OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : DS/PO, Robert Simpson

DATE: March 23, 1978

FROM : DS/RES, Floyd O'Quinn FEO

SUBJECT: Small Research Project - Determinants of Growth Among Poor Children - The Johns Hopkins University

This project proposes to carry out simple analyses of existing dietary and socio-economic data taken from observations and interviews with a group of malnournished children and their families in Lima, Peru.

The proposal can be supported as a small research effort although much of the work will be exploratory or preparatory prior to (or during) the principal investigator's undertaking potentially major analytical activities which may not be AID funded. DS/N is supporting several projects which require the collection and analysis of food consumption data. There are reliability problems associated with the use of such data which need to be worked out as more experience is gained in nutrient intake studies. This project would be an inexpensive source of this type of experience.

A regression analysis is proposed that would be performed on only 26 observations. While there is a chance that significant new relationships between nutrient intakes and growth can be found, the major contribution of such a small analysis might be a better understanding of the errors associated with food consumption data. In view of the cost of collecting and analysing data of this type, I think such small scale exploratory activities are appropriate.

The descriptive analysis proposed for some longitudinal socio-economic data (on 167 households, 885 children) could yield much more useful results than might be expected. It should be possible to observe major trends and relationships among the main variables from cross tabulations of this data. The data should be useful to AID in designing future studies concerning the growth of children.

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The innovative aspect of the researchers work is his hypothesis that "the size of children in very poor urban settings is more a function of nutrient intakes and environmental influences during the entire period of growth than of the severity of finite episodes of severe malnutrition." This hypothesis will be tested as a long range objective and not as a part of the proposed small research project. However, a major benefit from this proposal will be its contribution to the ultimate testing of the hypothesis.

In summary, the project is worthwhile because the combination of benefits that would be derived from it, namely, (1) experience in an area of data analysis where more experience is badly needed, (2) some immediate results from the research that would aid in developing new projects in this field and (3) its contribution to the ultimate development in larger research efforts of new information concerning growth in children.

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28 MAR 1978

MEMORANDUM

TO : AA/DS, Mr. Sander Levin

THRU: DS/RES, Floyd O'Quinn

FROM: DS/ tin J. Forman

Discussio attached proposal for a small research contract proposes to carry out a multiple regression analysis that relates several growth outcomes (in children) to nutrient intakes and modifiers of nutrient intakes. The proposed work also would support the editing, storage on computer tape, and descriptive analysis of a large set of socio-economic data. The regression analysis and the processing of the socio-economic data would produce immediate results that are useful to AID and would also contribute to the long range research efforts of the principal investigator. This long range effort, which is not funded by AID, could provide important new information on the determinants of children's growth that would, nevertheless, be available to AID.

Principal Investigator: Dr. George G. Graham
Director, Nutrition Programs
School of Public Health
The Johns Hopkins University
Charles & 34th Street
Baltimore, Maryland 21218

Timing: June 1, 1978 - May 31, 1979

Total Cost: $35,000

The principal objectives of the long range research effort are: (1) to demonstrate that the ultimate size of children in very poor urban settings is much more a function of nutrient intakes and environmental influences throughout the entire period of growth than of the severity of finite episodes of severe malnutrition in early life; (2) to relate growth of children to a wide range of socio-economic factors and, by appropriate statistical analysis, to estimate their importance; (3) to make recommendations based on the analysis, on non-nutritional interventions which can be expected to have a favorable impact on the growth of children.

For a decade (1966-76) the principal investigator directed research in Lima, Peru, that yearly collected dietary, clinical, anthropometric, environmental and socio-economic information concerning 885 living children of 167 poor urban families. Data on the families were also collected and organized. Preliminary analyses have been conducted on economic, nutritional and certain societal factors. The researcher plans to carry out more elaborate statistical analyses of the data and will determine the minimum socio-economic standards which are consistently associated with rates of body growth comparable to those of the lower middle class in Peru. Satisfactory growth rates of children should be a sensitive indicator of social well-being among the poor and the identification of major deterents to that growth will be a major concern in setting recommended priorities.

This small research proposal would allow the researcher to carry out an early analysis of the relationship between nutrient intakes and growth in children. An alternative approach to the analysis that takes into account the fact that energy is absorbed less completely in some food sources will be developed. These analyses and the descriptive analysis of the socio-economic data will influence the research protocol of the investigator's long range efforts which will test some new hypotheses concerning growth in children. Both the immediate research in this small proposal and the long range research are relevant to AID's objectives in combatting malnutrition in the very young and growing child.

