HUMAN NUTRITION CRSP - EGYPT PROJECT

ANNUAL REPORT

October 1, 1985 - September 30, 1986

USAID Contract #DAN-1309-G-SS-1070-00
Nutrition Intake and Function

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TABLE OF CONTENTS

Principal Investigators' Summary Report

During the past year the project has achieved several of its objectives both for the development of analytical approaches and for institution building in the host country. Statistical activity of the project has ranged from exploratory data descriptions to the development of analytical strategies for addressing the hypotheses of the CRSP research. An overview of these activities is presented in the Egypt Statistics Report by George P. McCabe, October 16, 1986 (Attachment A).

The goal for subject participation in the Egypt project was achieved by more than 100 individuals of each target type completing their participation in the study by December 31, 1985 (Table 1).

Table 1. Total number of individuals by target type completing their participation in the Egypt Project, Nutrition CRSP*

Target Type	Number of Subjects
Lead males	258
Lead females, non-pregnant and non-lactating	120
Lead females, pregnant	133
Lead females, lactating	102
Schoolers	126
Toddlers	150
Infants	104

*Based on information from the Egypt DMU and the Kansas DMU

The flow of project data to Management Entity and the statisticians did not proceed on the projected schedule. However, recent reports from the Nutrition Institute (Egypt) indicate that all remaining project data, with the exception of the socio-demographic update, are scheduled to arrive at the University of Kansas via a traveler on October 17. The slow flow of data from the Nutrition Institute to the Data Management Unit at the University of Kansas (Attachment B) has impeded some progress in data analyses. However, within the last month a large volume of data was received at Kansas and after adequate documentation and data preparation it will be forwarded to the Data Analyses Unit (Purdue University) to update the present files (Attachment C). A variety of descriptive summaries for food intake, disease and growth can then be generated for presentation at the November SCB meeting for cross-project comparisons.

Development of Analytical Approaches

The Egypt project has been using the autoregression model approach to explore the relationships among food intake, morbidity and anthropometry variables for toddlers based on data available. As mentioned above, complete data sets for all three areas have only recently become accessible. However, the major portion of all three data sets has been available for several months and has provided the basis for some preliminary analyses. Although these will be rerun now that data sets are complete and the preliminary runs may well have produced

different results from those which are produced from the full data set, the opportunity has been provided for the development of analytical strategies. The following comments are based on these preliminary analyses.

First, to the extent that the preliminary analyses have produced significant results, they have been interpretable, i.e., have seemed to make sense. For example:

1. The fact that weight at a given time predicts 65-75 percent of the variance in weight a month later is quite reasonable.
2. When there has been an effect of food intake on weight in the models, it has been in the expected direction (i.e., higher food intake in period t-1 associated with higher weight at time t).
3. The preliminary models indicate that diarrheal illness and fever have more effect on subsequent weight than do blunter morbidity measures, and again in the expected direction (i.e., more diarrhea and fever associated with lower subsequent weight) as shown in Reports #86-065, 86-073 (Attachments D and E).
4. When sex and socioeconomic effects have appeared in the models, they have been in the expected directions. For example, one model showed an effect of sex on diarrheal illness, with males being ill more days with diarrhea than girls; this is consistent with other studies including at least one in Egypt. Report #86-073 (Attachment E) includes a model in which lower socioeconomic status was associated with more morbidity.

The next priorities in refining these analyses are to address two points: (1) making use of all available data; and (2) refining the forms of variables and the structure of the model to capture the relatively small effects in which we are interested. Such refinement is necessary not only because the data are inherently "noisy" but also because the relevant variables can be expected to change over time in different ways, and to relate to each other in different lag periods.

The first of these problems, making maximum use of available data, has been addressed in part by the technique of incorporating dummy variables into the equations. Another type of adjustment is needed to make use of data which fall outside of the prespecified time periods used in the model. For example, when one month is used as the lag period between t and t-1, a measurement which was taken a few days after the schedule for month one would give the appearance of no measurement for month one and two measurements in month two (Report #86-062, Attachment F).

The second issue, that of refining the presentation of variables and the structure of the models for particular questions, needs detailed attention based on expected relationships. The following discussion is meant to address some of these questions.

The matter of the appropriate lag period needs to be addressed in the context of each dependent variable and with attention to ability to estimate the independent variables in the preceding period. The initial runs have been done with one-month lag periods. This may be too short a period to estimate kcal intake; and it may be too short to be reasonable for any of the dependent variables. One recent study (Khan and Ahmed 1986) showed a lag period of more than 90-days after a diarrheal episode before weight could catch up to that of matched controls. Three months may be a more appropriate lag period. When

height is the dependent variable, the lag period should be even longer, since the amount of expected change per month at this age is small in relation to the measurement error in two measures. It may be better in the case of height to predict the slope of the line of change over the year, especially since differences in timing of measurement may be substantial between projects and even with data sets.

When morbidity is the dependent variable, one month may again be too short to be realistic. Illness episodes are not neatly timed on a monthly basis, but should occur more or less randomly with respect to measurement of other variables and to interview dates. It may be possible to devise models in which the begining of an illness episode or the period encompassing the episode defines time t.

Another consideration is the construction of "baseline" variables. The value of a variable (e.g. energy intake, morbidity, weight) in the first 90 days in the study is a valid measure of background for that individual only when not affected substantially by time-related factors. The most obvious example is morbidity, which in Egypt is highly seasonal. Since toddlers were enrolled in the study over the course of the full calendar year, the first 90 days for some individuals occurred during high-diarrhea periods (summer), for other during high respiratory infection periods (winter), and for others during relatively "healthy" periods. Thus the baseline morbidity variable is probably measuring season rather than the background for that individual. A better approach might be to use the individual's first 90 days in relation to the morbidity experience of the sample as a whole during the same 90 calendar days.

A similar problem may arise with food intake in relation to temporal events. For example, if a toddler's enrollment date was such that the month of Ramadan fell in the first three months of his/her participation, the baseline kcal variable might be artificially inflated. The fact that weaning occurs at different ages for different toddlers also is a potential problem since the first 90 days for some represents a period in which breast milk was part of the diet, while for others it does not and for still others the change occurred during this period. The best approach may be either to refine the "baseline" variables to account for some of these difficulties or to explore other methods to account for individual differences.

The issue of adjusting for breast milk intake has received recurrent discussion in the Egypt project. Dr. McCabe has done some analyses which indicate that the pattern of energy intake from sources other than breast milk before and after weaning is not uniform; thus a modeling approach to correct for breast milk intake is not as simple as it would appear to be on a theoretical basis. An additional consideration which has not been discussed is that the event of weaning may be significant in itself apart from absolute effects on energy intake. Aside from social and behavioral reactions to weaning, it is possible that the quality of the diet (and of energy utilization) may change with the withdrawal of breast milk from the diet. Perhaps the time of the weaning event should be somehow included in the model.

The models which consider morbidity variables as dependent variables are especially interesting because they directly address one of the major research questions. In terms of morbidity, we are making efforts to define meaningful variables more precisely. Separation of chronic but non-serious illnesses (such as minor skin diseases) from the remainder of the morbidity is important in this

regard. Separate consideration of diarrheal and respiratory illnesses should be particularly informative, and should be possible since both are present in the data with relatively high prevalence. Since the two types of ailments are inversely seasonal, it would be instructive to know whether the toddler who has relatively a lot of diarrhea in the summer is also more likely to be sick with respiratory infections in the winter.

The issue of overlapping illnesses (a single episode with two diagnoses overlapping in time) has received some attention. The Egypt project may be the only one of the three whose data set will allow this question to be addressed. After listing all occurrences of overlapping diagnoses (i.e., less than two well days between them), we have undertaken to separate from all others those which may be regarded as progressive--that is, increasing in severity or progressing into a more severe illness. The most common of these are a) diarrhea overlapping with and followed by diarrhea with dehydration or fever; and b) upper respiratory infections overlapping with and followed by lower respiratory infections. Of course, without etiologic diagnoses one cannot be sure that such progression is entirely due to host factors (different etiologic agents could be responsible, with the overlap in timing a matter of coincidence); but it is important to look at toddlers who exhibit these illness patterns in contrast to those whose simple diarrhea or upper respiratory infections do not overlap with more serious illnesses of the same system.

Institution Building in the Host Country

This year has seen a major shift in focus as the project has completed fieldwork and moved into the analytical phase. The impact of the CRSP's activities and concerns on the human and physical resources in the Nutrition Institute (NI) has undergone a similar shift. The changes in the NI which have been derived in part from participation in the CRSP are beginning to make themselves felt in relation to other activities.

From the beginning, it has been the policy of the CRSP that the original data remain in Egypt, and that copies of all clean, official data tapes be shared with all participating institutions. As fieldwork was completed, participating scientists in Egypt began to find time to think seriously about analysis. In addition, junior professional staff who had devoted up to several years to the project in the field and felt the need to complete their postgraduate degrees provided the impetus for on-site analysis of parts of the data set which were locally available. In addition, the country faces major questions of health policy as the Ministry of Health is about to embark on a major child survival and health project on a national basis. The visibility of the CRSP has resulted in an expectation that the results will be available in a timely manner to assist with the planning of these activities. Thus the NI has been recently faced with immediate needs to be able to accomplish locally-relevant analyses of CRSP data already available (i.e., Phase I), needs to have the entire data set locally accessible in as short a time as possible, and the need to implement analyses of other data sets available to the NI from past and concurrent projects, but which had not been locally analyzed or only minimally so.

To accomplish these objectives, the NI embarked on a program of upgrading its internal capacity to analyze data, including the introduction of microcomputers, training of key staff in basic computer skills and review and updating of statistics, and establishment of a Data Analysis Unit to provide accessibility to hardware, software, and data sets belonging to the NI.

The first activity in this regard was the establishment of a Data Analysis Group. Growing out of the group of senior CRSP scientists and eventually replacing the regular CRSP weekly staff meetings with its ongoing activities, the Data Analysis Group consists of a core of five senior NI scientists, with additions of other individuals (both local and visitors) according to their availability, interest, and the agenda. The group has met regularly since January 1986 to discuss analytical issues, to provide a focus for local interaction with the CRSP statistician at Purdue, and to set priorities for local analysis and interpretation of results from both CRSP and other data sets.

Also early in 1986, the NI submitted proposals to regional offices of the Population Council (Middle East Awards Program) and the Ford Foundation, for the support of various aspects of the process of upgrading analytical capacity in the NI. Assisted by the efforts and resources of these organizations, the NI has added to its microcomputer and software resources; established a Data Analysis Unit which houses these resources; and provided basic training in relevant skills to a number of key staff.

The NI now has five IBM-compatible microcomputers (two IBM-PC's, two Micronets, and a Kaypro), all but one of which are equipped with hard disks; one Apple-II; several dot-matrix printers; and a variety of software including statistical packages (SPSS-PC and SL-MICRO); wordprocessing (WORDSTAR); data base management (DBASE III); and utility programs.

During the summer of 1985, one NI staff member (Dr. Magda Shaheen) attended a hands-on training workshop in the use of microcomputers in research sponsored by the Population Council. In February 1986, a similar workshop was held for key NI staff and other selected professionals engaged in child survival research. The workshop was held in the NI from February 3 through 12, and was taught by Mr. Bruce McLeod (consultant to the regional office of the Population Council) with the assistance of Dr. Magda Shaheen, Dr. Saneya Wahba, and Mr. Ray Langston of the Social Research Center at the American University in Cairo. About 15 senior and advanced mid-level NI staff participated in the workshop, which provided both theoretical and hands-on learning in relation to work processing, database management and basic statistics using the software mentioned above. One US PI from the CRSP (Dr. Harrison) assisted in arranging for the workshop and attended along with NI staff.

Since that time, NI staff have been actively involved in analysis of Phase I data and of other data sets available in the NI. The Phase I data set was transferred locally onto floppy disks from tape and is now accessible in this form to all NI scientists. Local scientists are particularly anxious to have official Phase II data available as soon as possible, since the local analysis of small subsets of "unofficial" data can do no more than provide practice and the generation of analytical approaches and ideas. To the extent that this has been possible, these activities have been proceeding. One Ph.D. thesis based partially on CRSP data was defended in September 1986 (Sawsan Ahmad Abdel-Ghany, "Impact of Nutritional Health of the Mother on the Outcome of Pregnancy"), and several others are in process.

The Nutrition Institute has, as part of the analytical upgrading effort, employed a full time biostatistician for several months (on non-CRSP funds). Dr. Laila Barrage, on leave from the Faculty of Health Sciences at the American

University in Beirut, has been an integral part of NI activities and of the Data Analysis Group for the last several months, providing feedback and facilitating the progress of individual scientists in developing their data analysis skills. Her appointment ends in November 1986.

The general upgrading of analytical capacity meets a major need of the NI and its scientists to be able to utilize the data which they have collected for local policy and academic purposes. The process requires time and resources, and one may argue that the focus of all resources should have been exclusively on the process of data cleaning and management. However, the skills and efforts required for data management and cleaning cannot be developed nor the motivation for these tasks sustained without an appreciation of the process of analysis; nor can a professional staff be expected to continue the tedious tasks of data cleaning without confidence that they will be able to directly benefit from the effort and have the ability to utilize the information. Thus the concurrent development of these capacities probably benefitted the CRSP in the sense of maintaining enthusiasm through the process of data entry, flow and cleaning.

An important aspect of institutional follow-on in Egypt has been the issue of further activities in Kalama. The NI's commitment to the community is ongoing, and was presented as such in the beginning of the CRSP when the cooperation of the village in participating in the study was sought. Research activities and community support have continued through a follow-on project being conducted by CRSP investigators Drs. Osman Galal, Nargis Bassily and Avanelle Kirksey, to further investigate the finding made in the CRSP of low vitamin B-6 levels in human milk. This study, funded by the Thrasher Foundation, has provided a continuing presence of NI staff in Kalama since the CRSP and a continuing focus on pregnant and lactating women and young infants.

Other research activities have included an attempt to continue documentation of the growth of CRSP target infants and toddlers. Dr. Farouk Shaheen and the staff of young doctors have continued to weigh and measure target children on a less rigorous schedule than during the CRSP, but as often as available staff and vehicles allowed. In April 1986, Dr. Harrison set up the data file structure and began entry of these follow-up data in DBASE III at the NI, and left these files and instructions for ongoing entry with Dr. Magda Shaheen, director of the Data Analysis Unit. Thus some followup data on at least part of the CRSP targets may be available to the NI.

A major opportunity for Kalama and the NI to use their mutual experience to the benefit of the country exists in relation to research questions related to Egypt's current efforts in child survival. Thus, the NI applied to the Ford Foundation regional office for support of the continuation of Kalama as an ongoing "community laboratory" for the exploration of relevant questions through small-scale, limited research projects. The proposal includes provision for feedback of benefit to the community through an intensive health education program. This will also provide for continued development of the young women workers from the village who participated as CRSP data collectors. The proposal has been approved and awaits the official approval of the Egyptian government. Meantime, the NI is proceeding with these activities on a more limited level, awaiting release of the funding. An example is a small study accomplished in the spring of 1986 by Dr. Sawsan Abdel-Ghany in collaboration with Dr. Sandra Clark of the University of Arizona, exploring the role of grandmothers and other older women as channels of health information and education.

Collaboration of the NI with the US institutions which participated in the CRSP is continuing in the context of these ongoing activites. Purdue and the NI are investigating possible vitamin B-6 inadequacy in Kalama; the University of Arizona has assisted in developing the analytical upgrading and community-followon proposals and will continue to collaborate in these activites; a predoctoral student from the University of Kansas will soon be carrying out a small study in Kalama with the NI in the hygiene-sanitation area preliminary to her dissertation on health education programs.

Other Nutrition CRSP Research Activities

While awaiting the arrival of Phase II data, the principal investigators have examined some parts of the Phase I Nutrition CRSP data. A paper which includes data collected in Phase I and entitled "Fatty Acid Composition of Mature Human Milk of Egyptian and American Women" was published recently in the American Journal of Clinical Nutrition (Attachment G).

Phase I anthropometric data of adult women were analyzed in relation to the prevalence of obesity and its relation to age and height. An abstract was submitted to the Vth International Congress on Obesity, held in Jerusalem, Israel September 15-19, 1986 (Attachment H). Although the abstract was accepted for presentation, the author who had planned to attend (Dr. Ritenbaugh) was unable to attend the Congress due to illness and none of the coauthors could attend. As a result, the paper was not presented.

A paper entitled "Women's Food Production Activities in an Egyptian Village Undergoing Socioeconomic Transition" was presented at the Farming Systems Symposium, October 5-8, 1986 at Kansas State University (Attachment I). A potentially important finding from preliminary analysis of a partial data set on time allocation and time use by target females is that a woman's role in pre- and post-harvest food production activities continue unchanged despite her socioeconomic status and evidence of rapid socioeconomic transformation in the village. In other words, "role stasis" in women continues side by side rapid role changes in men.

The Egypt project has moved far ahead of sociodemographic description by developing a functional approach to classifying households. This approach gives prime value to two social structural variables which in themselves are powerful indices of ongoing social and economic change in rural settings. When combined in a classification scheme, the variables, (a) family type within households, and (b) dominant occupational mode of households, show at a glance how family structure is linked to a household's occupational mode. Moreover, one quickly notes how distribution of categories in the classification scheme changes with ongoing socioeconomic change.

Summary

During the past several months and while awaiting the completion of data sets, the statisticians invested a major effort in the development of analytical strategies to address the major research questions. In particular, work on the refinement of the autoregression approach has been a major activity of the statisticians. The principal investigators have interacted with the statisticians on Phase II data analyses. They have also analyzed some parts of Phase I data for presentation at scientific meetings and publication. Also the PIs continue to be involved with the NI in Egypt in some follow-on projects in Kalama. The experience and expertise which were gained during the past months of the project in data preparation, use of data files, and development of analytical approaches should facilitate future analyses of the completed data sets.

Egypt Statistics Report

George McCabe

October 16, 1986

During the past year the statistical activity for the Egypt project has ranged from exploratory data descriptions to the development of analytical strategies for addressing the CRSP research questions.

An overview of some of these activities is contained in the Statisticians' Report by George P. McCabe, October 16, 1986.

Details of many of our efforts are contained in a series of about 100 short reports. The following is a brief summary of the contents of these reports.

For morbidity, we have prepared a collection of data summaries dealing with various quantifications in this domain. Thus, we have examined wellness intervals, illness durations and illness frequency in different ways. Illnesses have been studied by type with separate analyses for all, respiratory, digestive and skin. Monthly variation has also been examined. Most of the summaries are for toddlers but a few deal with infants.

One particularly interesting report concerns overlapping illnesses. As a result of this report, such events have been categorized and some research questions relating to progressive illnesses have been defined.

Anthropometry has received much attention. Yearly growth rates have been calculated using linear fits to the data and these have been correlated with other variables. Monthly variation has been examined.

RMR has been studied in much detail. We looked at the underflying variables which generate the RMR measures and in this process we have uncovered some difficulties with the data that are perhaps related to malfunction of the Beckman equipment. A collection of reports deal with VO_2, RQ, heart rate and variation over time within a recording session.

