs With Social Characteristics Correlates*

Categories	*r*	*b*	*B*	*p*
Male employment rate	.14	.136	.136	.0018
H. S. completion rate	.32	.111	.322	.0013
Female employment rate	.26	.071	.260	.0014
Household real income	.46	.0005	.482	.0015
Household size	.24	1.13	.235	.0017

dent variables with food costs as the dependent variables was .55 which explains 30 percent of the variance in food expenses. This coefficient is the largest compared to the values of the earlier sets of regressions.

The results of analysis in food costs clearly support the final hypothesis that income is the most important variable (significant at beyond .001) in explaining the variations in dietary intake. While four other independent variables were held constant, each removing from the total relationship what is proper to each one of them as a factor, the partial coefficient for the household real income still remains the highest. While household real income is a very important factor for food expenditures, earlier evidence shows that household size explains most the variation observed in food and nutrient intake. Therefore, household size is more important factor relative to real income that has a real contribution to make for dietary intake.

Stratum As Compared With Social Characteristics

So far, the findings provide evidence that the association of social factors with household food consumption refers to two distinct impacts: between dietary intake and strata on one hand, and between intake and household income, education, occupation, and household size on the other. The analysis now attempts to examine the relative importance of these two types of association to food consumption.

The data used for comparison are the beta coefficents and their significance levels. The stratum variable is a dummy (D) variable, dichotomized into high and low. For D_1, stratum I is given the code one and the other strata the number zero, and for D_2, stratum III is given the code one and the other strata the number zero. Thus, the minus coefficient indicates a positive association between a higher stratum and dietary intake. The aspect of dietary intake examined are food and nutrient intake. Each of the correlates of social characteristics and stratum as independent variables is incorporated into a regression with the dietary indicators as dependent variables.

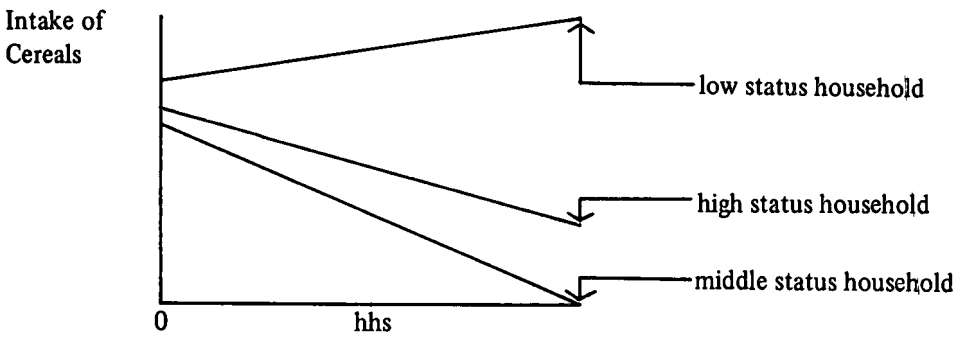
Of the explanatory variables in food intake, the largest contribution to association comes from the household size; the next in importance is stratum. In terms of nutrient intake, the same results appear as in food intake.

While these results are not surprising because knowledge of the earlier regression equations shows a weaker association between dietary intake and either income or occupation, these results are still of interest because the data confirm earlier findings in this study and other existing research that show household size to have the largest impact on changes in household diets.

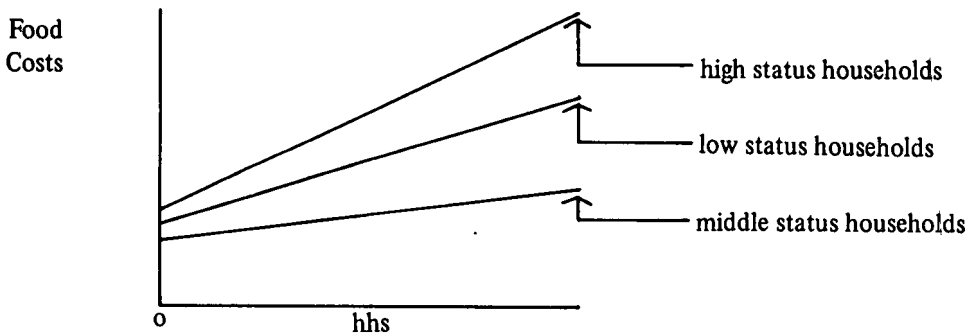
Another interesting result refers to the significant interaction of the explanatory variables when the dependent variables are cereals and other products and fish, meat and poultry (see Figure 1). In terms of cereals, the study finds that as high and middle status households increase in family size, their consumption of rice and corn decreases. By contrast, as low status households raise their size, their consumption of rice and corn increases. Why significant interactions appear is an interesting question. One may speculate that a lower status households decides to consume more rice and corn because these cereals are cheaper to buy than meat, poultry or fish. This is to be expected – lower status household has a lower income that buys less food relative to higher status household.