The proposal has been reviewed by DS/N and meets the requirements of an unsolicited proposal contained under AID PR7-4, 5301(3). It is recommended that a contract be awarded to the Johns Hopkins University without consideration of other sources.

Recommendation: Approval of the proposal as a small research contract.

Approved: Caroline D. McGrath

Disapproved: for S. Levin

Date: April 20, 1978

Clearance:

DS/PO, JGunning JG

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THE JOHNS HOPKINS UNIVERSITY

GRANT PROPOSAL

Submitted to: Office of Nutrition
Technical Assistance Bureau
Agency for International Development
Department of State
Washington, D.C. 20523

Project Title: Determinants of Growth Among Poor Children

Period of Support: 4/1/78 - 3/31/79

Funds Requested: $34,998

Grantee: The Johns Hopkins University
Charles and 34th Streets
Baltimore, Maryland 21218

Performance Site: Instituto de Investigacion Nutricional
Miraflores (Lima), Peru
and
School of Hygiene and Public Health
615 North Wolfe Street
Baltimore, Maryland 21205

George G. Graham, M.D.
Director, Nutrition Program
or
William C. MacLean, Jr., M.D.
Associate Director,
Nutrition Program

Approved:

D.A. Henderson, M.D., M.P.H.
Dean
or
Edyth H. Schoenrich, M.D., M.P.H.
Associate Dean

Date: February 8, 1978

I. RATIONALE

The alarming spread of slum populations in developing world cities has created problems of nutrition that differ importantly in their etiology and manifestations from those of the rural areas and call for appropriately different solutions. The poor family depends on the homemaker's ability to buy, prepare and serve food and to maintain an environment which favors its consumption and efficient utilization. Survival and growth rates of children from these families are a function of maternal efficiency, the quality of the environment, and the availability and quality of food; in privileged societies they are primarily a function of heredity.

Serial observations were made over a 15-year span (1961-1976) of the characteristics of 167 very poor Peruvian families and homes and of the growth and educational achievements of their children. Food and nutrient intakes were measured in 1972-1974 in a representative sub-sample.

We plan to quantitate by appropriate statistical analysis the effect of environmental and socio-economic factors and of food buying, preparation and consumption practices on the growth rates and school status of these children. Although no single intervention by a government or an individual family is likely to have a measurable effect, the results of this analysis should help identify those measures which are most likely to contribute to the survival, well-being and development of poor children. These could be in the field of environmental sanitation, provision of services, incomes policies, family planning, adult education, agriculture, food processing, food distribution, food buying or food consumption practices.

In the present contract we propose to analyze the dietary study sub-sample in detail while preparing the longitudinal data from the full 167 family sample for a larger in-depth analysis.

II. PLAN OF PROCEDURE

A. Specific Objectives

1. Utilizing multivariate analysis of measured food and nutrient intakes and growth outcomes, we plan

- to delineate the nutrient variables most significantly correlated with linear and ponderal growth

- to estimate desirable intakes of nutrients and the most efficient way of achieving them with limited disposable income

- to estimate the relative efficiency of equivalent amounts of the major foods in satisfying nutrient requirements

- to investigate whether the size of children in very poor urban settings is more a function of nutrient intakes and environmental influences during the entire period of growth or of the severity of finite episodes of severe malnutrition.

2. Carry out preliminary analysis of longitudinally collected growth and socio-economic data that will allow us in the future to relate growth of children to a wide range of socio-economic factors and to estimate their relative importance.

3. A long range goal deriving from the above is to be able to make recommendations on both nutritional (food production, processing, etc.) and non-nutritional interventions that can be expected to have a favorable impact on the growth of children.

B. Work Completed or in Progress

Between January 1, 1961 and December 31, 1971, 272 severely malnourished infants and children from the slums of Lima, Peru, were admitted for treatment and study to a research unit located at the

British American Hospital. There were 36 hospital and 23 later deaths; of the 213 survivors, 178 from 167 families have been followed regularly since discharge. When it began to be apparent that the subsequent growth rates of the children were more a function of their home environments than of the severity of early malnutrition, we began in 1966 a yearly evaluation of their homes, their socio-economic status, and the growth of all their siblings. Data collection was completed in October of 1976.