Relationships among the variables are examined in many of the reports. Thus, simple correlations are given and a large number of autoregression results are detailed.

The data that we have been working with contain many errors and are incomplete. Much work has been done to address these difficulties which is not contained in the reports. However, some results of our efforts to identify questionable values and to examine the extent of our missing data are given in several reports.

In view of the above comments, it is clear that most of these reports will need to be redone as we receive more data. A large amount of data has been sent to us within the past month.

Unfortunately, the quality of the data received and the lateness of its arrival at Purdue have hampered our progress significantly. We have had to deal with obviously bad values, missing codes, duplicate records and numerous other inadequacies. As a result, an excessive amount of our time that should have been spent on statistical analyses has been spent on data preparation.

Attachment B

STATUS REPORT ON EGYPT PROJECT DATA TRANSMITTAL

University of Kansas DMU
October 10, 1986

TYPE OF DATA FILE	FIELD DATES INCLUDED	CURRENT STATUS OF DATA	ESTIMATED ARRIVAL TO ME & STATISTICIAN
Household Food Intake	6/85-12/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data* flow from Egypt
Morbidity Recall Attachments J & K	10/83-12/85	Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Household Entry, Change and Exit	8/84-12/85	Requires coding keying, verifying and assembly into SAS data set	Depends on data flow from Egypt
Demography Update	8/84-9/84	Requires assembly into SAS data set	Depends on data flow from Egypt
Sanitation & Hygiene	8/84-10/84	Requires assembly into SAS data set	Depends on data flow from Egypt
Reproductive History	8/84-12/84	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Socioeconomic Update	8/84-9/84	Requires assembly into SAS data set	Depends on data flow from Egypt

* Indicates that date cannot be assigned. Priorities will change as data tapes in Egypt are received.

TYPE OF DATA FILE	FIELD DATES INCLUDED	CURRENT STATUS OF DATA	ESTIMATED ARRIVAL TO ME & STATISTICIAN
Lactation and Infant Feeding History	9/84-1/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data* flow from Egypt
Clinical Exam	8/84-12/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Pregnancy Monthly Visit	8/84-3/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Immunology	4/84-6/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Parasitology	1/84-2/85 & 1/85-2/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Lactation and Infant Feeding Practices	8/84-3/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Child-Care	1/84-8/84	Requires assembly into SAS data set	Depends on data flow from Egypt

* Indicates that date cannot be assigned. Priorities will change as data tapes in Egypt received.

TYPE OF DATA FILE	FIELD DATES INCLUDED	CURRENT STATUS OF DATA	ESTIMATED ARRIVAL TO ME & STATISTICIAN
Time Allocation	7/84-10/84	Requires error correction and assembly into SAS data set	Depends on data* flow from Egypt
Food Intake Recipes	8/84-12/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Water M crobiology	8/84-7/85	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt
Reproductive Lactation History Supplementary Form	12/84-1/86	Data keyed in Egypt - Requires error detection, correction and assembly into SAS data set	Depends on data flow from Egypt

* Indicates that a date cannot be assigned. Priorities will change as data tapes in Egypt are received.

Addendum to Status Report on Egypt Project Data Transmitttal

University of Kansas DMU
October 20, 1986

The following data files were received on tape or diskette on October 20, 1986:

TYPE OF DATA FILE	FIELD DATES INCLUDED	CURRENT STATUS OF DATA	ESTIMATED ARRIVAL TO ME & STATISTICIAN
Sociodemographic	10/83- 2/84	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician
Reproductive History	8/84-12/84 6/85- 7/85 12/85- 1/86	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician
Lactation and Infant Feeding Practices	8/84- 9/85	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician
Supplementary Foods	9/84-10/85	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician
RMR	11/85-12/85	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician

TYPE OF DATA FILE	FIELD DATES INCLUDED	CURRENT STATUS OF DATA	ESTIMATED ARRIVAL TO ME & STATISTICIAN
Brazelton	7/84- 9/85	Data keyed in Egypt- Requires error detection, correction and assembly into SAS data set	Awaiting prioritization by statistician
Sanitation and Hygiene	8/84-12/85	Data keyed in Egypt- Required error detection, correction and assembly into SAS data set	*

*Coding information not yet received from Egypt.

Copies of raw data collection instruments were received for the following data: 10/30/85

TYPE OF DATA FILE	FIELD DATES INCLUDED
Toddler Cognitive	10/83- 9/85
Schooler Cognitive	1/84-10/85
Adult Cognitive	1/84- 9/85
Infant Cognitive Test Data	3/85-10/85
Child Behavior Teacher Ratings	2/85- 4/85
Water Microbiology	7/85-12/85
Food Intake Form V	8/84-10/85
Food and Beverage Prices	10/85

Status Report on Egypt Project
Data Received by Statisticians
Purdue University
October 15, 1986

Filename	Date Received	Dates Covered	Number of Observations
ANTHROPOMETRY Targets			
ANTHALL	JUL 85	11/83-7/84	1407
ANTA	JAN 86	7/84-8/85 (-5/85)*	4828
(HAS DUPLICATE OBSERVATIONS)			
ANTA	JUN 86	2/84-7/84, 6/85-12/85	1795
(ADDITIONAL DATA)			
ANTHROPOMETRY Non Targets			
ANTHRO	NOV 85	11/83-7/84	386
ANTB	JAN 86	7/84-5/85 (8/84-1/85)	173
(HAS DUPLICATE OBSERVATIONS)			
ANTB	JUN 86	2/84-7/84	44
(ADDITIONAL DATA)			
ANTHROPOMETRY Lactating Women			
ANTLA	JAN 86	7/84-11/85 (-8/85)	746
(HAS DUPLICATE OBSERVATIONS)			
ANTLA	OCT 86	6/85-12/85	20
(ADDITIONAL DATA)			
ANTLASUB	OCT 86	6/85-12/85	95
(SUBSTUDY)			
ANTHROPOMETRY Pregnant Women			
ANTPG	JAN 86	11/83-10/85(1/84-8/85)	766
(HAS DUPLICATE OBSERVATIONS)			
ANTPG	OCT 86	6/85-12/85	7
(ADDITIONAL DATA)			
ANTPGSUB	OCT 86	6/85-12/85	229
(SUBSTUDY)			
ANTHROPOMETRY Infants			
ANTIN	JAN 86	1/84-12/85 (7/84-9/85)	942
(HAS DUPLICATE OBSERVATIONS)			
ANTIN	OCT 86	6/85-12/85	23
(ADDITIONAL DATA)			
ANTINSUB	OCT 86	6/85-12/85	117
(SUBSTUDY)			
FOOD INTAKE			
INDFOOD	JUL 85	12/83-7/84	3292

* date for majority of observations

Filename	Date Received	Dates Covered	Number of Observations
INDFOOD1	FEB 86	12/83-7/84	3292
(REPLACES INDFOOD JUL 85)			
INDFOOD2	FEB 86	8/84-4/85	9441
(ADDITIONAL DATA)			
INDFOOD	JUN 86	12/83-7/84, 5/85-6/85, 8/85	2292
(ADDITIONAL DATA)			
INDFOOD	JUL 86	2/85, 7/85-8/85	490
(ADDITIONAL DATA)			
INDFOOD	SEP 86	10/83-12/85	16077
(REPLACES PREVIOUS DATA SETS)			
BFEED	MAR 85	12/83-7/84	884
BFEED	JUN 86	12/83-6/85, 8/85	2674
(REPLACES BFEED MAR 85)			
BFEED	OCT 86	12/83-11/85	2799
(REPLACES BFEED JUN 86)			
MEALS	MAR 85	12/83-7/84	424
MEALS	OCT 86	12/83-12/85	4763
(REPLACES MEALS MAR 85)			
FESTIVE	JUN 86	5/84-7/84	732
HHFOOD	APR 86	12/83-5/85	4209
PHYSIO	JUL 86	12/83-8/85	4963
(ADDITIONAL DATA)			
PHYSIO	OCT 86	12/83-12/85	5150
(REPLACES PHYSIO JUL 86)			
<u>MORBIDITY</u>			
MORBID	JUL 85	11/83-8/84	936
MORBID	MAY 86	10/83-12/84	2148
(REPLACES MORBID JUL 85)			
MORBID	JUL 86	10/83-8/85	3683
(REPLACES MORBID MAY 86)			
MORBID	SEP 86	10/83-12/85	3888
(REPLACES PREVIOUS DATA SETS - HAS INVALID ILLNESS CODES)			
<u>RECALL</u>			
RECALL	JUL 85	11/83-8/84	14915
RECALL	MAY 86	10/83-12/84	50766
(REPLACES RECALL JUL 85)			
RECALL	JUL 86	10/83-8/85	82796
(REPLACES RECALL MAY 86)			
RECALL	SEP 86	10/83-12/85	88921
(REPLACES PREVIOUS DATA SETS - HAS DUPLICATE OBSERVATIONS)			
<u>SES</u>			
SESIN	JUL 85	10/83-2/84	1400
SESIN	JUN 86		2180
(REPLACES SESIN JUL 85)			
SES	JUL 85		197
SESCO	NOV 85	12/83-5/85	9

Filename	Date Received	Dates Covered	Observations
SESHH	NOV 85	10/83-10/84 (-2/84)	191
SES	SEP 86		312
(REPLACES PREVIOUS SES DATA SETS)			
DEMOGRAPHIC			
DEMO	NOV 85	10/83-2/84	1337
DEMO	JUN 86	10/83-10/84	2180
(REPLACES DEMO NOV 85)			
SANITATION			
HHSH	MAR 85	1/84-9/84	188
THHSH	MAR 85	1/84-9/84	156
TISH	MAR 85	1/84-9/84	150
LABORATORY			
PARA	NOV 85	7/84-8/84	656
URINE	NOV 85	11/83-7/84	737
HEMO	NOV 85	11/83-8/84	872
BIO1	DEC 85	11/83-7/84	504
BIO2	DEC 85	11/83-1/84	28
IMMUN1	DEC 85	11/83-6/84 (-5/84)	125
IMMUN2	DEC 85	11/83-6/84	177
IMMUN3	DEC 85	1/84-12/84	176
IMMUN4	DEC 85	11/83-5/84	177
HEMO	SEP 86	11/83-12/85	3961
(REPLACES PREVIOUS HEMO & URINE DATA SETS - HAS DUPLICATE OBSERVATIONS)			
RMR			
RMR	DEC 85	1/85-3/85	198
RMR	APR 86	10/84-10/85	798
MEDICAL HISTORY			
HIST01	DEC 85	11/83-12/83	279
HIST02	DEC 85	12/83-8/84	995
PHYS01	DEC 85	10/83-12/83 (11/83-)	279
PHYS02	DEC 85	12/83-9/84	940
REPRODUCTION/LACTATION			
REPRO	NOV 85	11/83-7/84	118
PREGO	NOV 85	2/84-8/84 (-7/84)	50
INFANT	NOV 85	7/84-8/84	3
OUTCOME	OCT 86	4/84-5/85	124
DUBOWITZ	OCT 86	7/84-5/85	110
(HAS DUPLICATE OBSERVATIONS			

Filename	Date Received	Dates Covered	Number of Observations
PSYCHOLOGY			
BEHAVE	NOV 85	12/83-8/84	640
FATHER	NOV 85	12/83-5/84 (1/84-4/84)	20
SCHOOL	NOV 85	12/83-5/84	41
MOTHER	NOV 85	12/83-5/84 (1/84-4/84)	44
TODDLER	NOV 85	12/83-5/84	53
RATING	NOV 85	2/84-3/84	25
CLASS	NOV 85	12/83-4/84	113
BEHAVE (TODDLERS)	OCT 86	12/83-11/85	2596
INFANT	OCT 86	3/85-10/85	246
ENTRY	NOV 85	10/83-8/84	223

Filename	Description
ANTHALL	Anthropometry
ANTA	Anthropometry - targets
ANTHRO	Anthropometry - nontargets
ANTB	Anthropometry - nontargets
ANTLA	Anthropometry - lactating women
ANTPG	Anthropometry - pregnant women
ANTIN	Anthropometry - infants
INDFOOD	Individual Food Intake
BFEED	Breast fed toddlers
MEALS	Target males <3 meals/day
FESTIVE	Festive events affecting individual food intake
HHFOOD	Household food intake
PHYSIO	Physiologic state of target females
MORBID	Morbidity illness episodes
RECALL	Weekly morbidity recall
SESIN	Individual socio-economic
SES	Household socio-economic
SESCO	Community socio-economic
SESHH	Household socio-economic
DEMO	Demographic
HHSH	Household sanitation & hygiene
THHSH	Toddler household sanitation & hygiene
TISH	Toddler individual sanitation & hygiene
PARA	Parasitology
URINE	Urine examination
HEMO	Hematology
BIO1	Biological data - form #1
BIO2	Biological data - form #2
IMMUN1	Immunology - cell mediated immunity
IMMUN2	Immunology - humoral immunity
IMMUN3	Immunology - complement

Filename	Description
IMMUN4	Immunology - serum proteins
RMR	RMR
HISTO1	Medical history - form #1
HISTO2	Medical history - form #2
PHYSO1	Physical exam - form #1
PHYSO2	Physical exam - form #2
REPRO	Reproductive history
PREGO	Monthly pregnancy survey
INFANT	Lactation and infant feeding
OUTCOME	Pregnancy outcome
DUBOWITZ	Dubowitz
BEHAVE	Behavioral observation - toddler
FATHER	Adult cognitive
SCHOOL	Schooler cognitive
MOTHER	Adult cognitive
TODDLER	Toddler cognitive
RATING	Child behavior rating
CLASS	Schooler classroom observation
BEHAVE	Behavioral observation - toddler
INFANT	Behavioral observation - infant
ENTRY	Household entry change exit

L. Doyle McCabe
Egypt Project September 1986
Report 86-069 (page 1 of 5)
Toddlers
Autoregressive Models
Food Intake (12/83-8/85)
Anthropometry (11/83-12/85)
Morbidity (10/83-8/85)

N=300 (117 Toddlers)

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE	.73	0.75

Parameter	Estimates	Std Error
Intercept	- 5.02	1.37
WT	0.26	0.03
WTBASE	0.49	0.06
DWTBASE	2.68	0.68
HT	0.16	0.02
HTBASE	- 0.05	0.02
DHT	12.71	1.68
DHTBASE	- 2.08	1.83

Test	F	p
HT HTBASE DHT DHTBASE	19.66	.0001

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE KCBASE DKCBASE	.74	.74

Parameter	Estimates	Std Error
Intercept	- 4.53	1.36
WT	0.26	0.03
WTBASE	0.50	0.06
DWTBASE	3.26	0.70
HT	0.15	0.02
HTBASE	- 0.05	0.02
DHT	11.89	1.70
DHTBASE	- 2.40	1.83
KCBASE*1000	- 0.02	0.13
DKCBASE	0.83	0.33

Test	F	p
KCBASE DKCBASE	4.07	.0180
HT HTBASE DHT DHTBASE	14.05	.0001

Report 86-069
September 1986

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE KCBASE DKCBASE KC DKC	.74	.74

Parameter	Estimates	Std Error
Intercept	- 4.82	1.38
WT	0.26	0.03
WTBASE	0.49	0.06
DWTBASE	3.25	0.70
HT	0.15	0.02
HTBASE	- 0.05	0.02
DHT	11.93	1.70
DHTBASE	- 2.25	1.84
KCBASE*1000	- 0.06	0.13
DKCBASE	0.81	0.33
KC*1000	0.15	0.11
DKC	0.09	0.18

Test	F	p
KC DKC	1.39	.2520
KCBASE DKCBASE	4.36	.0136
KC DKC KCBASE DKCBASE	2.73	.0293
HT HTBASE DHT DHTBASE	14.27	.0001

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE SICKBASE FEVRBASE DIARBASE	.73	0.76

Parameter	Estimates	Std Error
Intercept	- 4.82	1.40
WT	0.26	0.03
WTBASE	0.49	0.06
DWTBASE	2.73	0.68
HT	0.15	0.02
HTBASE	- 0.05	0.02
DHT	12.43	1.69
DHTBASE	- 2.01	1.85
SICKBASE	- 0.00	0.02
FEVRBASE	- 0.08	0.06
DIARBASE	- 0.00	0.03

Test	F	p
SICKBASE FEVRBASE DIARBASE	0.70	.5539

Report 86-069
September 1986

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE SICKBASE FEVRBASE DIARBASE SICK FEVER DIAR KCBASE DKCBASE KC DKC	.75	.72

Parameter Estimates		Std Error
Intercept	- 4.72	1.41
WT	0.24	0.03
WTBASE	0.48	0.06
DWTBASE	3.25	0.71
HT	0.14	0.02
HTBASE	- 0.03	0.02
DHT	11.29	1.70
DHTBASE	- 1.47	1.98
SICKBASE	0.00	0.02
FEVRBASE	- 0.12	0.06
DIARBASE	- 0.01	0.03
SICK	0.04	0.02
FEVER	- 0.06	0.05
DIAR	- 0.06	0.02
KCBASE*1000	- 0.12	0.13
DKCBASE	0.75	0.33
KC*1000	0.12	0.11
DKC	0.07	0.18

Test	F	p
SICK FEVER DIAR SICKBASE FEVRBASE DIARBASE SICK FEVER DIAR	3.15	.0250
KC DKC KCBASE DKCBASE	1.95	.0729
KC DKC	1.05	.3515
	2.65	.0335

Report 86-069
September 1986

SAS Model	R^2	MSE
WT2=WT WTBASE DWTBASE HT HTBASE DHT DHTBASE KCBASE DKCBASE KC DKC SICKBASE FEVRBASE DIARBASE SICK FEVER DIAR SES DSES HHSIZ SEX	.76	.71

Parameter	Estimates	Std Error
Intercept	- 5.28	1.54
WT	0.24	0.03
WTBASE	0.47	0.06
DWTBASE	3.20	0.70
HT	0.13	0.02
HTBASE	- 0.02	0.03
DHT	10.90	1.71
DHTBASE	- 0.62	1.91
KCBASE*1000	- 0.14	0.13
DKCBASE	0.71	0.33
KC*1000	0.12	0.11
DKC	0.09	0.18
SICKBASE	- 0.00	0.02
FEVRBASE	- 0.06	0.07
DIARBASE	- 0.01	0.03
SICK	0.04	0.02
FEVER	- 0.06	0.05
DIAR	- 0.07	0.02
SES	- 0.09	0.06
DSES	- 0.13	0.22
HHSIZE	0.25	0.11
SEX	- 0.11	0.11

Test	F	p
SES DSES HHSIZ	2.58	.0530
SEX	0.93	.3347
SICKBASE FEVRBASE DIARBASE SICK FEVER DIAR	1.93	.0757
HT DHT	12.92	.0001
KCBASE DKCBASE KC DKC	2.51	.0425
KC DKC	0.75	.4713