But somewhat surprising is the interaction observed in fish, meat, and poultry. While more households in the middle and lower strata consume fish, meat and poultry when more members have finished high school, the association in the upper status households with the same dependent variable is in the opposite direction: the more members finished high school, the lesser the upper status household's consumption of fish, meat and poultry. Apparently, after the upper status households have

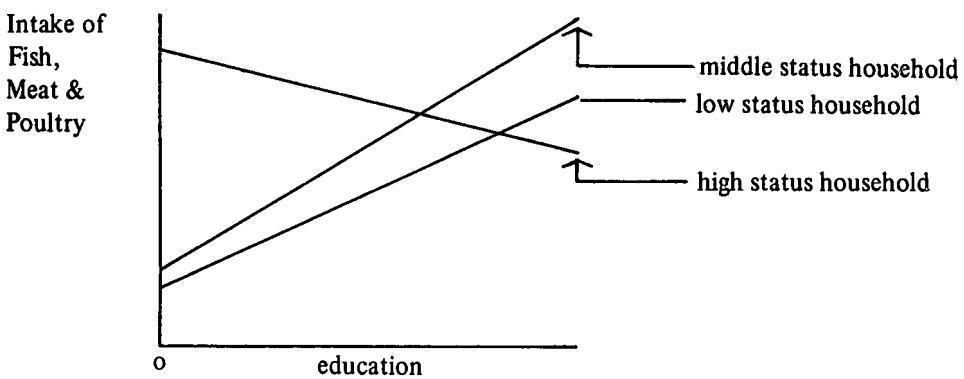
Household Size and Stratum with Cereals and Other Products



Household Size and Stratum with Food Costs



Rate of H.S. Completion and Stratum with Fish, Meat & Poultry



Model: $Y = bo + b\ 1x1 + b2D1 + b3D2 + b4D1x1 + b5D2x1$

where X1 = correlate of social factors
D1 = upper status household
D2 = lower status household

Figure 1. Effects of Social Factors-Stratum Interaction on Household Dietary Intake

reached a certain threshold of improvement in education and income, further increases of this factor relates negatively with food intake. That is, fish, meat, and poultry is a non-linear function of social status and high school completion. These results are important research leads which deserve further invetigation.

Conclusion and Implications

The stratum analysis leads to the conclusion that stratum III is the group of barangays greatly exposed to the risk of malnutrition. Multivariate analysis confirms earlier results and has specified that a decrease in family size influences dietary intake significantly. Household real income is the most important predictor but only in food costs.

The results indicate that decreases in family size will effectively improve the households level of living. Households with fewer children could be expected to be more capable than households with higher real income to provide their members with an adequate dietary intake. The expected sequence of influences may be that: first, a decrease in the number of children makes it more possible to buy adequate food; second, these foods have enough nutrient content that they meet the daily recommended dietary requirements; and third, when adequate nutritious foods are available, the good health of family members is promoted.

The results also show that stratum III with households have the greatest risk of malnutrition in the province. This risk involves actual nutrient deficiency and the observed unequal distribution of food availability in these households. Recall that after applying the FNRI recommendations, households in stratum III have an 89 percent insufficiency rate in calorie intake. Using the statistical property of the normal distribution, the predicted actual calorie deficiency is estimated to be 18 percent of all households in stratum III. If the said stratum sample takes 137 households, 25 families are expected to have actual calorie malnutrition.

This study should be useful not only in terms of predicting the prevalence of protein-calorie. Because its major result shows that many households, in all likelihood, do not have sufficient amounts of food to meet their nutrient needs, this study should also be useful for development planning to attain human welfare by specifically recommending to increase the amount of food effectively reaching the high-risk households. This can be achieved by reducing family size rather than increasing real income.

Notes

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[1]The Food and Nutrition Research Institute (FNRI) has identified households as poorly fed if they have less than the following minimum requirements of nutrients: a) less than 80 percent of energy, and b) less than 70 percent of protein and fat.

[2]The same result appears in Madigan (1981).

[3]The exchange rate during the survey period was eight (₱8.00) pesos to a dollar.

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