There were a total of 885 living children in the 167 families being seen regularly. Of the ex-patients, 81 were followed for 10 to 15 years and 58 for 5 to 10 years. Height, weight and head circumference of the parents was determined once. For all the children, yearly measurements by the same person included length, weight, head circumference, skin-fold thickness, degree of sexual maturation, and wrist x-ray for bone age. For each family member we noted origin, length of residence in Lima and at the current address, age, marital status, church attendance, years of schooling completed, occupation, income, drinking habits, personal hygiene, and major health problems. A careful estimate was made each year of the income available to the mother and of the amounts spent on rent, water, lighting, public services, transportation, clothing, medicines, and food. Birth weights and early feeding histories of all children were recorded. In a yearly visit to the home we took note of its location, ownership, type of occupancy, size, construction, composition, services, state of repair and sanitary condition, and of its furnishings, sleeping facilities, and conveniences.

Comparisons between the growth of the ex-patients and that of their "healthy" siblings have shown that nearly complete catch-up was evident two years after discharge (Pediatric Research 5:691-697, 1971). Ex-patients who were adopted were matched with others for age and body length on admission: much greater catch-up occurred in the adopted ones, who reached heights equivalent to the 25th percentile of the Boston standard (J. Hopkins Med. J. 131:204-211, 1972). Thirty infants from these families were reared in a protected environment until 12-18 months of age and their growth was compared to that of their siblings: when they were returned to their homes they were significantly much larger than their sibs but their growth immediately slowed down and within a year they were not different in size (Am. J. Dis. Child. 130:33-36, 1976). Linear regressions were established between some of the socio-economic factors and the height quotients achieved by ex-patients. The most significant correlation coefficients ($P<0.001$) were those for per capita disposable incomes (0.555), mid-parental height (0.406), paternal education (0.391), a crowding index (-0.320), and maternal education (0.292). These have been reported (Am. J. Clin. Nutr. 25: 1184-1188, 1972). The correlations between height quotient and number of children in the home or birth order were not significant, although these two factors were significantly correlated with infant mortality rates in these same families.

When preliminary analysis indicated that certain factors, most notably per capita disposable income, were significantly correlated with the growth of the children, we assumed that they were operating principally through nutrient intakes. To verify this, 26 of the 167

families were selected for a detailed seven-day dietary survey carried out in 1972-74. They were chosen to represent the spectrum of growth rates encountered up to that time, and included six adoptive families in which ex-patients had demonstrated accelerated and prolonged catch-up growth. The following were weighed: food in the house at beginning and end of the week, food purchased, each raw food item as prepared for a cooked or uncooked dish, each cooked dish prepared for each meal (e.g., weight for each vegetable prepared for soup and its final cooked weight), amount of each food or prepared dish consumed by each person at each meal, food left on plate, and prepared food remaining after each meal. Food eaten between meals or outside the home was estimated by recall. Peruvian, INCAP, Handbook #8, and McCance-Widdowson food tables were used, in that order, to calculate nutrients. The following were calculated, edited, corrected, and stored on magnetic tape: money spent per family/week and per person/day[1], foods consumed by family and person per week, nutrient composition of each prepared food, nutrient intakes of each individual per week and per day, and sources of each nutrient: energy, protein, animal protein, vegetable protein, fat, Ca, P, Fe, thiamin, riboflavin, niacin, ascorbic acid, retinol, beta-carotene, and other carotenes. Complete data are available on 162 individuals: 135 children from 0 to 22 years of age, and 27 parents (very few fathers are included because they either did not live in the home or were away for too many meals). Information was also recorded on

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1 The "r" between per capita disposable income (determined in the follow-up study) and per capita food expenditure during the dietary survey (determined by a different observer) was 0.938 for the 26 families, reassuring us of the validity of the second set of data.

seasonal availability of foods, effects of scarcity and cost on food patterns, cultural beliefs about foods, buying habits, and cooking practices.

Mean (± SD) individual daily nutrient intakes found in the survey were as follows: 1675±498 kcal, 41.1±12.1 g protein, 14.7±8.1 g animal protein, 42.1±21.1 g fat, 293±167 mg Ca, 708±217 mg P, 8.9±3.0 mg Fe, 0.6±0.2 mg thiamin, 1.0±0.5 mg riboflavin, 10.4±3.7 mg niacin, 51.5± 31.0 mg ascorbic acid, 0.12±0.13 mg retinol, 1.68±1.73 mg beta-carotene, and 0.36±0.35 mg other carotenes.