VARIABLE	DEFINITION
WT2	Weight at time t
WT	Weight at time t-1
WTBASE	Baseline Weight
DWTBASE	Dummy variable for baseline weight
HT	Height at time t-1
HTBASE	Baseline Height
DHTBASE	Dummy Variabe for Baseline Height
DHT	Dummy Variable for Height DHT=1 if HT is Missing 0 if HT is Not Missing
KC	KCAL at time t-1
DKC	Dummy Variable for KCAL
SICK	Number of days Sick at time t-1
FEVER	Number of days with Fever at time t-1
DIAR	Number of days with Diarrhea at time t-1
KCBASE	Baseline KCAL (average of first 3 months)
DKCBASE	Dummy Variable for Baseline KCAL
DIARBASE	Baseline Number of days with Diarrhea
SICKBASE	Baseline Number of days Sick
FEVRBASE	Baseline Number of days with Fever
SES	SES Score
DSES	Dummy Variable for SES
SEX	Sex
HHSIZ	Square Root of Number of members in family

L. Doyle McCabe
Egypt Project September 1986
Report 86-073
Toddlers
Autoregressive Models
Food Intake (12/83-8/85)
Anthropometry (11/83-12/85)
Morbidity (10/83-8/85)

N=1230 (160 Toddlers)

SAS Model	R^2	MSE
DIAR2=SICK FEVER DIAR SICKBASE KC DKC KCBASE DKCBASE SES DSES HHSIZ SEX WT DWT WTBASE DWTBASE HT DHT HTBASE DHTBASE	07	4.78

Parameter Estimates		Std Error
Intercept	2.86	2.34
SICK	0.01	0.02
FEVER	0.03	0.08
DIAR	0.19	0.03
SICKBASE	0.02	0.02
KC*1000	0.21	0.13
DKC	0.22	0.22
KCBASE*1000	- 0.09	0.17
DKCBASE	- 0.27	0.28
SES	0.01	0.07
DSES	0.03	0.26
HHSIZ	- 0.07	0.14
SEX	- 0.26	0.13
WT	- 0.04	0.05
DWT	- 0.61	0.64
WTBASE	- 0.07	0.06
DWTBASE	- 1.04	0.68
HT	- 0.03	0.03
DHT	- 2.32	2.42
HTBASE	0.02	0.03
DHTBASE	1.78	2.01

Test	F	p
SES DSES HHSIZ	0.08	.9670
SEX	3.97	.0467
SICKBASE		
SICK FEVER		
DIAR	17.05	.0001
WT WTBASE DWT		
DWTBASE	0.88	.4750
HT HTBASE DHT		
DHTBASE	0.50	.7380

Test	F	p
WT WTBASE DWT DWTBASE HT HTBASE DHT DHTBASE	1.20	.2972
KCBASE DKCBASE KC DKC	0.85	.4963
KC DKC	1.27	.2814

VARIABLE	DEFINITION
DIAR2	Number of days with diarrhea at time t
HT	Height at time t-1
DHT	Dummy Variable for Height
HTBASE	Baseline Height
DHTBASE	Dummy Variabe for baseline height
WT	Weight at time t-1
WTBASE	Baseline Weight
DWTBASE	Dummy Variable for baseline weight
DWT	Dummy Variable for Weight DWT=1 if WT is Missing 0 if WT is Not Missing
KC	KCAL at time t-1
DKC	Dummy Variable for KCAL
SICK	Number of days Sick at time t-1
FEVER	Number of days with Fever at time t-1
DIAR	Number of days with Diarrhea at time t-1
KCBASE	Baseline KCALX(average of first 3 months)
DKCBASE	Dummy Variable for Baseline KCAL
SICKBASE	Baseline Number of days Sick
SES	SES Score
DSES	Dummy Variable for SES
SEX	Sex
HHSIZ	Square Root of Number of members in family

Attachment F

L. Doyle McCabe
Egypt Project August 1986
Report 86-062
161 Toddlers
Anthropometry 11/83-12/85
Number of Records Per Month

TODDLERS ANTHROPOMETRY - WEIGHT

OBS	AID	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1	10023406	0	1	0	0	0	1	1	0	0	0	0	0
2	10027405	1	1	0	0	0	0	0	0	0	0	1	1
3	10041404	1	0	1	0	1	0	0	0	0	0	0	0
4	10047408	1	0	1	1	2	0	1	1	1	2	1	2
5	10052407	0	1	0	1	0	1	1	1	0	1	0	1
6	10059405	0	2	0	0	1	1	0	1	0	0	0	0
7	10071409	0	1	1	1	1	2	0	1	1	1	0	0
8	10076410	1	0	1	1	1	1	1	1	0	1	1	1
9	10079405	1	0	0	0	2	1	0	0	0	0	1	2
10	10087410	2	1	0	1	1	0	0	0	0	1	0	1
11	10095407	1	1	1	1	1	0	1	1	1	0	1	1
12	10099406	1	1	0	1	1	0	0	1	1	0	0	0
13	10118405	0	1	1	0	0	1	1	1	1	1	0	1
14	10124407	1	0	0	0	0	0	1	0	1	1	0	0
15	10136406	2	0	0	0	0	0	1	1	0	0	0	0
16	10142415	0	0	1	1	1	1	0	0	2	1	1	0
17	10149407	2	1	1	1	0	1	1	1	1	0	0	2
18	10154405	1	0	2	1	0	1	0	1	1	1	1	2
19	11059406	0	0	0	1	0	0	0	0	0	0	0	1
20	12035408	1	0	1	2	0	0	0	0	0	0	0	0
21	20008409	1	1	1	1	0	0	0	2	0	0	1	0
22	20019407	1	1	1	0	2	0	1	0	0	1	0	1
23	20022405	1	0	0	1	0	0	0	0	1	0	1	2
24	20024407	1	0	0	0	1	0	0	0	1	0	0	0
25	20029407	0	0	0	0	0	0	0	1	1	0	1	1
26	20049407	0	0	0	0	1	0	1	0	0	0	1	1
27	20051404	0	0	0	0	0	0	0	0	1	0	1	0
28	20052406	1	0	1	2	0	1	0	1	1	1	0	1
29	20054406	1	1	0	0	0	0	0	0	1	0	1	2
30	20078405	1	1	0	0	0	1	0	1	0	0	0	2
31	20087406	1	0	1	1	0	2	0	0	0	0	0	0
32	20102407	1	0	1	1	1	1	1	0	0	0	1	1
33	20104407	1	0	1	0	0	2	0	0	0	0	1	2
34	20133407	1	0	1	0	0	1	1	0	0	0	1	1
35	21010408	1	0	1	0	1	1	1	0	1	1	1	2
36	30002406	1	0	0	0	1	1	0	0	0	0	0	0
37	30015407	0	0	1	0	1	2	1	1	1	1	1	0
38	30028406	0	0	0	0	0	1	2	0	0	0	1	1
39	30030408	1	0	1	0	1	1	1	0	1	1	0	1
40	30038406	0	0	0	1	0	0	0	0	0	0	0	0
41	30041408	2	0	1	1	1	0	1	1	1	1	1	2
42	30061405	0	0	0	0	0	0	1	0	1	0	0	0
43	30062407	0	1	1	1	1	1	0	2	1	0	1	0

Report 86-062

OBS	AID	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
44	30072408	1	0	1	0	1	1	1	1	1	1	0	1
45	30079404	0	1	1	2	0	0	1	1	1	1	1	1
46	30089405	1	1	1	1	0	1	0	1	1	0	0	0
47	30102406	0	0	1	1	0	1	1	0	1	1	0	2
48	30115405	1	1	1	0	0	1	0	0	0	0	0	0
49	30143409	2	1	0	0	1	0	1	1	1	0	1	0
50	30144407	2	0	0	2	1	0	0	1	1	1	0	2
51	30153409	0	0	1	0	0	0	0	0	1	1	0	0
52	30156410	2	0	0	1	0	1	1	1	0	1	1	2
53	30175405	2	0	1	0	1	1	0	0	0	0	0	2
54	30192406	1	0	1	0	0	0	1	1	0	0	0	0
55	30197407	0	0	0	0	0	1	0	0	0	0	0	0
56	30200407	2	0	0	1	0	1	0	0	1	0	0	1
57	31086408	2	0	1	1	1	0	0	0	1	1	1	0
58	31205406	0	1	0	1	0	0	1	0	0	1	1	0
59	32005406	0	1	0	0	1	1	1	1	0	0	0	1
60	32007407	0	0	1	0	1	1	0	2	1	1	0	0
61	40009408	1	1	1	0	1	0	0	0	1	1	0	0
62	40011403	1	0	0	1	1	1	1	0	1	0	1	1
63	40018405	1	0	1	0	2	0	0	0	0	0	0	1
64	40019404	1	0	0	0	0	0	0	0	0	0	0	0
65	40031405	0	0	0	1	0	1	0	0	0	2	0	0
66	40052406	1	0	0	0	0	1	1	0	0	1	1	1
67	40056410	0	1	0	0	0	1	1	0	1	2	0	1
68	40062409	2	0	0	0	0	0	0	0	0	0	0	1
69	41007407	1	3	0	1	1	1	0	0	1	0	1	1
70	50056405	0	0	1	0	0	1	0	1	1	0	1	2
71	50089408	0	0	1	1	1	1	1	1	0	0	0	0
72	60028408	2	0	1	1	2	1	0	1	1	1	1	1
73	60042405	2	0	0	0	0	0	1	1	1	0	1	1
74	60105405	1	0	0	0	0	0	0	0	0	0	0	0
75	60108405	0	0	1	1	1	1	1	0	1	1	1	1
76	60112405	1	0	0	1	2	0	1	0	1	0	1	2
77	61085406	0	1	0	1	1	0	0	0	1	0	0	0
78	61091406	1	0	0	0	1	1	0	0	1	1	1	1
79	70004405	0	0	0	0	0	1	1	1	0	1	1	1
80	70043407	0	1	1	0	1	1	0	0	0	0	0	0
81	70049405	0	1	0	1	1	0	0	1	0	0	0	0
82	70052406	1	1	0	0	1	0	0	0	0	0	1	0
83	70068404	1	0	0	0	1	0	0	0	0	1	0	0
84	70077404	0	0	1	2	0	0	1	1	1	0	0	0
85	70083405	0	1	0	0	0	1	1	0	1	1	1	1
86	70085407	1	0	0	1	0	1	1	0	0	1	1	1
87	70107407	0	1	0	1	0	0	0	0	1	1	0	0
88	70112406	1	0	0	1	0	1	0	1	1	1	1	2
89	70132410	0	0	0	0	1	0	0	0	0	1	0	0
90	70163407	1	0	1	1	1	1	0	1	0	0	1	2
91	70184406	1	1	0	0	0	1	0	0	0	1	1	2
92	70189407	1	1	1	0	0	0	1	1	0	0	1	1
93	80019407	2	1	0	1	0	1	1	1	1	1	1	1
94	80037409	0	0	1	1	1	0	0	1	2	0	0	2

Report 86-062

OBS	AID	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
95	80066403	3	0	0	1	1	0	0	1	0	1	0	1
96	80067407	0	1	1	2	0	1	0	0	1	1	1	1
97	80074406	1	0	1	1	0	1	1	0	1	0	1	0
98	80078406	1	1	0	2	0	0	0	0	0	1	1	0
99	80085406	0	0	0	0	0	0	0	0	0	0	0	0
100	80151410	2	1	2	0	1	1	1	1	1	0	0	0
101	80163403	1	0	1	0	0	0	2	1	0	0	0	1
102	80171406	1	0	1	0	1	2	0	0	1	1	0	2
103	80205406	2	1	0	1	0	0	0	0	0	0	0	0
104	90005406	0	0	0	1	0	1	1	1	1	0	0	1
105	90019409	0	0	1	1	0	1	0	0	0	0	0	1
106	90028406	1	1	0	1	0	1	1	0	1	0	0	1
107	90038408	0	0	1	0	0	0	1	1	0	0	0	0
108	90039408	1	1	0	0	0	0	0	0	0	0	0	0
109	90053406	0	1	1	1	1	1	0	0	0	1	1	1
110	90061410	1	0	1	0	0	0	0	1	0	1	1	2
111	90069404	1	1	0	0	0	1	1	0	0	0	1	0
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113	90114406	1	1	1	1	1	1	0	1	1	1	1	2
114	90119407	1	1	0	0	0	0	1	1	0	0	0	2
115	100011406	0	0	0	1	0	1	1	1	1	1	1	1
116	100018407	1	1	1	0	0	1	0	1	1	1	1	2
117	100021406	0	0	0	1	1	0	0	0	1	1	0	1
118	100031408	1	0	1	0	1	0	1	0	0	1	1	0
119	100046405	1	0	0	1	0	0	0	0	1	0	1	1
120	100053406	1	1	0	0	0	0	1	1	0	0	0	0
121	100084409	1	0	0	0	0	0	0	0	0	0	0	0
122	100097408	0	1	1	0	1	0	0	0	0	0	1	0
123	100105405	0	1	0	1	0	1	0	1	1	0	1	0
124	100112410	1	1	1	2	0	0	0	1	0	0	0	0
125	100167407	1	0	1	0	0	1	1	1	1	0	0	0
126	103027406	1	0	0	1	1	1	0	2	0	0	1	2
127	110002405	2	1	1	0	0	0	0	0	0	1	0	1
128	110029406	2	0	1	1	0	0	0	1	1	0	1	2
129	110041405	0	0	1	1	1	1	0	1	1	1	1	0
130	110071409	1	1	0	0	1	0	0	1	0	0	1	2
131	110086405	2	0	0	0	0	0	0	1	1	2	0	1
132	110106405	1	1	0	1	2	0	0	0	0	2	0	1
133	110114407	0	0	0	0	0	0	0	0	0	0	1	0
134	110131406	2	0	2	0	2	0	1	1	0	0	0	2
135	110156406	1	1	0	1	0	0	0	0	0	0	0	0
136	111049406	0	0	0	1	1	0	0	1	1	1	0	1
137	120021410	2	1	0	0	0	0	0	0	0	1	1	1
138	120024409	1	1	1	1	0	0	1	1	1	0	1	1
139	120027406	1	0	0	0	1	1	0	0	1	0	1	0
140	120030405	1	0	1	0	0	0	0	0	0	0	0	0
141	120046406	1	0	1	0	1	0	1	0	1	0	1	1
142	120051405	1	1	0	0	1	1	1	0	1	1	1	0
143	120052409	0	0	1	0	0	1	0	1	1	1	1	1
144	120055407	0	0	1	1	1	1	1	1	0	0	1	0
145	120070407	2	1	1	0	2	1	0	2	1	0	1	2

Report 86-062

OBS	AID	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
146	120089407	0	0	1	1	0	0	1	1	0	1	0	0
147	120114405	0	0	0	0	2	0	1	1	1	0	0	0
148	120131407	1	0	0	0	1	0	0	1	0	0	1	1
149	120168405	0	0	0	0	2	1	0	1	1	0	0	2
150	120170408	2	0	2	1	0	1	1	1	1	0	1	1
151	121037406	0	0	0	0	0	0	0	0	0	0	0	1
152	121069407	0	0	0	0	0	0	0	0	0	0	0	1

Note: M1: [18 month date-14,18 month date+30)
M2: [18 month date+30,18 month date+60)
.
.
.
M12: [18 month date+330,18 month date+374)

Attachment G

Fatty acid composition of mature human milk of Egyptian and American women[1-4]

Marlene W Borschel, RD, PhD, Robert G Elkin, PhD, Avanelle Kirksey, PhD, Jon A Story, PhD, Osman Galal, MD, PhD, Gail G Harrison, PhD, and Norge W Jerome, PhD

ABSTRACT Fatty acid composition of mature human milk of rural Egyptian and American women was determined by gas-liquid chromatography. Milk of Egyptian women contained significantly higher percentages of capric, lauric, myristic, linoleic and arachidonic acids, saturated fatty acids (SFA), and polyunsaturated fatty acids (PUFA). Conversely, milk of American women contained higher percentages of stearic and oleic acids, total unsaturated fatty acids, and monounsaturated fatty acids. The PUFA:SFA ratio in Egyptian samples was 0.54 ± 0.18 compared to 0.47 ± 0.22 in American samples. Increased percentages of medium-chain SFA in Egyptian milk suggested increased mammary gland lipid synthesis. Analysis of Egyptian diets indicated high-carbohydrate and low-fat intakes may have resulted in limited availability and incorporation of dietary fatty acids into milk triglycerides. Thus, increased percentages of medium-chain SFA observed in Egyptian milk may reflect mammary gland synthesis in an attempt to maintain lipid concentrations in milk. *Am J Clin Nutr* 1986;44: 330-335.

KEY WORDS Fatty acids, human milk, lactation, infant nutrition, lipid

Introduction

Lipids are the most variable constituent in human milk (1). Examination of milk-lipid concentration and composition is of interest because milk-lipid provides the major fraction of calories in human milk (1), contains fat-soluble vitamins (2), and provides essential fatty acids necessary for growth and development of the central nervous system (CNS) (3). Although milk-lipid concentrations show considerable variation both during a feeding and diurnally, the fatty acid pattern remains constant (4, 5) and, cross-culturally, milk fatty acids are more remarkable for their similarity than dissimilarity (3). However, the fatty acid composition of human milk responds rapidly and markedly to dietary changes (6, 7).

The purpose of this study was to compare the fatty acid composition of lipid in the milk of rural Egyptian women, some of whom may have been marginally malnourished, with that of well-nourished American women.

Materials and methods

Description of subjects

Egyptian subjects included 22 rural women residing in the village of Kalama. This village is currently being examined to determine the effects of marginal malnutrition on human function. In preliminary studies assessing body size and composition (Galal O, Harrison GG, Jerome NW, and Kirksey A. Unpublished draft report, Phase I research

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on food intake and function, September 1983), anthropometric measurements, including height (length for infants), weight, midarm circumferences, skinfolds at three sites, and for infants only, head circumference, were utilized to assess those aspects of body size and composition most sensitive to alterations in energy balance. Data collected in Kalama documented a range of normal through moderately malnourished status in relation to international reference data (8, 9). Stunting was the most common pattern of growth alteration observed in Kalama and was typical of that reported in the Egyptian National Nutrition Survey (10). Stunting was defined as a deficit in linear growth for age and appeared to be reflective of a nutritional deficit over an unspecified time during the past. In Kalama, stunting appeared to occur predominantly in the first 2 yr of life. Substantial catch up growth was not demonstrated in the ages surveyed in the preliminary study, in spite of appropriate weight for height values.

Egyptian women were 18 to 45 yr of age ($\bar{x}$ = 28 ± 6.5 yr). These women had an average of four living children (ranging from one to nine children) and only one woman was a primipara. Weight and height measurements were available for all except one woman and the mean weight was 65.2 ± 12.0 kg and height was 155.6 ± 6.1 cm.

American subjects included 21 nonvegetarian women from a university community participating in a larger study. American women were 25 to 44 yr of age ($\bar{x}$ = 30 ± 5 yr). These women had an average of two living children (ranging from one to four children) and nine were primiparas. Mean weight of these women was 60.8 ± 7.4 kg and height was 165.5 ± 5.7 cm. All procedures were approved by the University Committee for Use of Human Subjects in Research.

Dietary intakes

Food consumption of all participants in the study was ad libitum. Preliminary analysis of Egyptian diets in the village of Kalama indicated that these women likely consumed 2400 to 2600 kcal/day with ~18 to 20% of the total calories from dietary fat, 70% of total calories from carbohydrate (CHO), and 10 to 12% of total calories from protein. The major source of dietary fats appeared to be cooking fats and oils and cheese since meat and poultry were consumed only once weekly. Cheese (whole and skim) was produced from buffalo milk. Unhydrogenated cottonseed oil comprised ~90% of the fat used in the village. Linoleic acid accounted for 48.9% of the fatty acids in cottonseed oil (11). Hydrogenated vegetable oil, beef lard, cow ghee (butter oil), and buffalo butter, cream, and ghee were also consumed.

The American women consumed calories sufficient for weight maintenance. Examination of food frequency patterns indicated that 20 of the 21 American women consumed 2% fat or skim milk, 18 of 21 used margarine rather than butter, and all used vegetable fats and oils for cooking. Generally four servings of beef and/or pork and two servings each of poultry and fish were consumed per week.

Milk sampling

Milk samples (~5 ml) obtained from Egyptian and American women were collected manually at a midmorning feeding. Twelve of the Egyptian samples were fore milk and 10 were hind milk. All American samples were fore milk. Due to the preliminary nature of the study, it was not possible to obtain a 24 h expression or milk volume assessment for Egyptian women. The stage of lactation at the time of sampling ranged from 0.5 to 29 mo. Mean stages of lactation were comparable between the Egyptian (7.5 mo) and American women (6.6 mo) as an attempt was made to select matched controls for the Egyptian women. In both groups, 13 samples were collected during the first 6 mo of lactation. Egyptian milk samples were immediately placed on ice until transport to Cairo where they were stored at −30°C. Within a month after collection, samples were transported to the United States for analysis. Milk samples from American women were stored in a similar manner.

Fatty acid analysis

Lipids in 0.2 ml of milk were extracted by the Bligh-Dyer method (12). An appropriate amount of heptadecanoic acid (17:0) was added to the milk prior to the extraction procedure and served as an internal standard. Fatty acids were methylated (13) and analyzed using gas-liquid chromatography. The separation was achieved by using a Model 5700A Hewlett Packard (Palo Alto, CA) gas chromatograph equipped with a flame ionization detector and a Model 3390A Hewlett Packard integrator. A 2 mm × 1829 mm silanized glass column was packed with 5% DEGS-PS on 100/120 Supelcoport (Supelco, Inc. Bellefonte, PA). The injection port and detector were each maintained at 250°C while the samples were run isothermally at an oven temperature of 175°C with a nitrogen carrier gas flow rate of 40 ml/min. Hydrogen and air flow rates were 40 and 160 ml/min, respectively. Identification of the milk fatty acids was based on retention times of known fatty acids. Although arachidic acid (20:0) was included in the standard mix, it was detected in only one American sample. The 5% DEGS-PS column used in this study did not enable the selective resolution of cis and trans isomers.

Statistical analysis

Means of fatty acids in milk of Egyptian and American women were compared by an analysis of variance (14). Pearson correlations (14) were used to determine relationships between various fatty acids.

Results

Data for fatty acid composition of milk samples are shown in Table 1. Milk of Egyptian women contained significantly greater percentages of total fatty acids as capric (10:0), lauric (12:0), myristic (14:0), linoleic (18:2) and arachidonic (20:4) acids, saturated fatty acids (SFA), and polyunsaturated fatty acids (PUFA) compared to milk of American women. Conversely, milk of American women contained significantly higher percentages of fatty acids as stearic (18:0) and oleic (18:1)

acids, unsaturated fatty acids (UFA), and monounsaturated fatty acids (MUFA) than milk of Egyptian women. Percentages of fatty acids as palmitic (16:0), palmitoleic (16:1), and linolenic (18:3) acids were similar for both groups. The PUFA:SFA ratio in Egyptian milk samples was 0.54 ± 0.18 compared to 0.47 ± 0.22 in American milk samples. The differences were not statistically significant ($p > 0.05$).

Medium-chain SFA (capric, lauric, and myristic) comprised 19.8% of the total fatty acids in Egyptian milk whereas they accounted for only 13.7% of the total fatty acids in the American milk samples. Frequency distributions of lauric and myristic acids indicated that milk of American women generally contained small percentages (< 10%) of these fatty acids whereas milk of Egyptian women often showed significant elevations in percentage of fatty acids as lauric and myristic acids (10–20%) (**Figures 1 and 2**). Percentage of fatty acids as medium-chain SFA was inversely correlated to the percentage of total fatty acids as oleic acid in Egyptian ($r = -0.83$, $p < 0.001$) and American milk ($r = -0.66$, $p < 0.001$). A similar relationship was not found for palmitic acid; however, the percentage of total fatty acids as palmitic acid was inversely related to the percentage of total fatty acids as long-chain fatty acids (stearic, oleic, linoleic, linolenic, and arachidonic) in American milk ($r = -0.66$, $p < 0.001$) but not in Egyptian milk ($r = -0.28$, $p > 0.05$).

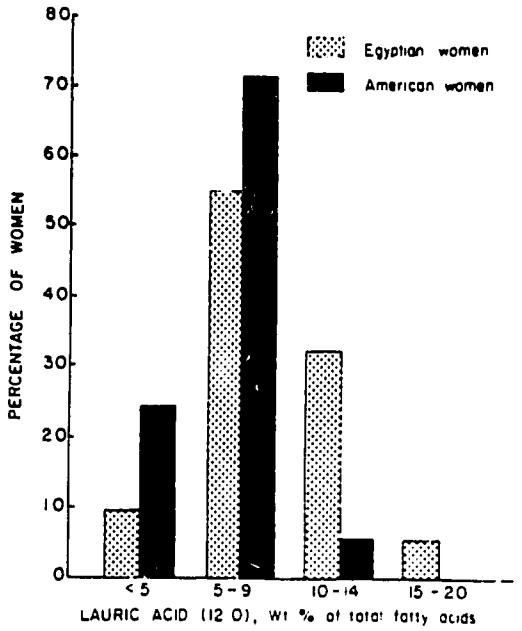

FIG 1. Frequency distribution of lauric acid as percentage of total fatty acids in milk from Egyptian and American women.

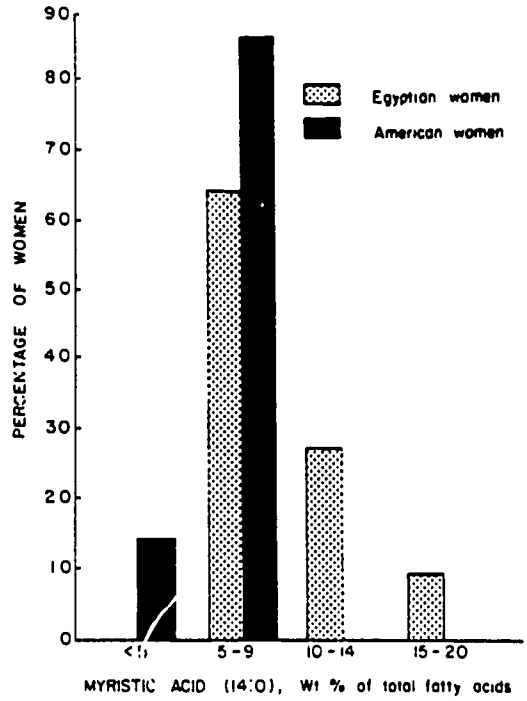

FIG 2. Frequency distribution of myristic acid as percentage of total fatty acids in milk from Egyptian and American women.

Discussion

Fatty acids appear in milk as a result of dietary intake, mobilization from fat depots, and endogenous synthesis by the mammary gland. The human mammary gland is capable of synthesizing SFA, primarily 10 to 14 carbons in length. Fatty acids of chain lengths > 16 carbons are not synthesized in the mammary gland and must be obtained either from the diet or mobilized from fat depots (3, 15, 16). Thus, the fatty acid composition of milk is dependent on the amount and type of dietary fat consumed, the total caloric intake, and, most importantly, the CHO intake of the lactating woman in relation to the total calorie intake (16–19).

Fatty acid composition of mature milk of American women in this study was similar to reports by other researchers (5, 20–23) except that linoleic acid comprised 17.2% of the fatty acids (Table 1). This was slightly higher than that observed by others (5, 20–23) in milk of women consuming ad libitum diets. Increased percentages of fatty acids as linoleic acid resulted in a slightly increased PUFA:SFA ratio of 0.47 observed in the milk of these women. Dietary intakes of linoleic acid have been reported to influence the content of this fatty acid in milk (4, 6, 7, 17, 18). Therefore, it seemed likely that the increase in the percentage of linoleic acid in the milk of American women in the present study was a result of increased dietary intakes of linoleic acid. During the past 25 years, there has been a marked increase in the consumption of vegetable fats relative to animal fats by the American population (20). American women in this study consumed primarily low fat or skim milk, margarine, included poultry and fish as frequently as beef and pork in their weekly diets, and used vegetable fats and oils for cooking. Therefore, fat contributed ~35–45% of the total calories in their diets, and in conjunction with other sources of energy was sufficient for weight maintenance. As a result a high percentage of the total fatty acids in the milk of these women appeared to have been of dietary origin. This was supported by the fact that medium-chain SFA comprised only 13.7% of their milk fatty acids. Palmitic acid can either be synthesized by the mammary gland or obtained from the diet. The percent of palmitic acid in the milk of American women was significantly correlated to the percentage of long-chain fatty acids in their milk. These findings, similar to those of Read et al (19), indicated that the content of palmitic acid in milk probably was related to those fatty acids derived from the diet rather than from synthesis by the mammary gland.

Oleic acid represented the largest percentage of total fatty acid analyzed in both American and Egyptian milk samples; however, levels of oleic acid in Egyptian milk were significantly less than those in American milk (**Table 1**). Levels of oleic acid in American milk samples were within the range of 33 to 40% of total, reported by others (4, 20, 21, 23). The percentage of oleic acid most likely represented not only oleic acid but also its trans isomer, elaidic acid, since the 5% DEGS-PS column used in this study did not separate cis and trans isomers. American women were consuming ad libitum diets containing significant amounts of hydrogenated fats. Dietary intake of hydrogenated fat has been reported to significantly influence the levels of elaidic acid in human milk (24). Dietary fat intakes of the residents of Kalama suggested that Egyptian women consumed diets containing limited amounts of hydrogenated fat. Unhydrogenated cottonseed oil contributed ~90% of the total fat intake. This difference most likely contributed to the higher levels of oleic acid observed in American milk compared to Egyptian milk.

The fatty acid composition of the milk of Egyptian women was, with few exceptions, markedly different from that of American women in this study. This was not unexpected since the diet of Egyptian women differed considerably from that of American women. In addition, the possibility exists that some of the Egyptian women were marginally malnourished since this condition was observed in the village of Kalama. Due to the preliminary nature of the study, it was only possible to obtain information regarding dietary con-

TABLE 1
Weight percent (wt%) of fatty acid composition in mature milk of Egyptian and American women

Fatty acid	Milk: Egyptian (n = 22)	Milk: American (n = 21)	p
	wt%	wt%	
Saturated, total	47.7	41.9	<0.05
10:0	1.6 ± 0.9*	1.0 ± 1.1	<0.05
12:0	9.1 ± 3.2	6.5 ± 2.3	<0.05
14:0	9.1 ± 3.8	6.2 ± 1.7	<0.05
16:0	22.4 ± 3.2	20.9 ± 4.4	NS
18:0	5.5 ± 2.2	7.3 ± 1.9	<0.05
Unsaturated, total	52.4	58.2	<0.05
Monounsaturates, total	27.7	39.6	<0.05
16:1	3.1 ± 0.9	2.9 ± 1.4	NS
18:1	24.6 ± 5.7	36.7 ± 4.8	<0.05
Polyunsaturates, total	24.7	18.5	<0.05
18:2	23.8 ± 5.1	17.2 ± 6.2	<0.05
18:3	0.7 ± 0.5	1.3 ± 1.7	NS
20:4	0.2 ± 0.3	0.1 ± 0.2	<0.05

* Mean ± SD.

sumption trends in the village and not dietary intakes of specific subjects.

Linoleic acid accounted for 23.8% of the fatty acids in milk of the Egyptian women. These findings were contrary to those of Soliman et al (25) who reported that linoleic acid comprised 7.65% and 7.97% of the fatty acids in the milk of rural and urban Egyptian women, respectively. UFA comprised 40 to 43% of the fatty acids in the milk of these women. These researchers attributed the lower levels of UFA in the milk of these women to their high intakes of hydrogenated oils as the primary source of dietary fat. Precise caloric intakes of these women were not reported but were said to be generally less than the recommended allowances. Percent of total calories from fat and protein was not included but the percent of total calories from CHO was 68 to 82% and similar to those in the present study. In the present study, Egyptian women consumed diets where unhydrogenated cottonseed oil containing high amounts of linoleic acid, comprised ~90% of the fat. Therefore, increased levels of linoleic acid in the milk of Egyptian women reported by us can be attributed to dietary intakes of the acid (4, 6, 7, 17, 18) as well as other factors such as caloric intakes.

Preliminary analysis of Egyptian diets indicated that fat supplied 18–20% of the total calories and CHO supplied 70% of the total calories. Also, the fat content of the Egyptian diet appeared to increase as the socioeconomic status of the family increased. Read et al (19) observed that consumption of diets containing high percentages of CHO resulted in increased lauric and myristic acid levels with a concomitant reduction of oleic and stearic acids in the milk of lactating women. Increases in dietary CHO appear to favor increased synthesis of medium-chain SFA by the mammary gland (18). Milk of Egyptian women in this study contained significantly higher percentages of capric, lauric, and myristic acids and significantly lower percentages of oleic and stearic acids compared to American women. In addition, the percentage of oleic acid in the milk of Egyptian women was inversely related to that of the medium-chain SFA, a finding recently observed by Bitman et al (23) in the milk of mothers of both preterm and term infants. Despite the increased percentages of medium-chain SFA, the PUFA:SFA ratio in Egyptian milk remained significantly higher compared to that in milk of American women due to the considerable amounts of linoleic acid in milk of Egyptian women (Table 1).

Assuming that the total fat concentration of milk from Egyptian and American women was similar and within the normal range, the possible nutritional implications of these findings to the infant is of considerable interest. For the American infant, increased percentages of linoleic acid in milk will result in increased intakes of this fatty acid. The American Academy of Pediatrics, Committee on Nutrition (AAP.CON) has stated that linoleic acid comprises 8 to 10% of the fat in human milk (26); however, results of this study and those of others (5, 20, 23) suggest that linoleic acid may comprise up to 14 to 18% of the fat in milk of American women consuming typical Western diets. Although linoleic acid is an essential fatty acid necessary for growth and development of the CNS (3), excess linoleic acid produces excessive peroxidation and increases the vitamin E requirement of infants (26). The AAP.CON has recommended that infants receive 0.3 IU of vitamin E/100 kcal and at least 0.7 IU of vitamin E/g of linoleic acid (26). However, lactating women who increase their dietary intakes of linoleic acid also increase their intake of tocopherols since foods high in linoleic acid may have higher vitamin E content as well (6). Jansson et al (21) found a significant correlation between total tocopherol content and the linoleic acid content of mature human milk of Swedish women and the AAP.CON recommendations were met in 21 of 24 samples. Although further investigation is needed, it seems unlikely that levels of linoleic acid that comprise up to 18% of the fatty acids in milk place the infant at risk. In contrast, linoleic acid comprised nearly one-fourth of the total fatty acids in the milk of Egyptian women. Despite the naturally high vitamin E content of cottonseed oil (11), some vitamin E may be lost due to storage conditions in Egypt, particularly exposure to sunlight and warm temperature. Thus, the milk of Egyptian women may contain proportionally less vitamin E/g linoleic acid compared to that in milk of American women. This possibility warrants further investigation.

Fat in human milk, especially medium-

chain SFA, is well absorbed by the infant (23, 27). In addition, medium-chain triglycerides, from which medium-chain SFA are derived, are more easily hydrolyzed than long-chain triglycerides (23). For this reason, the increased percentages of medium-chain SFA in milk of Egyptian women may be beneficial to their infants. However, Crawford et al (3) observed both increased levels of medium-chain SFA and lower fat content (< 2%) in the milk of malnourished women compared to values for well-nourished women. Also, infants of malnourished women have lower milk volume intakes than those of well-nourished women (2). If Egyptian women were marginally malnourished, possible advantages to the infant resulting from high levels of medium-chain SFA in milk could be compromised by decreased intake of milk containing lower amounts of fat and thus lower energy. These could seriously affect the nutritional status of these infants.

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Attachment H

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ABSTRACT FORM

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5th International Congress on Obesity

RELATIONSHIP OF ADULT HEIGHT TO OBESITY IN EGYPTIAN WOMEN

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Obesity in the US shows no relationship to adult height. However, this relationship has not been investigated in developing countries. In some developing areas, obesity is emerging as a public health problem even in the persisting presence of a high prevalence of undernutrition in children. It is possible that short stature resulting from early malnutrition could result in increased risk for adult obesity.

We investigated the relationship of height to Body Mass Index (BMI) in 350 adult women aged 20 to 50 in an Egyptian village in the Nile delta. All subjects underwent a clinical examination, were weighed and measured by a physician, and participated in a brief interview. None had any serious illness.

Mean height (± sd) was 155.5±6.1 cm (range 114-178 cm). BMI ranged from 15.0 to 48.0 ($\bar{x}$±sd=26.0±5.3). The prevalence of obesity (BMI>30) was 20 percent, and of overweight (BMI>25) 60 percent. BMI showed no relation to reported age. BMI was negatively related to height ($r=-.21$, $p<.00001$). This association was attributable to the extremes; i.e., those with heights over 170 cm all had BMI<20, while the two severely obese individuals (BMI>45) were quite short (113 and 125 cm). BMI was not related to height in the range from 140 to 165 cm.

Although we do not have data on the childhood nutritional experience of these women, the prevalence of childhood stunting in Egypt as a whole and in this village is on the order of 25 percent and has changed little in the last two decades. We speculate that marked stunting due to early malnutrition may elevate risk for obesity in adult life.

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Attachment I

ABSTRACT - FARMING SYSTEMS SYMPOSIUM 1986

WOMEN'S FOOD PRODUCTION ACTIVITIES IN AN EGYPTIAN VILLAGE UNDERGOING SOCIOECONOMIC TRANSITION

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Kalama, an Egyptian village in the rich Nile delta region, is located 25 kilometers from the heart of Cairo. Kalama is best described as a village undergoing rapid socioeconomic transition. Its proximity to Cairo is but one factor facilitating change. The village is also bisected by the major highway which connects Cairo to Alexandria. In addition, Kalamans communicate regularly with family members working in the oil-rich gulf countries; many residents own television sets and/or radio cassette equipment.

The village economy is mixed. In 1982, 24% of the 1,470 households derived its subsistence largely or solely from farming, 65% from commercial and governmental occupations, and 9% from a mixture of the two sources. Despite this economic mix, women's food production activities remain unaltered. This is not surprising since village culture supports economic diversity at all levels of social organization. Economic diversity is particularly evident in extended households.