In order to establish meaningful correlations between energy and protein intakes and growth outcomes it was necessary to express the first as a function of some recommendation and the second as a function of some growth standard. The 1973 FAO/WHO recommended intakes of energy and protein are for children growing along the 50th percentile of the well-known Boston standard. When the measured intakes of all children in our survey under the age of 19 were referred to the FAO/WHO recommendations, energy intakes were found to be 76.28±17.96% (range 45.19-134.14%) and protein intakes 161.05±41.33% (range 93.65-337.26%) of the recommendations for age, without taking into account the much smaller size of our children. As a first step in compensating for this discrepancy, the heights and weights of our subjects were converted to height ages and weight ages (Boston), the ages to which they correspond on the 50th percentile of the Boston standard. Mean height ages of our subjects were found to be 75.4±14.4% (range 50.7-129.5%) of chronologic age and mean weight ages 84.9±20.1% (range 27.7-153.7%) of chronologic age. These percentages are referred to as height and weight "quotients".

The mean WQ/HQ ratio, a measure of weight for height, was found to be 1.113±0.156 (range 0.414-1.478), indicating that by the Boston standard these children were generally overweight for their small stature. Energy and protein intakes, expressed as a percentage of those recommended for "height age", were 85.23±18.84 and 180.95±38.66%, respectively. As a percentage of the recommendations for "weight age", they were 82.13±17.35 and 173.59±36.51%.

Although the above form of expression seems reasonable, and is in line with the FAO/WHO instructions for use of their tables, it has a serious flaw when applied to girls. The significantly earlier (by 2 years) age of menarche in Peru makes the girls have impressive gains in height and weight quotients between eight and 13 years of age, followed by a dramatic fall, as the "Boston" girls continue their adolescent growth spurt. This complicates the expression of energy and protein intakes as percentages of those recommended for height and weight ages and makes height and weight quotients have different meanings at different ages. For this reason we constructed a new table of recommendations.

The recommended calorie and protein intakes of the FAO/WHO publication per unit of weight at each age for each sex were multiplied by the weight at each age, for each sex, found in our already published (Am. J. Clin. Nutr. 26:926-930, 1973) growth tables for children from our large sample. Using these same tables, we converted the heights and weights of the survey children to height ages and weight ages (Peru). This corrected for possible sex differences while simultaneously adjusting for the inherent growth of the population. As a result,

mean height ages were now found to be 105.8±17.6% (range 75.3-164.7%) of chronologic age and mean weight ages 106.6+20.0% (range 74.3-184.8%) of chronologic age. The mean WQ/HQ ratio was now found to be 1.015± 0.138 (range 0.689-1.432). This indicated that our sub-sample, though slightly taller and heavier than the larger population, had a very similar weight to height ratio. The slightly larger size was not unexpected as a disproportionate part of our sub-sample represented "adoptive" families of slightly better means. Most important, the quotients derived from this standard have the same meaning at any age and can be used as the dependent variable without regard to age or sex, if so desired. When energy and protein intakes were expressed as a percentage of the "new" recommendations for age, they were found to be 91.53±19.48 and 190.30±50.68%. As percentages of recommendations for the "new" height and weight ages they were found to be minimally less than the above figures.

The first stages of the statistical analysis relating "modifiers" and "nutrient intakes" to "growth outcomes" by linear and polynomial regression and by covariance analysis by sex has been initiated. In a subsequent stage, "food intake" (source) variables will be substituted for nutrient intakes and similar analyses will be carried out. Much further in the future, "catch-up growth" (both linear and ponderal) achieved by the ex-patients will be used as the "outcome" variables instead of size at the time of the survey. This last will have to await the computerization of the growth data in the longitudinal study.

As "modifiers" of intake we are considering: age, sex, birth order, height, weight, height age and weight age (Boston), and height age and

weight age (Peru). "Nutrient intake" variables include weight of food consumed daily, total protein, animal protein, vegetable protein, fat, calcium, phosphate, iron, thiamin, riboflavin, niacin, ascorbic acid, retinol, beta carotene and other carotene intakes per day, as well as additional derived variables: percent of the calories and protein recommended for age (Boston-FAO/WHO), percent of calories and protein recommended for height and weight ages (Boston), percent of calories and protein recommended for age ("new" standard), percent of calories and protein recommended for height and weight ages ("new"-Peru), percent protein calories, percent of protein from animal sources, percent fat calories, and the micronutrient densities per 1000 calories. In the U.S. Ten State Nutrition Survey, these nutrient "densities" were found to be reliable indicators of the quality of the diet. The "outcome" variables in this first stage are: height and weight quotients Boston (height or weight age x 100/chronologic age), WQ/HQ (Boston), height and weight quotients and WQ/HQ (Peru).