This paper will describe women's food production activities in the various types of households. It will also provide a cultural analysis of village life to illustrate how cultural expectations of women support their involvement in a wide variety of food production activities. Socioeconomic factors such as household economic resources and amount of formal education appear to have less influence on women's food production activities than do cultural expectations.

Our data support the need for a comprehensive cultural analysis of change processes in transitional or mixed economies in order to determine the rate and direction of change for specific elements of a culture. We hypothesize that maintenance of traditional food production activities is closely linked to maintenance of food habits, food consumption patterns and nutrition. If so, there are important policy implications here.

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Nutrition Intake and Function

Dr. Osman Galal, Principal Investigator

TABLE OF CONTENTS

I. PROJECT OVERVIEW

Mild and moderate deficits of food intake are prevalent in Egypt. The data from the National Nutrition Survey (1978-1980) demonstrated that chronic undernutrition is common but acute undernutrition is rather rare. The functional consequences of mild undernutrition have not been systematically studied. The present project is a collaborative research effort between the University of Arizona, the University of Kansas, Purdue University, and the Nutrition Institute (Ministry of Health of Egypt), funded by USAID and with the objective of investigating the functional effects of mild to moderate undernutrition. There are two other projects in Mexico (the University of Connecticut and the National Institute of Nutrition in Mexico) and in Kenya (the University of California and the University of Nairobi). The overall three-country Collaborative Research Support Program (CRSP) is administered by the University of California at Berkeley. The scientific management is handled by a Scientific Coordinating Board (SCB) the members of which include the principal investigator from each US institution and each overseas institution.

Major objectives of the Egyptian project include:

1) the prospective investigation of the effects of variation in energy intake on functional performance in terms of course and pattern disease frequency, reproductive outcomes, cognitive and sensory function, physical activity and work performance, and social performance, (defined in locally relevant terms).

2) development and validation of techniques and instruments for further field research; and

3) assistance to Egypt in developing the infrastructure to improve nutrition services.

Phase I was completed in one year (September 1982 - November 1983) and consisted of pilot studies necessary to decide, in collaboration with the Mexican and Kenyan projects, critical details of design for the preparation of the longitudinal study. These preliminary studies included the ethnographic pattern of the village community selected (Kalama village), the distribution of nutritional status in that community, description of the mortality, fertility, and morbidity characteristics, and pilot testing of methodology projected for use during collection of data which included testing of the feasibility and practicability of all methods.

The longitudinal study consisted of 312 households in Kalama village which were studied for 2 years (November 1983 - December 1985). The data were collected according to protocols agreed upon and approved by the technical advisory groups of the overall CRSP. Household eligibility criteria included the presence of a leading male, a leading female of childbearing age, one toddler and/or one schooler. In February 1984 the presence of a pregnant female was added as a criterion for household eligibility. Anyone within a household suffering from severe malnutrition, severe physical handicap, severe psychiatric illness, or illness requiring severe dietary restriction was excluded from the study.

The various areas of scientific investigation included food intake, nutritional status, and several types of functional variables (reproductive outcomes, cognitive and social status, disease experience and immunocompetence, social performance and work performance). Senior scientists from the Nutrition Institute and Egyptian universities were assigned for each area, and worked with their U.S. counterparts from the three U.S. universities (Arizona, Kansas and Purdue). The Nutrition Institute staff reallocated their activities to cover all the necessary activities. The staff of research assistants of the Nutrition Institute underwent extensive training in a program specially designed for this project.

The core measurements were:

1. Food Intake

Since the project was designed to assess relationships between food intake and function, the quantity and nutrient composition of the respondents dietary intake was measured with the greatest accuracy possible. Care was needed to operate within local tradition, conventions, and cultural norms, and, at the same time, avoid risk of excess intrusion to families which might cause refusals to participate. This necessitated ethnographic studies which was conducted by Dr. Sohair Stolba in conjunction. The study showed, in great detail, the food flow within a household, and also, that food has its own prestigous position in a typical Egyptian household. The observations of the ethnographic study confirmed some of the approvals for collecting food intake data.

2. Nutritional Status

The central focus of the research design was on energy intake; therefore, energy was also the focus of nutritional

status measures. It included both anthropometric and clinical measures, with the anthropometric measures forming an extensive longitudinal data base on each subject.

3. Morbidity and Immune Functions

A close association between malnutrition and disease was anticipated to be shown in the study. The main objective of this work was to identify the interactions of mild-to-moderate malnutrition with appearance history and/or immune function changes. This work included collection and analysis of disease histories, and biochemical analyses of biological samples. The biological analyses included secretions of tears, saliva, and breast milk. Studies for secretory immunity and cellular immunity were via skin (tine) tests. Methods were chosen to minimize blood sampling and invasive procedures.

4. Reproductive Performance

The project was concerned with the problem of maternal nutritional depletion over several pregnancies and periods of lactation, and therefore measured pregnancy outcome (fetal outcome) and lactation performance. Pregnancy outcome was assessed utilizing anthropometric measurements, and notation of any neonatal abnormalities such as recording of stillbirths and miscarriages. Gestational age was estimated using the Dubowitz scale and the dates of the last menstrual period. Maternal food intake and maternal energy expenditure are discussed in the Food Intake section and Work Performance section of this report. Adequacy of lactation in terms of milk quantity and nutrient composition were assessed by measurement of infant growth before supplementary foods are introduced and by some measurement of breast milk quality.

5. Cognitive Performance

The relationship between mild-to-moderate malnutrition and cognitive functioning was the focus of this sector. This relationship is not a simple linear one. A variety of factors overlap with chronic mild malnutrition, to either magnify or diminish the impact upon cognitive development. These factors included chronic morbidity, disturbances in caretaker-child interaction patterns, and the child's own individual and behavioral characteristics, such as growth pattern and pattern of activity level.

Specific tests were adjusted to account for cultural differences between the CRSP projects, with the emphasis being on the measurement of cognitive processes rather than on the utilization of specific tests.

6. School Performance

The school performance of children were studied. An adequate methodology for studying the school performance was designed as outlined below:

a) school performance was measured as attendance and grade earned;

b) the household budget for allocating time and energy of household members to productive tasks was observed and recorded.

7. Social Processes and Social Performance

Culture-specific methodologies were developed to study child caregiving, hygienic practices and time use by target household members. In addition, data were obtained on selected social processes viz. food exchange and sharing patterns of intro-family food distribution, pattern of communication with local and distant communities, acquisition and use of water, oresence or absence of safety hazards and protection of children from danger, and significant life events.

8. Work Capacity

The relationships among mild-to-moderate malnutrition, physical status and resting metabolic rate were examined. Resting metabolic rate was determined and used for the purposes of this project. The difference between energy intake and RMR of an individual provided an estimate of the quantity of energy theoretically available for physical activity. One hypothesis examined was that a decrease in RMR is a path of adaptation to maintain energy balance when energy intake is inadequate.

II. RESEARCH ACTIVITIES

A. FOOD INTAKE RESEARCH ACTIVITIES:

Food intake research activities were conducted by a team supervised by a senior scientist who is medical nutritionist. The team is composed of:

A. Food Intake Data Management unit:

3 members acting; a medical nutritionist, a dentist nutritionist and a pharmacist nutritionist.

B. Field Researchers:

started by 10 competent senior dietitians and reached 19 during the peak of the study.

C. Reviewers at Nutrition Institute:

eight senior dietitians.

D. One junior statistician is involved in manual analysis of data.

In spite of previous vast experience of the food intake group, yet, before the start of the research activities of Phase II, each dietitian was exposed to intensive training for at least 3 months in the Nutrition Institute and in the field. Training and retraining was a continuous process throughout Phase II, through strict supervision, reviewing data collected and weekly meetings discussing difficulties, correcting errors and exchanging experience.

Since results available at the present time are very preliminary, so this report will present in brief the following topics:

Implementation of food intake data collection in the field according to protocol agreement.

II. Validation and quality control of food intake methods.

III. Food Composition Data Base, Conversion codes and Validation.

IV. Validation of Food Composition Data Base by Chemical analysis.

V. Biological evaluation of diets of toddlers.

VI. Data Analysis (Preliminary)

I. IMPLEMENTATION OF FOOD INTAKE DATA COLLECTION IN THE FIELD

A. Selection of Methods:

Food intake is the major independent variable to be measured. Therefore, a great deal of care has been taken to ensure that the core food intake design would fulfill the following criteria:

1. Feasible in all 3 project settings with some flexibility to suit local conditions.

2. Yield data which can be compared across projects with confidence.

3. Adequate to characterize the food intake of target individuals, the food used by the households, and the partitioning of the food resources among individuals in the households.

The focus in design decisions relative to the food intake core was on meeting the above criteria for energy intake.

During Phase I, lot of research activities were conducted to test feasiblity and adequacy of suggested methods. Based on previous experience of Nutrition Institute in that field, observation and weighing method was excluded due to its cultural unacceptability within the community. The method usually used by the Nutrition Institute was suggested; 24-hour recall with Sample Weighing. It was tested on 67 households (HHs) during Phase I for individual food intake assessment. Results proved its efficiency (ref. Red Book of Phase I-Egypt Nutrition CRSP).

For household food use, Household Food Inventory method was tested on 20 HHs for 3 successive days. Each HH was studied simultaneously by two dietitians ; one using HH Food Inventory, the other using 24 H-Recall with Sample Weighing. Detailed report was presented to SCB Meeting (Ref. published in Red Book of Phase I-Egypt Nutrition CRSP).

In brief, results revealed the following :

1. HH Food Inventory is time-consum ng and tedious both during performance in the field or in the handling of data .

2. It is not accepted by the community and may lead to negative reaction towards CRSP particularly with the long duration of the study.

3. Results obtained by HH Inventory could be obtained efficiently by the 24-hour Recall with Sample Weighing method.

4. As regards the information needed on the dynamics of food circulation in and out of the household, a modified form of that which was designed for 24-hour Recall and Sample Weighing was suggested. It became "Form II" which was used throughout Phase II for household food use.

5. It was felt that the four-day period suggested for data collection every month from each household would be tedious for the HH, particularly the target female. It was also felt that this would not be needed due to monotony of dietary pattern in the village. It was suggested that 3 days study in the first , fourth, seventh and tenth months of the year with two-days study in the rest of the months of the year would give enough opportunity to gain information needed. The survey period for each HH would be represented in first third, middle third and last third of the month during the three months of each season. Also the seven days of the week would be represented in the 3 months season. These suggestions were accepted and adopted during Phase II with minor modifications to facilitate flow of work and to suit local conditions. Thus, during Phase II those HHs which were studied during the first third of the month were exchanged with HHs which were studied during the last third of the month at the middle of the study period. The system of representing the 7 days of the week during the three months of the season was adopted from beginning of Phase II till end of March 1984. Then it was found necessary to omit Fridays from study days due to several reasons. These were explained in details in the documents presented to May SCB Meeting 1984; "Rational for changes in field schedule and quality control method in food intake", (Ref. Attachment "I" in the Annual Report of Nutrition CRSP -Egypt Project,October 1983 - September 30,1984). <u>In brief, it was found that</u>:

* On the third consecutive day of the study the target female "T.F." becomes bored and feels the monotony of the process which affects reliability of the information she gives.

* On Friday, the target male "T.M." usually stays at home "Official holiday" and does not welcome the disturbance.

* On Friday, the T.F is usually overloaded with many responsibilities (shopping, cooking, serving guests) so she does not welcome interference.

* On Friday, food intake of Thursday, which is an ordinary day of the week, is recorded. while food intake of Friday, which is the best food of the week, is recorded on Saturday.

FOR DATA COLLECTION DURING RAMADAN FAST AND FEASTS:

Pilot study was conducted during Ramadan Fast and Feast of 1983 during Phase I to test proposed methods for capturing changes in dietary pattern. During Ramadan Fast data were collected during 1st 10 days, intermediate and last 10 days. There was difference in energy intake during first and last 10 days only and so it was decided that food intake data collection would be carried out through one day within the 1st 10 days and another day within the last 10 days. However during Ramadan Fast of Phase II 1984, 120 HHs were already included in the sample and their days of study were scattered all over the month, so the usual field schedule was followed and almost all the sample was studied during Ramadan Fast. The method tested for data collection during the Feast was the same one used during Phase II.

ADEQUACY OF THE PROPOSED METHOD:

24-Hour Recall and Sample Weighing which was tested during Phase I, proved adequate enough to capture differences in dietary pattern among different socio-economic status "SES" groups and through usual times, fasts and feasts. Results showed that energy intake of target individuals was highest for intermediate and sometimes low SES. Results were consistent and matched with anthropometric data. These results were a major factor to change the system of scaling of SES and start a new method of SES score during Phase II. Results also showed that energy intake of T. School, T. Male and T. Female was lower during Ramadan Fast than usual times and Feast. However, target toddlers who were not fasting, got higher energy intake during Ramadan Fast than usual times and highest energy intake during the Feast. This was most probably due to more availability of food within the house during Ramadan Fast and Feast.

Another interesting finding was a prominent gradient in consumption of sources of animal protein and fruits. It was highest in the feast, lowest in usual times and in between during Ramadan Fast (Figure 1). These results were presented in detail during the CRSP workshop in Phase I held in Nutrition Institute "N.I." from 6-8 September 1983.

B. PROCEDURE OF FOOD INTAKE ASSESSMENT DURING PHASE II:

The detailed steps of procedure were described in the Updated Manual: Food Intake. However, the procedure can be briefly described as follows:

- Food Intake Research Activities were implemented to fulfill the following objectives:

1. To obtain accurate amounts of foods and beverages consumed by individuals and households in the 24 hours preceding data collection.

2. To record and code the data accurately on the instruments provided.

- Instruments were designed and intensively tested and retested and updated till they were developed in their final form. The four instruments designed for collecting core research data on household and individual food consumption are listed below:

Form I : Household Census and Physiologic State of Adult Females (Appendix 1-A).

Form II : Household Food Intake Record (Appendix 2-A)

Form III : Household Recipes for Mixed Dishes (Appenix 3-A).

Form IV : Individual Food Intake Record (Appendix 4-A).

These forms were used from November 1983 till January 1985. Food intake data were entered in Kansas computer from start of Phase II uptil July 1984. Starting from August 1984, data were entered in Al-Ahram computer in Cairo and due to difference in systems, food intake forms had to be coded in addition to original codes and this consumed a lot of time and effort. So starting from February 1985, the food intake four forms of core research were modified so that no extra-coding would be needed. (Appendix 1-B, 2-B, 3-B and 4-B).

Form V : Household Food and Beverage Consumption Frequency Record (Appendix 5).

This form was designed to collect non-core research data at entry of household to the sample and before exit. It gives a brief profile about food pattern at beginning and end of the 12 months study of each HH.

-The Tools used were simply 0.5 kg and 10 kg dietary scales for weighing foods and beverages. A special wooden base was locally made and provided for each scale to ensure leveling conditions in the field.

- The Field Schedule was so designed as to collect data for 7 days of the week during a three months period. This system continued up to the end of March 1984 then Friday was omitted from the study days due to reasons stated previously (Page 3). For each HH and Target individual the study days rotated in a 3 months period as follows:

1st month : Saturday and Sunday.
2nd month : Monday and Tuesday.
3rd month : Wednesday and Thursday.

A household at entry can start on either Saturday, Monday or Wednesday.

- During Ramadan Fast of 1984 and 1985, the usual field schedule was adopted.

- For Ramadan Feast "El Fetr" and Bayrum. The schedule was modified so that about 30% subsample was studied. Dietitians collected data at first day of work after the feast holiday. They collected data on food intake on first and second day of the feast, using long term recall and sample weighing .

- Morbidity Subroutine: Food intake of targets suffering from specific illnesses which were reported from morbidity group through a well established system, was studied through the usual method. "24-hours recall and sample weighing" immediately after reporting and every other day until reported to be cured then 2 days after cure.

- Target Individuals were studied simultaneously with the household. They were :

. Target Male who is father of target toddler or target schooler or husband of a target pregnant-woman .

. Target Female who is mother of target toddler or target schooler and may be :

- Non-pregnant, non-lactating
- Pregnant
- Lactating
- Pregnant and lactating

. Target Schooler 7-9 years of age

- Target Toddler 18 months of age at entry of study.

Target pregnant who is studied monthly from beginning of fourth month of pregnancy till delivery and then for first 6 months of lactation.

- Target Infants from birth to 6 months of age .

SEQUENCE OF FOOD INTAKE ACTIVITIES:

PRE-FIELD:

1. Senior scientist received Master field Schedule of the month from Field Coordinator.

2. Senior scientist - assisted by data management unit of food intake group - developed a weekly food intake field schedule with individual dietitians assignments; two HHs for each. Assignments were distributed during the weekly group meeting at Nutrition Institute with Form I .

FIELD:

3. Field dietitians completed their assignments of data collection in the field. They record the information in their notebooks.

POST-FIELD:

4. At the Nutrition Institute, they transferred the data collected to the specified forms and recorded appropriate codes from the document they have (Food Codes for Use in Egypt).

5. Within 2 days they submitted completed forms to Data Management Unit of Food Intake Group "DMU-F.I.".
This process was recorded in Record Book. A sample is shown in Appendix 6.

6. The completed forms were then distributed to reviewers. Each reviewer received the forms of 2 field dietitians.

7. Within 2 days, reviewers submitted forms to DMU-F.I. This process was also recorded in the Record Book.

8. DMU-F.I. staff had a final comprehensive review of the forms.

9. DMU-F.I. submitted finalized forms to CRSP DMU. This process was also recorded in the Record Book.

The Senior Scientist developed the system, supervised and checked efficiency of the staff and adequacy of the system throughout the whole process. Problems were discussed and solved. The Record Book proved to be a good monitor for integrity of the process and helped in early detection of any deviations from the correct flow. The flow of activities continued as described above from November 1984 till end of January 1985. Starting from February 1st 1985, the flow was modified; step 4 ,i.e. transferring food intake data from notebook to forms and recording appropriate codes was carried out by Junior dietitians. Field dietitians "Seniors" were assigned four households each instead of two. This decision was taken after engagement of 6 newly graduated dietitians to CRSP during July and August 1984. In spite of their intensive on-the-job training, it was noticed that during the few months of their participation, rate of refusals increased. After this modification of the system, the rate of refusal returned back to the usual rate of 12%.

MONITORING OF FOOD INTAKE ACTVITIES:

Through checking of record book every week, a list of missing data by cause was submitted to senior scientist. This was discussed in the weekly meeting with concerned dietitians.

The causes of missing data included:

- Late submission to DMU-FI
- Refusal of the HH in study
- Inavailability of T.Female :
    - temporary
- moving to another house
- leaving the village

In case of inavailability of T.Female, the visit was attempted again the next week. If the refusal was repeated, the situation was reported to the concerned group of social workers who visited the HH and investigated the cause of refusal. After the feedback and discussion of the refusing families became cooperative later on.

<u>Later during the study check lists were prepared for:</u>

1. Missing data by cause: the major segment was refusal and this did not exceed 12% throughout the study on the average.

2. Record of HH numbers which were submitted to CRSP DMU and not received from Kansas by month. Copies were submitted to CRSP-DMU and to Field Coordinator.(one page, e.g. Appendix 7).

3. Record of core pregnant women who were studied monthly (one page, e.g Appendix 8). Missing data not exceeding 12%.

4. Record of pregnant substudy by month (one page, e.g. Appendix 9).

During the weekly CRSP Meetings any problems related to other activities were discussed and solved.

BRIEF DESCRIPTION OF FOOD INTAKE METHOD "24-HOUR RECALL AND SAMPLE WEIGHING":

The target female was asked to report on the food items and mixed dishes consumed by household members on the day prior to the day of data collection. Information was requested for eating events in sequence; beginning with the first eating event of the day. Dietitians recorded the data in Arabic in notebooks specifying each event whether major or minor and recorded food items in each event then inquired about number of household members sharing each food item. If mixed dishes such as those made of cereals or cereal products, legumes, cooked vegetables or meat were reported, the dietitians first determined whether they had been prepared at home or purchased. If home made, the amount of each ingredient in the recipe was obtained and recorded in the pre-preparation state. Ingredients purchased by weight were recorded. For ingredients purchased by price, the dietitian purchased a similar item with similar price and recorded its weight. If ingredients were obtained from home stores e.g. onions, oil, ghee, garlic, etc., the dietitian asked the target female to bring a similar size or similar amount by household mesaure and she recorded its weight by the weighing scale. If the mixed dish had been purchased ready to eat from the market e.g. stewed fava beans, "foul medamis" or Kushary, the amount of each ingredient in the product was transformed in the field in its pre-prepared weight e.g., weight of stewed beans was divided by 3 to record weight of dry beans. Ingredients of recipes such as kushary were recorded from the list of recipes which had been studied in Kalama during Phase I, and given to each dietitian as appendix 7 in the collection of documents she used for the study (Ref.).

Simple food items as eggs, cheese, meat, etc., were recorded after weighing similar portions in the household.

For each food item recorded in the household food consumption instrument, the flow of food in the HH was recorded by inquiring about source of food whether purchased, gift, from field, etc. and about fate of food prepared for HH use but not conumsed (Appendix 2).

After finishing with the HH food consumption, information was then obtained about food intake of each target individual. For cooked dishes consumed communally, additional information was obtained about distribution ratios based on the portion consumed by each target in relation to the target female respondent. For simple food items similar portions were weighed.

OBSERVATIONS AND IMPRESSIONS OF DIETITIANS THROUGHOUT THE TWO YEARS STUDY IN THE FIELD:

A. Major Causes of Refusal of Food Intake Study:

1. Collecting blood samples by physicians from target individuals.

2. Weighing toddlers by physicians was followed sometimes accidentally by illness of the toddler. This was explained by evil eye and refusal of researchers including food intake group.

3. Food was considered a very private family affair. They were particularly annoyed by weighing toddlers' diet.

4. Participating HHs did not feel any appreciable reward from the researchers.

5. Treatment given was not sufficient and sometimes the N.I. physician prescribes a medicine to be purchased, so many of the participating HHs resort to private doctors.

6. Twice monthly visits of dietitians for 12 months was considered too long period and most participating HHs became bored during the last months of the study.

7. Sometimes the target female was cooperative but afraid tc give information in the presence of her husband or mother-in- law. Target males needed more intensive orientatcn about the study.

8. Counting the HH members sharing each food item in the different eating events caused a lot of nuisance.

9. Inquiry about source of food to define the food dynamics in the HH was always answered with caution. Most of participating HHs denied the field and home stores as sources of food and pretended that they purchased everything. This again was to protect themselves from the evil eye. However, the dietitians could reach the true information by asking other indirect questions.

10. Frequency of consumption of different food items (form V) which was non-core research activity was sometimes boring to them and the dietitians usually divided the forms among the two days study, i.e. two 30-minutes sessions. When this form was inquired for the second time before exit of the HH, the Target female was reluctant to answer the questions and expecting the dietitian to have known this information already from the first time at the beginning of the study.

B. Dietary Habits:

What was written in this part was not based on computer or manual analysis of food intake results. It was abstracted from observations of dietitians during their work. The following points summarized those observations:

1. Plenty of geese, ducks and rabbits were grown in the houses but very rarely consumed. It seemed that they were sold.

2. Milk was rarely consumed even for toddlers. HHs which owns cows and buffalos use milk in production of cheese which they both consume and sell.

3. Sugar and water was very commonly consumed by toddlers.

4. Through the morbidity subroutine, it was noticed that during attacks of diarrhea, the toddler was offered the usual family diet. During attacks of fever, toddlers were offered sugar and water or plain tea.

5. Most toddlers drink nearly the same amount of tea as adults or a little less.

6. Cooked vegetables which were consumed cooked like okra, squash, egg plant, were usually consumed raw by toddlers, whether during preparation of the meal in the house or in the market.

7. Green salad was very rarely consumed but its ingredients were commonly consumed as fresh green vegetables, e.g. lettuce, cucumber, green onions and tomatoes.

8. Chard which is commonly cooked with colcacia in the city, was not consumed in Kalama. It grows spontaneously in the land and used as animal feed. Sometimes it was sold at very cheap prices. If they cook colcacia, they cook it with tomato sauce.

9. Garlic was grown in the land but consumed in minute amounts; mostly sold outside the village.

10. There was very little consumption of yellow carrots, inspite of large amounts of production. It was transported outside the village.

11. Squash was available in the Kalama market but consumed at low level. Peas were not available in the Kalama market and were rarely consumed. Artichoke was not consumed at all.

12. Mallow was rarely consumed.

13. Potatoes were highly consumed in many different varieties of recipes; boiled and mashed with oil, boiled then fried, or fried.

14. Varieties of fruits consumed were very limited; dates and guava in summer, oranges and mandarine in winter. Banana was rarely consumed.

15. The amount of fat used for stuffed vegetables (Mahshi) was large. Usually different varieities were used simultaneously, e.g. beef fat, oil and ghee.

16. Tameya was usually consumed without bread by toddlers.

17. Average amount of salt consumed per person per day usually does not exceed 5-6 gram. In winter, weight of salt is usually higher because of the high moisture content.

18. Yoghurt was rarely consumed. It was not prepared at home or sold in the market. When consumed, it was purchased from Qaliub.

19. Almost, there was no table waste. Left overs of dinner were consumed next day at breakfast.

20. Guests who shared the food were very few, only on occasions as seventh day after delivery usually of a baby boy "El Souboh" or in weddings.

21. Most food items consumed were purchased; even Koushary was purchased ready to eat from the market.

22. After delivery, the lactating mother was usually offered chicken - which was shared by other members of the family - only for the first 2 days; then she was offered the usual family diet.

23. Some mothers only breast feed the infants and do not offer the child any external food until he asks for it.

24. Ice cream "Granita" which is composed of water, sugar and a fruit flavour was highly consumed during summer by toddlers. It is locally produced at homes under poor hygienic conditions.

25. Only frozen fish was consumed. It was purchased from cooperative society of the village at 40 P.T. per kg which was very cheap compared with prices of fresh fish.

26. Salted fish "Fesik" was not commonly consumed on "Sham El Nessim" which is a national Feast as it is commonly consumed in Cairo and most of Egypt. On that day most HHs consume boiled sprouted beans.

27. On days of religious ceremonies, most HHs if not all consume meat, chicken or ducks.

28. During the main Feasts particularly Ramadan or "El Fitr", large amounts of biscuits and cookies were home made and consumption was high for several weeks until the stock was over. Biscuits and cookies were mostly consumed at breakfast by all HH members and as snacks by toddlers.

29. In brief, it can be stated, just by observation, that in Kalama; breakfast was usually composed of bread with either full cream white cheese, or stewed beans or tamia or left over of cooked vegetables from dinner. Rural bread was predominating, however, sometimes ordinary balady or french bread was consumed.

The main meal (lunch) was usually composed of cooked vegetables or potatoes with bread or rice. Meat was included on Fridays.

The evening meal may be like breakfast or lunch but is usually like breakfast.

Minor eating events or snacks include a big variety of foods and beverages, however tea was the commonest. For toddlers, the commonest were Kerate', biscuits, sweets and in the evening sugar and water. Cheese sandwiches "basha" are commonly offered to toddlers between meals.

30- Usually on one day the Target Female prepares cooked meals and the second day the family consumes the left overs. Thus it is noticed that usually in one of the 2 days of study larger amounts of food were consumed than the other day. This phenomenon is common with low income groups in general and this may explain the large intraindividual variation sometimes detected in energy intake.

VALIDATION AND QUALITY CONTROL OF FOOD INTAKE METHODS

To ensure validity and accuracy of food intake data collected, several methods of validation and quality control have been designed and attempted in the field. However, some of them proved feasible and acceptable and others proved infeasible in the community of Kalama. In this part a brief account is presented with some of the results.

A. METHODS NOT FEASIBLE IN THE EGYPTIAN RURAL COMMUNITY

1. Rotation of Dietitians Every 3 Months

Out of 24 HHs whose assigned dietitians were rotated, 6 HHs refused to give information to the new dietitians i.e. 25% refusal. Other HHs who accepted the new dietitian did not welcome the change and treated the new dietitian with caution. One of the HHs was visited on the same day by both the new then the old dietitian as requested by the new. Two different types of data were given to the 2 dietitians; the correct information was given to the old dietitian. The two forms were kept as a document to prove that in the Egyptian rural community, it is very important to gain confidence and friendship of the people in order to get the proper information about food intake which is considered a very private concern of the family.

Also rotation created a row in the village about the motives behind the change of the dietitian and lot of inquiries from the households were raised if something wrong has happened.

So, this method was stopped for the food intake group.

2. Reliability of Data given by the Respondent:

Each household in the sample would be studied twice on the same day by two different dietitians, once during the one year study. This method was started at the end of February 1984. Three dietitians were assigned 9 HHs for quality control by this method. Only 4 HHs could be studied for the second time on the same day , i.e. less than 50% achievement. Even the HHs which could be studied, did not welcome the process and expressed negative reactions. The other 5 HHs refused totally to allow the dietitian to do her job. This method was thus discontinued.

3. Observation and Weighing by Trained Village Data Collectors:

The idea was to validate 24-hour recall with sample weighing method against weighed food intake of individual targets for the whole day. Due to cultural constraints, dietitians of the Nutrition Institute, could not stay in the village home for the whole waking hours from the morning till the evening. So, we resorted to middle level educated village girls and trained them for the job. The trained girls - 13 in number - declared they can perform this job only in selected households of their relatives and intimate friends beside their own households.

50 HHs were studied by the two methods,24-Hour Recall and Sample Weighing "X-R", and Observation and Weighing method "X-O" during September 1984 preceded by two months training of data collectors. Each HH was studied to assess food intake of the target individuals for the whole waking hours of the 24 hour period by "X-O" on one day. The next day the N.I. dietitian collected food intake data for the same individual targets during the same period by "X-R". Amounts of food consumed by each target as assessed by each method were converted to energy value as Kcal/target individual/day. The aim of the study was to test if there was significant difference between energy intake of each target individual by the two methods. Out of the 50 HHs studied by "X-O", 7 HHs were studied by trained household members and the rest by a relative or friend data collector. Of the 50 HHs, 15 were core HHs and the rest were non-core.

During implementation of the study, it was realized that the non-HH member data collectors could not accomplish thier job as designed and instead of doing observation and weighing for the whole waking hours, they resorted to short interval visits every 2-3 hours, attended the main meals and a new method evolved which was Short Recall with Sample Weighing "X-SR". The details of the cultural constraints and technical difficulties which lead to that conversion of "X-O" to "X-SR" were discussed in the preliminary report on "Observation And Weighing Method For Food Intake Assessment" published in the Nutrition CRSP-Egypt Project Annual Report, October 1983-September 1984.

Results of this study revealed no significant difference between total 24-hour energy intake of individual targets - except schooler - as obtained by the 2 methods and analyzed by t-test. There were also no significant difference between energy intake obtained in major eating events and minor eating events by the two methods. However, when comparison in depth was done, individual by individual, and not comparing the means of the group by the 2 methods, appreciable differnces were found in energy intake as obtained by the two methods particularly in case of toddlers. In depth analysis of data, where difference between energy intake per day by "X-O" and "X-R" was more than 20% of energy intake by X-O, was carried out for each target female "T.F." and each target toddler "T.T" in the study. A special form was designed to detect the causes of differences in energy intake in each case as obtained by the 2 methods. Items of comparison were:

1. Missed meals: major or minor.
2. Missed items: major or minor.
3. Differences in food items without missed data.
4. Differences in amounts of food items or ingredients of recipes and which amounts were reasonable.

This analysis showed very interesting results which were in favour of the Nutrition Institute dietitian. It also showed that the weak point in X-R is the minor eating event or the snacks which may be missed partially.

Results of this study showed that difficulties encountered in food intake study whether by 24-hour recall or by observation and weighing or by short recall are more or less the same. It has to be realized that conducting research within the community has its own limitations and what can be applied in metabolic wards or institutions cannot be applied within a household, particularly when these HHs are in an Egyptian rural community with all cultural and social constraints prevailing.

B. VALIDATION AND QUALITY CONTROL METHODS FEASIBLE IN THE EGYPTIAN RURAL COMMUNITY:

(1) Interviewer Reliability:

The method was adopted from the beginning of study and continued for several months. By this method, two dietitians enter the house simultaneously and study food intake at the same time; each filling a separate set of instruments (forms) and weighing food with her own scale. In most forms filled by this method, there were minimal differences between the forms of the 2 dietitians. However, statistical evaluation of the method has not yet been received from Kansas.

(2) Validation of Recall Data against Weighed Data:

This method was followed whenever feasible without problems . It was done for data of both the household and the individual. It was evolved by dietitians and then refined.

a. Household:

On day 1 of the two study days of food intake by 24 hour recall and sample weighing; if the T.F or care-taker was in the process of food preparation, all ingredients of the recipe were weighed and recorded on Form 2 labelled "Weighed During Preparation". On day 2, recall data was obtained as usual on form 2.

b. Individual:

On day 1 of the 2 study days, if the toddler was eating a meal or a snack, it was weighed and recorded on Form 4 labelled "Weighed During Eating".

On day 2 recall data was obtained as usual from the adult informant.

(3) Observation and Weighing by Trained Household Members Versus Short Recall and 24-Hour Recall by Dietitians:

After analysing results of Observation and Weighing by trained village data collectors, it was realized that to conduct a reasonably accurate Observation and Weighing Method "X-O", it should be implemented by a well trained cooperative eligible household member. Thus, a plan was designed to screen core househoolds for eligible members who can co-operate with us and do the job properly. Results of the screening showed that 60.6% of the core HHs have eligible data collector, i.e. adult or teenager female or male with middle level education. However, eligible data collectors who accepted to participate in the study constituted 47.9% of the total, while those who actually participated in the training process were only 4.2% of the total core HHs screened. So it was realized that "X-O" cannot be implemented on a large number of HHs enough to validate 24-hour recall with sample weighing "X-R" on sound statistical basis. It was thus thought quite reasonable to attempt validating Short Term Recall "X-SR" by "X-O" so that "X-SR" can be used for validating "X-R" on enough number of core households based on proper statistical grounds.

It was thus decided to study 15 core HHs by the 3 methods conducted simultaneously "X-O", "X-SR"and "X-R". Those HHs were chosen by the dietitians.

Qualifications for Selection of the Sample:

1. To have an eligible HH member who accepts intensive training for the job and accepts to carry out the job.

2. All HH members should be ccoperative.

3. The HH has a target toddler or a preschooler.

The process of selection and training was very tedious and time consuming. However, 15 HHs were studied by the 3 methods during December 1984, January and March 1985. On day 1, the trained HH member was observing, weighing and recording food intake of all targets from morning immediately after waking till just before sleep in the evening "X-O". Also on day 1, dietitian 1 from N.I. studied the food intake of the same targets by 2 hourly visits using short recall with sample weighing "X-SR". On day 2, dietitian 2 from the N.I. studied food intake of the same targets by 24-hour recall and sample weighing "X-R". Energy intake per day "Kcal" for each target was compared as obtained by the 3 methods. Data were sent to Kansas and Dr. Beaton; based on results it was decided that "X-SR" can be used to validate "X-R".

Results were analysed manually at N.I. ANOVA "F-Test" showed there was no significant difference between energy intake of all targets studied as obtained by the "X-O" vs "X-SR", "X-O" vs "X-R" and "X-SR" vs "X-R" - whether for total energy intake per day or energy intake obtained by major or minor eating events separately.

Detailed results showed very minor differences between mean energy intakes per day of all targets as obtained by the 3 methods (figure 2), as well as, mean energy intake obtained by major and minor eating events (Fig.3). Figures 4-7 show individual results of energy intake per day for the 4 targets as obtained by the 3 methods. It is evident that differences are minor. Table 2 shows mean percentage difference in energy intake as obtained by the 3 methods for the 4 targets. Differences were higher with minor eating events than with major. It was also higher in case of toddlers and schoolers than T.M. and T.F. On the whole, "X-O" was nearer to "X-SR" than "X-R".

Fig. 8 shows the difference between mean energy intake of targets as obtained by the 3 methods. The difference ranges from less than 10 Kcal to less than 70 Kcal

Fig.9 shows the difference between mean energy intake of major and monor eating events of 4 targets as obtained by the 3 methods. Although difference is minimal except in case of T.S.(difference in amount of bread), yet results point to some defect in X-R to capture minor eating events efficiently particularly for toddlers and schoolers.

Figures 10-13 show the same information but for individual targets.

(4) Short Recall Versus 24-Hour Recall by Dietitians:

A random sample of 50 core HHs was selected to be studied by both X-R and X-SR. Energy intake of targets obtained by X-R will be compared with that obtained by X-SR. The study was conducted during July-September 1985. HHs selected in the sample who refused to participate were substituted by other HHs randomly selected. The protocol was supported by Dr. Beaton. Results are still being analysed.

(5) Interviewer and Respondent Reliability by Continuous Analysis of Means and Variances of Energy Intake:

It is thought that this method is most reliable and most applicable.

FOOD COMPOSITION DATABASE, CONVERSION CODES AND VALIDATION

Based on previous experience from several Food Intake studies, a list of the Egyptian foods and beverages classified under main groups was prepared by NI during Phase I. A coding system was designed (Kansas & N.I.) in such a way as to allow additions of food items or beverages which may be encountered throughout the study. Food code is based on 2 digits denoting the food group, 2 digits denoting the food item within the group and 2 digits denoting the state of food or method of preparation to be consumed. (Food codes for use in Egypt).

The Food Composition or Nutrient Data Base was prepared mainly from FAO Food Composition TableS "FCT" for the Near East (1983), AUB Food Composition Tables for the Middle East (1971) and FCT of the Nutrition Institute "N.I" (1975). Kansas prepared the energy data base and N.I has completed the data base for the rest of the nutrients.