The original and the derived variables were scanned for range, means, standard deviations and frequency distributions. "Outliers" were identified and the data checked against the original observations. We looked for sex differences in nutrient density intakes; the only ones found could be explained on the basis of a few "outliers".

A correlation matrix has been constructed for all the variables and some of the linear correlations are very suggestive. For example, there are statistically significant negative correlations between age and height or weight quotients (Peru), that may be due to the presence of a number of milk-drinking infants and children who are growing very

satisfactorily. The highly significant negative correlations between age and the adequacy of protein intakes, as well as the densities of calcium, phosphate and riboflavin can be similarly explained on the basis of milk consumption by younger children and infants. There are significant positive correlations between the growth outcomes and the adequacy of protein and calorie intakes, % protein calories, % protein from animal sources (most significant), % fat calories, and carotene densities. This last seems to be independent of the other intake variables. The only highly significant correlation for both HQ/WQ ratios is that with % fat calories.

Polynomial regression analysis has been undertaken to determine the proper relationships (linear, quadratic or cubic) so that these can be included appropriately in multiple regression analyses. This has included plotting of all the data to permit visual inspection and identification of the role of "outliers". Covariance analysis has detected important sex differences in some of the correlations.

C. Scope of Work Proposed Under this Contract

Inherent to the analysis of the dietary survey data is the assumption that the measured intakes were typical of each family for long periods before and after the survey, and did in fact determine the growth achieved up to the date of the survey and for a significant length of time thereafter. We believe that this assumption is warranted and have verified in a small number of families that when incomes did not change dramatically, food buying and consumption patterns remained virtually unchanged after two years. The narrow range of food choices

available at the lower income range indicates that maternal "efficiency" is possibly the major determinant of actual intakes when income is static, and that only when a certain income is exceeded is there a major shift in the quality of the food consumed.

In this contract, we propose to complete multiple regression analyses between the significant modifiers of nutrient intake, the nutrient intakes, and the six different growth outcomes. A preliminary investigation indicates that 50% of the variance in height and weight quotients can be explained by the nutrient variables, with most of them adding something to the multiple "r". The first analyses are being made with a program that determines the "order of importance" of the independent variables. Other analyses will be made in which the order will be forced according to a preconceived idea of the biologically logical significance of the variables: total calories as a percentage of recommendations, % protein calories, % animal protein, % fat calories and the nutrient densities. Because of variation due to gender in both the nature and duration of growth and nutrition practices, major sex differences in the importance of the various variables are anticipated. Therefore males and females will be analyzed separately as well as combined.

Our estimates of energy intakes, as well as those in the literature, assume that all sources of energy are utilized equally well, which is not true. Whereas cane sugar can properly be assumed to be completely digested and absorbed, and the same is probably true for "pasta", we have evidence to the effect that the energy in bread is moderately less well absorbed by children, and that from rice and potatoes

significantly less so. These, along with vegetable oil, are the major sources of energy in the diets surveyed. For these reasons reanalysis substituting sources of nutrient for the nutrient intake variables is to be undertaken. Specifically, as part of this contract we will transcribe all nutrient intake data into source (food) data. Source data will eventually be entered into regression analysis with the previously used growth outcome variables using the following food groupings (subgroups in parentheses): cereals (wheat, bread, pasta, rice, corn), roots and tubers (carrots, potato, sweet potato), legumes, fruits, vegetables, meal (fowl), eggs, fish, milk and cheese, separated fats (butter), sugar, alcoholic beverages, other beverages and miscellaneous. Inherent in this analysis will be the separation of family data from individual data. This will require construction of two tapes for source data. For variables that are family wide, average intakes will be used; for the remainder, individual intakes will be appropriate. In the coming year a preliminary descriptive analysis of these two tapes will be carried out. In addition, we plan to complete polynomial regression analysis of the relationship of per capita food expenditure (a family variable) to average family growth data. If possible, multivariate analysis of the food source data will be begun but completion of such an analysis is beyond the scope of the proposal. Eventually, by holding calorie intake for age constant, we should be able to determine the relationship between the intakes of these foods (and others) and the various growth outcome variables. This should provide valuable field evidence of the relative nutritive value of major foods.