The process of how to determine energy content and rest of nutrients in the specified amounts of foods and beverages as recorded in Form 2 and Form 4, i.e. household and individual food intake respectively, was explained in detail in the document, "Guidelines for Computer Analysis of Food Intake Data, A Tentative Plan", presented early in the study (January 1984) to PIs and ME (App. 10). During May 1984, another document was developed to give more illustration for conversion of gm of foods and beverages to energy and nutrients.

<u>The first document discussed the following issues</u>:

1. Determining edible portions of food recorded on Food Intake (F.I) instruments.

2. Determining nutritive values of complex dishes.

3. Correction factors for prepared foods.

4. Determining vitamin A value of foods and beverages.

5. Handling foods and beverages not present in the FCT.

6. Calculating nutrient intake for individuals and comparison with a standard; Recommended Dietary Allowances (RDA).

7. Specific nutrients of interest for Nutrition CRSP.

8. RDA for Egypt:
   a. Protein quality.
   b. Iron quality.

c. Vitamin A quality.

9. Other indicators of dietary quality:
   a. Protein energy ratio "Pe%".
   b. The ratio of fat to energy "Fe%".
   c. The ratio of fat calories to protein calories.
   d. Amino acid score.
   e. Net dietary protein calorie percent "NDpCal%".

The Second Document: discussed detailed issues for the proper use of Food Composition Data Base to get energy value of food intake, examples are:

1. Conversion factors for weight change of legumes and cereal grains and grain products from dry to cooked state and vice versa.

2. How to calculate the nutritive value of rural bread with different state codes.

3. Measures to standardize the use of food state codes.

4. How to deal with some typical Egyptian recipes as Fetir-Meshaltet, Besesa, Basbousa and Lokmet El Kadi.

During the course of the study and after some preliminary results of energy intake of targets became available, it was decided to check validity of Nutrient Data base and computer algorithm to convertfood consumed to energy value. A procedure of in-depth exploration was developed for that purpose.

The Exploratory Exercise included the following steps:

1. 26 HHs were randomly selected from one of the printouts obtained from Kansas University.

2. The original forms of target individuals "Form IV" of these HHs were obtained from Data Management Unit "DMU".

3. Manual analysis of these forms of food intake of targets was completed using the same conversion values of data base fed to Kansas computer (82 targets).

4. Manual analysis was based on the same procedure always adopted to convert grams of different food items and beverages consumed but recorded "as purchased" in the forms - to its energy value. The steps were as follows:

- Amounts recorded as "purchased" were multiplied by

$$\frac{100 - \text{waste \%}}{100}$$

to obtain edible portion of foods consumed.

- Edible portion of each food item was multiplied by energy value as obtained from conversion codes used by Kansas computer e.g.

$$\frac{50 \text{ gm} \times 370}{100} = 185 \text{ Kcal}$$

All energy values used were those for raw foods or foods in the pre-preparation state.

5. Results of manual analysis were compared with results in print out regarding energy intake per day of each target.

The difference between manual computations "as purchased" and computer values was related to computer value as percentage.

App.11 shows one page, as an e.g., of the results of 82 targets. In the last column (comments) the percentage of difference between manual and computer values was presented.

Results of this exercise showed that there was significant differences in most of the forms either to the larger or to the smaller side. Accordingly some of these forms (15 HHs and 51 targets) in which there were significant differences between manual analysis and print out, were computed again but assuming that the values recorded in the forms are weights of foods "as consumed" and not as purchased. Thus waste % was not subtracted and energy values of cooked items were used. Energy values thus computed "as consumed" were compared with the printout values. Most of the figures were identical or with very little differences.

Furthermoree, forms in which there were differences between computer and manual computed energy values, were scruitinized for possible reasons for differences.

The reasons were thus identified.

Conclusion:

Based on all information gained through this exploratory excercise, it was decided that:

1. The computer algorithm should be corrected to fit with type of data recorded in the forms "as purchased" i.e., waste % would be computed to get the edible portion which would be ready for nutritive value computations.

2. Nutrient Data base of Egypt Nutrition Institute where food items nutritive value were presented in the raw or uncooked state, was the suitable data base to be used asit fits with food intake data in the forms "as purchased".

VALIDATION OF FOOD COMPOSITION DATABASE BY CHEMICAL ANALYSIS

Composite food samples were collected from 7 types of targets representative of intermediate SES, according to a protocol developed at Nutrition Institute (app.12).

The aim was to validate food composition data base by chemical analysis.

The process of collection of samples from the field was implemented by a group of field dietitians under direct supervision of the responsible senior scientist. Laboratory analysis was supervised by Dr. Ehab Hegazy.

Table (2) shows energy intake of target individuals as obtained by composite foods samples compared with laboratory analysis. Energy values obtained by manual analysis were consistent with values obtained during the course of the study. The difference between energy intake per day as obtained by manual analysis and that by laboratory analysis ranges from 90 Kcal to 404 Kcal whether plus or minus. Difference of manual analysis "MA" from laboratory analysis "LA" was not in one consistent direction; it is equally higher or lower. When the difference was related to value obtained by manual computations as percentage, it ranged from 4.3% to 21.2%. Chemcial analysis of one of the samples; target female pregnant and lactating, had to be repeated. Validation of computer computations with laboratory analysis was not yet available.

PRELIMINARY DATA ANALYSIS

Before getting some preliminary results of Food Intake data from Kansas, some attempts were made to compute manually energy and protein intake of target individuals. The aim was to have a quick idea which will help to monitor Food Intake activities. Thus some batches of data collected in April, September, October and November 1984 were computed for energy and protein intake.

When we started to receive printout of computer computations of energy intake from Kansas, some other attempts were made to visualize results. However, these

attempts are very preliminary as the size of accumulating data was still very limited.

During December 1984 before the January meeting in Cairo of SCB, some ideas for correlating food intake to other body functions were presented in several meetings at Nutrition Institute. Some examples of each of the 3 categories of data analysis are presented in this section.

A. Energy and Protein Intake of Target Individuals as Obtained by Manual Computations

Tables 3-A & 3-B to Tables 6-A & 6-B show energy and protein intake of four Targets in two seasons; Spring and Autumn. Distribution of targets by %RDA, as well as, percentage contribution of protein energy to total energy are shown.

B. Energy Intake of Target Individuals as Obtained by Computer Computation

Energy intake of targets and their distribution among different categories of energy intake during the study period, December 1983 - July 1984, is presented in a summarized form in Appendix 13.

Another collection of tables were developed from available computerized data. They are seven tables related to toddlers age, sex, type of feeding and energy intake by these parameters, as well as, energy intake by geographic location in Kalama.

The comment on Tables 7-13 is shown in Appendix 14.

C. Proposed Correlations for Food Intake

A collection of dummy tables were presented in CRSP meeting specified for Food Intake during December 1984. Tables were designed to correlate food intake with other areas. To avoid repetition, correlations are left to be presented in other sections.

BIOLOGICAL EVALUATION OF TODDLERS DIET IN KALAMA

Originally this substudy was thought to investigate the hypothesis that one reason for relatively high energy intake of toddlers per unit body weight was low digestibility.

The protocol for the field component of the study, using controlled quantative collection of food, urine and stools from target toddlers in the village for a metabolic

period of 72 hours, was designed by the senior scientist responsible for the food intake. (app.11).

The protocol was submitted and approved during July 1985. However, due to the tedious process of selection of the sample and due to the antagonistic attitude of Kalama residents towards the inpatient section of the Health Center,it was not possible to start the study before December 1985. The study was conducted from December 14-17, 1985 in Kalama Health Center. The whole process was completed smoothly and successfully through the active cooperation of all participants of the study together with staff of HC and administrative authorities at Kaluib as well as the parents of toddlers. Details of this study will be published separately. The information gained through the study was enormous. Chemical analysis, supervised by Dr. Ehab Hegazy, is getting on actively, but not yet completed. However, manual analysis of the 6 toddlers food intake during the 72 hours metabolic period have been completed. Results of a very accurate assessment of food intake of toddlers as obtained by: "Observation and Weighing" method "X-O" are now available. They are supporting and validating food intake assessment carried out through the CRSP study.

Tables 14-17 show preliminary results of food intake of toddlers through manual computations as obtained by observation and weighing method.

RESULTING PROJECTS

Several projects have been completed or are now being run as spin-offs from CRSP. In 1985 a 30-day zinc supplementation study was done on lactating mothers as they exited from the CRSP core, and a present study involves a group of lactating mothers being studied for pyridoxine deficiency. Also, a project studying fetal malnutrition is underway, and a FRICOR sponsome survey of feeding practions during diarrhea has been completed in Cairo and outlying areas. Other projects resulting from questions raised by CRSP data have recently been finished by the Ford Foundation and the Population Council in Cairo.

Because of the need to organize local data analysis for CRSP and other Nutrition Institute data sets, a Nutrition Institute Data Analysis Group was formed, and with the assistance and guidance of The Population Council in Cairo, a program for upgrading the analytical capabilities of the Institute was begun.

DATA MANAGEMENT

1. Household and Target Enrollment and Completion

Data Management activities for Nutrition CRSP began with the identification of households and targets to be entered in the study. In order to facilitate this process, Kansas-Data Management Unit (DMU) produced a list of households having toddlers or schoolers of the age required for CRSP enrollment based on the Kalama village census. The Egypt-DMU verified this list against the most recent census data available and prepared a final list of households to be entered into the study. If the household was found to be ineligible for any reason, such as the toddler or schooler being too old or too young, the family having moved from the village, the occurance of a divorce or the death of a potential target, the household was not entered in the study. This enrollment procedure continued on a monthly basis until December 1984 when the final group of households was entered. Lists of pregnant females were generated from the field via periodic pregnancy tests.

Each household with a Target Toddler or Schooler remained with the study until 13 months of data had been collected on the Target Child. Households with Target Infants were followed for approximately six months of the mother's pregnancy, and continued until the infant was six months of age. All households were exited by the end of December 1985.

Following is a summary of Household and Target statistics for CRSP:

1) A total of 312 Households was entolled in the CRSP project:

   a) 181 households based on Target Toddler and/or schooler (Table 1), and
   b) 131 households based on pregnancy (Table 2).

2) A total of 191 pregnant females were followed: 131 as mentioned above plus an additional 60 pregnant females from households having a Target Toddler or Schooler.

3) The first infant in CRSP was born in July 1984 and the last, in May 1985. Total number of infants was 142: 104 infants from the pregnant female group of 131 and 38 infants from households with a Target Toddler or Schooler (Table 3).

4) The total number of infants who died during CRSP was 10.

5) A total of 258 households completed the study with 153 toddlers, 121 Schoolers and 124 Infants (Table 4). Fifty-four households or 17.3% of those entered were dropped from the study before completion.

6) Missing data was examined on a sample of 53 Toddlers who had completed 13 months of the study including one measurement at Monnth 0 and also at Month 13 (Table 5):

--Anthropometric measurements were completed at an overall rate of 60%, ranging from 36-85%;

--Food Intake ranged from 62-92% complete with an overall rate of 77%;

--Morbidity was 78% complete, ranging from 66-90%.

2. Data Management Staff Activities

At the beginning of CRSP the DMU staff consisted of a Senior Investigator and two researchers. After a few months the DMU was expanded to include two more members due to the increase in the work load.

Each week at the CRSP project meeting, which was attended by all Senior Investigators, a notification from the DMU was distributed containing any changes or new information concerning the study. Additional communication between the DMU members and Senior Investigators or data collectors was conducted on a verbal basis.

The activities of the Egypt-Data Management Unit can be summarized as follows:

1. Identifying the 181 Core Households by checking the enrollment lists from Kansas-DMU against the most recent censusinformation to be sure that the households met the CRSP criterea for eligibility.

2. Identifying the 30 case study households.

3. Screening all the Socio-Demographic forms for the purpose of identifying females to be categorized as "Potentially Pregnant". 663 households from the village were identified for this category based on the age of the female and the age of her youngest child. From this group 121 pregnant females were enrolled in

the study between February and November 1984. (Table 2)

4. Registration of all CRSP data forms delivered to DMU from the 13 research teams.

5. Verifying each data form by checking the Household and Target identification against the official enrollment list.

6. Reviewing and recording information received on the Change of Status forms prepared by the data collectors. During the two years of the project, a total of 466 changes, including illness, birth, or death of a target, were recorded. (Table 6)

7. Providing information for and answering questions of the data collectors to assist them in their field work and completion of data forms.

8. Providing the Field Coordinator with an accurate listing of all changes which occurred to targets and households .

9. Preparing ENTRY Forms which were submitted to Kansas-DMU to clarify the reason for the households's entry into the study, e.g. the presence of target toddler and/or schooler or a pregnant female. A total of 312 households were entered. (Table 7)

10. Facilitating the job of data collection by distributing a copy of the census pages of the sociodemographic instrument to all Senior Investigators, data collectors and Field Coordinator.

11. Preparing EXIT forms which were also submitted to Kansas-DMU to differentiate between the types of exits:

1) exit of a household from the study if the family moved from the village or if the Lead Male or Lead Female died; or if the family refused all activities;

2) exit of a Target Toddler, Schooler or Infant if the child died or was too ill to continue in the study while the households remained in the study if another target child was present;

3) exit due to completion of all required research activities.

12. Notifying all Senior Investigators about the status of the sample .

13. Organizing the xeroxing of all data forms that were sent to Kansas-DMU.

14. Submitting household activity status reports to Kansas-DMU.

15. Answering requests for information from the collaborating scientists at Arizona, Kansas, and Purdue.

16. Keeping an account of data forms sent to Al Ahram Computer Center for entry, i.e. recording total number of forms sent for entry and number returned.

17. Organizing and cataloging all data forms in the data storage room in a manner to allow for easy access.

18. Preparing summary information about each activity to show missing data for targets and households.

19. Processing all data resolution forms sent from Kansas-DMU.

20. Participating in training personnel to code instruments for data entry, handle errors encountered when recruiting priorities, and use validity checks.

21. Discussing data analysis strategies to include all CRSP data.

3. Evaluation

Beginning a project of the scope of CRSP necessitated the introduction of a new style of data management for the Nutrition Institute. The initial step was to relate to the participating scientists, who were unfamiliar with a centralized style of data management, that the DMU was an organizing and information-giving system rather than a department to evaluate and report errors in data collection. The Senior Investigators and data collectors now consider the DMU as a source of information about household and target status, verification of birthdates and ID numbers, missing data reports and other information.

Because the DMU was not an established department at the Nutrition Institute, office space and facilities had to be acquired and organized while at the same time the regular activities of the DMU as outlined above had to be carried out. At the beginning of the project, DMU was allocated one room for the staff and data forms, but after less than one year, a second room was needed and acquired to accomodate the staff and increasing numbers of data collection forms.

Preparation of copies of the data forms to be sent to Kansas-DMU for entry during the first year of the project was an activity that incurred many problems: inadequate staff, limited access to the copy machine, and mechanical problems with the copy machine. When data entry was organized to begin at Al Ahram Computer Center in Cairo for most of the research activities, these problems were reduced.

D. DATA ENTRY

In August 1984 a Data Entry Team (DET) was organized as the part of the Egypt DMU to be the link between all data collected by the research activities of the project (through the Senior Scientist) and Al-Ahram Computer Center in Cairo, and ultimately between Egypt DMU and Kansas DMU. The DET was concerned with the flow of data of the project activities from the Nutrition Institute in Cairo to Kansas DMU, through Al-Ahram, in the form of clean, checked data tapes ready for analytical use.

1. Data Entry Team Members:

A. A Junior Scientist at the Nutrition Institute to coordinate DET activities: Dr. Ghada Fouad served in this position until July 1985 when Dr. Magda Shaheen assumed the coordinator's duties.

B. A clerk to help in receiving and sending data between Al-Ahram and the Nutrition Institute.

C. A proposal was made to add three Junior Physicians, after a period of training, to form a team with each member being responsible for data from certain areas of the project while at the same time being informed about all other activities.

This team worked together under the supervision of Dr.Magda, to mention a direct link with Al-Ahram and transmit information between Al-Ahram, Nutrition Institute and Kansas

MORBIDITY

I. INTRODUCTION

It is well documented that the severity, duration, and number of infections are increased in severe protein -energy malnutrition. The relationship between less severe food deprivation and morbidity factors was tested in this study. Also considered were accidents injuries and psychological problems which may have had some association with nutritional status and sense of well-being. Structured interviews using common disease entities defined in locally used terms and descriptions were administered weekly by field staff to all households.

II. MORBIDITY PROTOCOL

A. Measurements taken:

1. Morbidity Recall

On day 1 of the weekly household visit, physicians field workers administered a questionnaire to obtain a history for all household members of illness and trauma during the previous week regarding the following system/states: gastrointestinal, respiratory, ear, eye, urinary, joint, febrile, skin activity pattern and pregnancy. If the respondent (mother or other knowledgeable adult) said there was no illness, this was recorded but there were additional questions asked to assure the interviewer that no illnesses were indeed present.

When an affirmative response was obtained for a target individual, then an in-depth questionnaire with selected pre-coded signs and symptoms for the day of interview and the six preceding days was completed. Information on symptoms, signs, date of onset,and duration were elicited, along with dietary modifications, medical or other treatment, source and type of treatment obtained and change in usual or customary activity. If a person was seen at a medical care facility, the medical record was checked to record the diagnosis if at all possible.

For non-target household members only probing questions were asked initially. However, the staff of Junior Physicians collecting morbidity data raised the importance of treating all members of the Target household, claiming that it would facilitate the activity of the group in collecting the data and, in addition, deepen the relation between the data collectors and the household targets.

If a death was reported the, circumstances or terminal event prior to death was inquired into (e.g, convulsions, etc.). If medical care was sought or if death

occured in a medical facility, the facility was consulted for further information. The morbidity questionnaire was administered for the deceased individual in the hope of identifying the terminal illness.

2. Illness Disability and Task Assignment Subroutine

This interview summarized the food intake, activity level, body weight (for infants and toddlers) and task assignment changes in adults and schoolers during periods of illness. If the respondent to the weekly morbidity recall questionnaire indicated that an illness that started during the preceding week continued on the day of the household visit or started within 24 hours of the household visit, a current illness observation form, one per person, was completed. Minor respiratory infection (common cold - except in infants less than one year), minor skin conditions and minor trauma or conjunctivitis were exempt from the subroutine.

Household visits on alternate days were made to individuals with current illnesses. This interview was conducted repeatedly throughout the period of illness: at the onset of the illness, day 3 of illness, and weekly throughout the illness until the 2nd symptom-free day occured. Additional weight records were kept during symptom -free periods for target infants and toddlers if the households were willing, in order to follow catch-up growth.

Recovery was defined as two symptom-free days with resumption of usual activities, appetite and in the case of an infant, smiling and normal responsiveness to the environment.

This activity was begun in January 1984, but proved to be very difficult to carry out, and only 19 cases were followed completely from that date until February 1985. In order to improve this activity, the group of physicians who was assigned to work in the RMR activity was also given the responsibility for the sub-routine.