Finally, during the period covered by this contract, we will complete the coding, punching and transcription into computer accessible form of the longitudinal data on growth and socio-economic status.

Transcription of the growth and socio-economic data to coded forms suitable for card punching and storage on magnetic tape has begun. A trial run has been made with ten of the 167 families and the results have been scanned for errors in transcription and for validity and logical consistency. The coded forms have been modified to eliminate possible sources of error and the requisite numbers of the corrected forms have been prepared. With the help of local funding, the raw data is now being transposed in Peru to these forms and the IBM cards are being punched. Preliminary printouts are prepared and the cards are then shipped to Baltimore for storage of the data on magnetic tape. The data from 50% of the families has already been coded, punched and stored on magnetic tape. Upon completion of the transcription, a preliminary descriptive analysis of the tape will be made to prepare for future work.

In summary, the following tasks will be carried out under the auspices of the contract:

1. Completion of multivariate analysis of effects of nutrient intakes on growth (weighed dietary survey data).

2. Preparation of two tapes (family and individual) for source (food) analysis of nutrient intakes. This will include a descriptive analysis of the tapes and polynomial regression analysis of per capita food expenditure and average growth data (by family).

3. Completion of coding, punching and transcription of longitudinal growth and socio-economic status data, including a descriptive analysis of the tapes created.

4. A report of the major findings of the analysis outlined above (1, 2, 3) will be submitted at the end of the year.

D. Plans for Future Work not Covered in the Contract

In the future, we plan to explore alternate ways of expressing the growth data, both longitudinal and cross-sectional, are being explored, relating them to standard U.S. tables and to our Peruvian tables. New growth curves for boys and girls will be derived from the data itself, as the sample size and the number of measurements on each child is much greater than that already published. For the ex-patients we will characterize anthropometric measurements at the time of admission, at discharge from the hospital, and serially during the ensuing years. They will be compared to those of their siblings and to the standards. We will determine if and when they have caught up completely with their siblings, relating this to the age at which they became malnourished and to the duration and severity of malnutrition. If, as expected, the later growth of the ex-patients is no different from that of the siblings, both will be related, by multiple regression analysis, to mid-parental height, birth weight, early feeding history, and to the various socio-economic factors and any changes over time in them. Incomes, whose purchasing power was altered over the years by devaluation and inflation, will be corrected to their values in 1973, when most of the dietary data was obtained. We have already obtained the conversion factors from the Peruvian Government. Performance in

school will also be looked at as a dependent outcome variable, relating it to the same socio-economic factors and to growth.

Nutrient utilization is significantly influenced by food preparation and by the frequency and severity of infections. It may well be possible to demonstrate an effect, in the 26 families for whom we have nutrient intake data, of specific environmental and socio-economic factors on the growth and weight gain of the children which is independent of nutrient intakes.

From our analysis of the above data we will determine the minimum socio-economic standards which are consistently associated with rates of somatic growth comparable to those of the lower middle class in Peru: educational level of the parents, income, disposable income, employment, public services, type and size of home, presence or absence of conveniences, etc. Growth rates of children should be a sensitive indicator of social well-being among the poor. Although it may be beyond the living standards of the very poor, the identification of major deterrents to the growth of children will be of major assistance in setting priorities. To the extent that any factors, such as the existence of an ample supply of clean water or of better cooking facilities, can be shown to maximize the consumption and utilization of existing or improved food supplies, it should be possible to make recommendations for interventions that are reasonable and productive.

Of paramount importance to the urban poor is the relative cost effectiveness of their food purchases. We will estimate the amounts or proportions of specific foods which result in satisfactory nutrient intakes and growth for each age group at varying levels of expenditure.

III. BUDGET

April 1, 1978 - March 31, 1979

I T E M		AMOUNT REQUESTED		
Faculty and Staff	Effort	Salary	Fringe Benefits	Total
George G. Graham	5%	2173	359	2,532
W.C. MacLean, Jr.	5%	2000	330	2,330
E. David Mellits	10%	3780	623	4,403
Clayton H. Kallman	10%	2484	410	2,894
Blanca Adrianzen	80%	6215	--	6,215
PERSONNEL - TOTAL				18,374
STATISTICAL SERVICES - 500 Units @ $12/Unit				6,000
COMPUTER CHARGES				3,850
	Total Direct Costs			28,224
	Indirect Costs: Off-Campus-24%			6,774
	TOTAL			$ 34,998