3. Medical History and Physical Exam

Every six months the interviewer obtained a history from the household for disabilities and chronic conditions and conducted a nutrition- related examination of each target individual covering numerous systems: hair, eyes, mouth, throat, face and neck, ears, chest and lungs, cardiac, abdomen, genitalia, joints, spine, neuromuscular and skin. Genitalia examination was performed on infants and toddlers, but it was a practical impossibility to perform on schoolers and adults because of social and

cultural constraints. Aereola examination and fundal level were not done on all females.

In order to carry out the examinations, ten physicians' hand bags were equipped with sphignomamoters, stethoscopes, otoscopes, ophthalmoscopes, thermometers, tongue depressors, etc. The bags were distributed to physicians in a way that two physicians would share one bag since the data collectors were divided into two groups (10 physiciams in each group) with each group being responsible for the field work every other week.

B. Schedule of Data Collection

1. Morbidity Recall

Morbidity Recall was recorded every 7 days for all target individuals. Non-targets were only recorded by illness diagnosis if present.

2. Illness Subroutine

The subroutine was conducted on days 1, 3, 7 of illness and once each week until recovery was evident for lead males, lead females, target toddlers and infants.

3. Medical History and Physical Exam

This routine was conducted every six months for all targets plus pregnant lead females at the 5th and 8th month of gestation and the 6th month post partum if lactating.

III. STANDARDIZATION OF DATA

In a study operating with a large data collection staff and population base for survey, standardization of data collection is of primary concern. All staff must be trained to equal mastery of skills, as well as, utilizing a standard protocol of collection. Considerable effort was directed toward establishing proper staff training, data collection procedures and ongoing quality control measures.

A. Staff Training

Initial training of staff was conducted by the morbidity principal investigator for performing the medical history, morbidity recall and illness subroutine interviews as well as the diagnostic procedures for the physical examinations.

Concepts of disease, and analysis of common diseases prevalent in a given study area were discussed in training sessions. Abundant visual aids were used. The staff was shown examples of all signs and symptoms they would need to recognize -- from patients in the clinic, hospital wards, households. Assistant lecturers from Cairo University in dermatology and ENT were assigned to train the Junior Physicians as a reflection of the importance of these two areas. The lectures were theoretical, as well as, clinical with observations in the outpatient clinics at Kasr El Aini Hospital.

Weekly meetings to discuss data collection problems plus monthly educational sessions were conducted. Role playing was used in training and standardization of interviewing. The initial training took approximately one month. Periodically, when a new group of Junior Physicians would join the Morbidity group, the same training courses were repeated for them.

In early December 1983, Dr. Esmat Ekladious and Dr. Ron Watson trained the physicians to administer the tuberculin and dermophytin skin tests, and to collect saliva samples. Drawing blood, skin tests and saliva collection were begun in the field in mid-December 1983. According to the morbidity protocol, blood was to be drawn from the four targets; however, toddlers were exempted from this activity because of the difficulty in drawing samples and the mothers' refusal, in many cases, to allow blood to be drawn from their toddlers.

A modification for collection of saliva was done for toddlers since the cotton pack was too large for the toddler's mouth. The cotton pack was divided equally into two parts which were to be kept in the mouth for 20 minutes instead of 10 minutes. Skin tests were not done for pregnant females as it is a contra-indication in pregnancy.

B. Morbidity Manual

This manual was composed to provide instructure of the rationale of interview standardization, utilization of the morbidity recall forms and the specific disease recall attachments, pre-coded diagnoses allowed and procedures for accommodating those illnesses which are non-coded health issues. Later an addendum for utilizing the illness subroutine which was developed after the data collection phase began was added. The manual included a glossary of disease terms to standardize the diagnosis of illnesses, and a treatment protocol and summary of approved pharmaceutical preparations for tertiary medical care of any target individuals. It was hoped that this inclusion would

minimize the intervention effects of the CRSP physicians using their own medical care upon the survey population.

C. Weekly Staff Meetings

Staff meetings between the morbidity principal investigator and medical staff provided opportunities to review the household interviews and any problems arising from them. Quality control was viewed as a continuing process through these meetings. Each data collector was asked by Dr. Galal to keep a record of his/her impressions about the morbidity activity and discuss this at the weekly meetings.

D. Reinterviews by the Morbidity Principal Investigator and Rotation of Staff

The project physicians reviewed each morbidity record within two days of the interview and made a diagnosis or diagnoses based on clusters of reported signs, symptoms and observations using the operational definitions which were precoded. To count the same illness as a new episode, symptom-free days had to elapse.

The field staff was rotated periodically to offset interviewer bias. Interview/reinterview bi-weekly by supervisory staff plus validation of illness were conducted by the nurse or M.D. for any serious illness. Regular spot checking of the field worker was carried out by the supervisor.

E. Diagnostic Coding

Diagnosis of respiratory illnesses was aided by a computerized algorithm using a list of 39 symptoms recorded from the morbidity recall form categorized as to the presence or absence for each illness; i.e. allergy, asthma, croup, pneumonia, cold, tonsillo-pharyngitis, and bronchitis.

F. Management of Data

Initially the data forms were reviewed by Dr. Shaheen alone, but in December 1983 a system of reviewing was established whereby each data collector reviewed the forms of his colleagues, with a final check being done by a team of reviewers. Dr. Shaheen continued to review a sample of the data forms.

An internal data management group was formed to be in contact with the CRSP-DMU, and to prepare and organize the day-to-day fieldwork.

From the beginning of the study until August 1984, morbidity forms were photo-copied and sent to Kansas-DMU for computer entry. Printouts of data from Kansas were reviewed by the morbidity group, questionable values were checked against the original forms, corrections made where needed and re-sent to Kansas-DMU. Beginning in September 1984, computer entry was done in Egypt and cleaned data tapes sent to Kansas. This process required some additional coding on the data forms to conform to the data entry system at the local computer center.

IV. DERIVED VARIABLES

Morbidity variables were derived from the recall symptoms and diagnoses for both the target individual and household. Components of the variables include: duration and incidence of wellness and sickness (by anatomical system; e.g. respiratory); a general morbidity index utilizing duration, severity, food intake and illness activity scales; and prevalence of household illness and food intake during illness. All of these variables were calculated over a variety of lengths of time. Wellness was defined as a period of consecutive sign and symptom free days with no reported illness for a minimum of three days.

The diagnoses obtained from the morbidity recalls were initially categorized as to their severity. Each diagnosis was defined in its severe state and compared to the symptoms present in each recall. If any of the conditions for severity were evident in the symptoms then that individual's illness was classified as severe. If none of the criteria were present then the illness was presumed to be mild.

V. Analysis Projects

The morbidity data which was collected in August, September, and October 1984 was used for an analysis exercise as shown in Table I. From this table the following points can be summarized:

1) Toddlers suffer from gastrointestinal problems at a rate (6.5%) which is greater than the other three targets. Schoolers showed the lowest prevalance (0.17%), however, this may be because they do not inform their mothers who report for the schoolers in over 90% of the households.

2) Ear and urinary problems are particularly infrequent in toddlers, presumably because the toddler cannot give a clear indication of localized pain.

Further indications drawn from this exercise were that the lead female is generally aware of her husband's health, and is particularly able to report on illnesses with some outward manifestations--skin, G.I., respiratory, eye, etc. Joint and urinary problems are mentioned for males at a far lower rate than would be expected in this population. Recall by the female was supplemented by direct queries to the male whenever possible, In order to supplement recall by the mothers for their schoolers, CRSP physicians interviewed schoolers individually at their schools.

In December 1984, a design was formulated to correlate morbidity data analysis with other project activities. The data of 57 toddlers were studied at that time to serve as a model for statistical analysis.

Table I. PREVALANCE OF DISEASES DURING 3 MONTHS (AUGUST, SEPTEMBER, OCTOBER 1984) BY RECALL METHOD AMONG LEAD MALES AND FEMALES, SCHOOLERS AND TODDLERS

	Lead Male (1301)		Lead Female (1301)		Schooler (574)		Toddler (753)	
	No.	%	No.	%	No.	%	No.	%
G.I.	18	1.38	33	2.5	1	0.17	49	6.5
Respiratory sore throat cough runny nose	20	1.53	25	1.9	8	1.39	28	3.71
Ear	-	-	3	0.23	1	0.17	4	0.53
Eye	4	0.3	14	1.07	3	0.52	32	4.24
Urinary	5	0.38	15	1.15	-	-	-	-
Joints	7	0.53	14	1.07	-	-	1	0.13
Fever	2	0.15	8	0.6	8	1.39	16	2.12
Accidents	3	0.23	4	0.3	1	0.17	2	0.26
Skin	4	0.3	38	2.9	14	2.4	26	3.45
Change in Activity	2	0.15	5	0.38	-	-	3	0.39

ANTHROPOMETRY

I. INTRODUCTION

Accurate documentation of changes in body size, proportion and composition is critical in interpreting the relationships between food intake and function. Food Intake may affect functional outcomes in a causal path through nutritional status as reflected in anthropometric measurements, or it may operate through separate pathways to affect growth or change in body size. In the CRSP design, change and rate of change in anthropometric variables were the variables of interest.

II. MEASUREMENTS

The measurements taken were the minimal ones necessary to document change in body size and energy reserves: height (length from birth through 30 months), weight, mid-arm circumference, head-circumference for infants and children, and skinfold measurements at two sites (triceps and biceps). The subscapular skinfold was originally included in the core data set, but dropped for the Egypt project partway through the study because of a relatively large number of refusals and consequently high proportion of missing data. When the measurement was not refused, it continued to be taken.

III. TIMETABLE

The core timetable for anthropometric measurements is detailed below. Body weight was measured monthly on all targets and twice a year on nontarget household members. Height (or length, depending on age) was taken once on lead males, lead females and nontargets, and monthly on infants, toddlers and schoolers. Arm circumference was recorded monthly for all targets. Head circumference was scheduled monthly for infants and toddlers, and at entry and once more for validation for schoolers and adult targets. Skinfold thickness measures were scheduled monthly for all targets. In addition to these routine measurements, body weight was obtained as part of the illness subroutine for targets (days 1, 3, 5, 7, and weekly until the second symptom-free day); and weight and height were measured at the time of RMR measurements for adults and schoolers. Target infants had the anthropometric pattern scheduled at 8 days and then monthly.

From January to March 1984, there was a deviation from the original anthropometric protocol in that it was decided by Dr. Shaheen to measure toddlers and schoolers every three

months and adults every six months. However, when this issue was presented to the SCB, it was refused and the physicians then followed the original protocol.

IV. EQUIPMENT

The scale used for most body weight measurements was a HeathKit Model portable bathroom-style electronic scale. These scales are battery operated and claimed by the manufacturer to be accurate to one percent. Batteries were changed every two weeks (before they became drained), and scales were recalibrated each time they were moved using 5, 15 and 25-kg standard weights. For the first three months of Phase II, the HeathKit scales had not yet arrived in the field and substitutes were used. A portable Accuweigh bench beam balance was used during this period. For infants at birth, at 8 days of age,and monthly a portable electronic scale (K-Tron) accurate to one gram was used.

Height and length were measured utilizing portable length/stature measuring boards constructed by Prospective Enterprises, Inc. For skinfold thickness measurements, Lange calipers were used and were calibrated at intervals against a standard measuring block. Zerfas paper insertion tapes were used for measurements of circumference.

V. PERSONNEL

57 Physicians participated in measuring the household individuals throughout the study. The starting number of physicians during the anthropometric measurements were 18 physicians.

Physician data collectors were responsible for routine anthropometry except for infants. Regularly, scheduled measurements and those associated with the illness subroutine were taken in the subjects' homes or, occasionally, at schools or elsewhere if it was necessary to find a subject who could not be located at home. The weight and height measurements taken at the time of RMR measurements were taken at the RMR laboratory. Anthropometric measurements of infants were taken by the reproduction field team, professionals who were trained by the same instructors as were the physician data collectors.

VI. QUALITY CONTROL AND TRAINING

Quality control measures included staff training and retraining, duplicate measurements on a subsample and procedures for evaluating the congruence of duplicate measurements in the field; standardized methods documented in a field manual; and calculation and feedback of reliability statistics at intervals. Equipment was checked and calibrated on a regular basis.

In April 1984 all Toddlers who were enrolled before that date were measured by quality control data collectors and their measurements were checked for validation. Registration books for recording weights and heights were used as a quality control measure and follow-up of growth.

The field manual was used as the basis for staff training. All staff responsible for anthropometric measurements were trained through lecture, demonstration, practice under observation, and periodic retraining. Training was carried out at the Nutrition Institute outpatient clinic and a Mother-Child Health Center located near the Institute. As new data collectors joined the team at intervals throughout the study, they were required to undergo the same training as the more experienced data collectors and to standardize their performance against the latter.

Preset permissible error limits were adopted based on the inherent error in the anthropometric equipment and the limits used by the Fels Research Center (Yellow Springs, Ohio) in their longitudinal studies. These preset limits were incorporated into the data recording form, which was designed so that duplicate measurements could be recorded on the same form without the second observer being able to see the result obtained by the first observer. Duplicate measurements were to be obtained on at least half of all anthropometry. If the difference between two observers with regard to a measurement exceeded the preset limit, they were instructed to take and record a second pair of measurements. The measurement taken as data was obtained by a computer program as follows: when only one measurement, take that one. When two, average them. When four, take their average. Dr. Farouk Shaheen (the Senior Scientist in charge of supervising this aspect) visited the field at regular intervals and both observed quality control procedures and randomly provided an external standardization measurements.

Dubowitz training was done through lectures, audiovisual instruction, and practical training in neonate centers and gynecological departments in university hospitals. Initially it was planned to allow a leeway of five days after birth to carry out Dubowitz scoring; later modification allowed only three day (72 hours) after birth in order to increase accuracy.

POLICY IMPLICATIONS

The main theme of the CRSP project was to examine energy intake and its effect on human performance, a subject which had never before been tackled in Egypt in a systematic manner. Since the Egyptian Government's strategy during the following five years was to improve and increase productivity in both agricultural and industrial sectors, it was quite logical to study the main factors which would improve an Egyptian individual's performance and capacity for productivity; since the human being is the driving force behind increased productivity. We are aware that even if productivity of food could exceed population expansion demands, malnutrition would not necessarily be eradicated. An assessment of factors other than food availability which contribute to malnutrition needs to be carried out and a national nutrition policy which include these factors needs to formulated.

Considering the Egyptian Government's plan for productivity, to understand the results of the CRSP project it is important for government policy makers which could, then, lead them to put nutrition planning in a more central position in relation to the socio-economic development planning. For example, an appreciation of food consumption patterns and their impact on nutrition could lead the food production sector to examine the yield of crops, quantitatively and qualitatively, which could then lead to a discussion of redistribution of food commodities within Egypt. ALso, preliminary results enable us to identify indicators for diagnosing the causes of malnutrition and even the causes of some marginal cases. The morbidity burden on growth and social development among toddlers is an example of some trends coming from the CRSP information.

The CRSP project introduced new methodologies in the discipline of nutrition, in laboratories (biochemical and immunological) at the Nutrition Institute, and also in developing instruments to capture information relevant to the project. The Nutrition Institute staff participated in the development of these instruments which created a means of communication between the scientist and the field. The protocols which were developed for each area of the CRSP project have been used or adapted by other projects in the Institute, which led to improved performance of the activities for CRSP and the possibility for comparative studies. CRSP is not the only project in the Institute, but for several years it was the largest; therefore, it is expected that the experience of CRSP will improve and upgrade the capability of the Institute to carry out its four main functions on a national level, i.e. generating

knowledge, disseminating information, training personnel and giving consultation.

Collaboration with the three U.S. universities, Purdue, Kansas and Arizona, established a broad spectrum of transfer of knowledge and technology which benefitted six Egyptian institutions: the Nutrition Institute, Cairo University, Ain Shams University, Helwan University, the Ministry of Youth and the National Research Center. The interaction of scientists from the USA and Egypt created an atmosphere for better understanding of nutritional sciences. The periodic visits by U.S. scientists to Egypt contributed greatly to the issue of improving performance of the individuals working on the project.

In Egypt in 1980 the National Nutrition Survey was conducted with the data on malnutrition being classified into an age grouping format. This classification by age made it difficult to plan for intervention, and those intervention programs which were implemented were without satisfactory or optimal improvement in the nutritional status. The CRSP project used an approach which is a departure from the classical age classification view of nutrition by focusing on household as well as individual measures. This is a more practical approach to the study of the nutrition problems in a developing country like Egypt. For the first time in Egypt, the profile of the nutritional status of households has been documented, and intervention programs are now being planned to examine the nutritional status of each household separately and to intervene at that level.

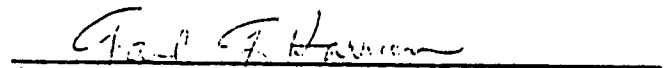
This procedure will lead us to more practical applications in nutrition planning to document the implementational impact of programs.

Nutrition CRSP

Annual Report, University of Arizona
October 1, 1985 to September 30, 1986

USAID Contract #DAN-1309-G-SS-1070-00

Submitted October 24, 1986



Gail G. Harrison, Principal Investigator

RESEARCH ACTIVITIES

This has been a year of completion of small laboratory-based tasks and participation as actively as possible in data anlyasis.

Immunology. Analyses were completed for all samples available, as summarized in Table 1:

Table 1. Number of Immunology Samples Analyzed

	Saliva					Colostrum & Milk
Assay	Lead Male	Lead Female	Schooler	Toddler	Nontargets	
IgA	95	203	62	12	2	126
IgG	80	186	55	11	21	**
Lysozyme	Attempted, but samples were nonreactive. Perhaps inactivated during storage and/or transport.					195

**IgG activity was too high for the plates' range. Could be run but has not been due to lack of budget to purchase additional plates for higher levels.

The data were sent to Egypt for entry with other immunological data there and subsequent transmission to Kansas. In the meantime, we entered the data from the above small set (unofficial though it is) at Arizona and accomplished descriptive analyses which are now being prepared for internal distribution. In addition, analysis of the immunological data for adults in relation to serum ferritin, serum transferrin, and C3 levels was done, and no significant relationships to these measures of nutritional status were found. Analysis of immunological variables in relation to morbidity and to other variables awaits the availability of all data sets.

Zinc Status. Serum samples had been previously analyzed for zinc and the data were transmitted to Egypt and to Kansas for entry. During this year, Ms. Mary Mohs, a graduate student in Nutritional Sciences, accomplished zinc analysis in 131 hair samples collected from schooler and toddler target subjects. These data are not "core" variables but are being used for Ms. Mohs as part of her dissertation research and will be available to the CRSP.

Laboratory Quality Control and Calorimetry. At the request of the Nutrition Institute, Dr. Charles Weber's laboratory ran quality control samples for proximate composition of several food items, and analyzed 12 72-hour composite diet and fecal samples by bomb calorimetry. The latter were from the "digestibility" study completed in November - December 1985 on six CRSP toddlers. The data were sent to the Nutrition Institute for comparison with energy estimates based on proximate analysis, and for use in Dr. Moussa's report on that substudy.

Data Analysis. Data analysis activities in this year have been in two major areas.

1) Phase I data analysis. As graduate student research assistant time has allowed, we have accomplished several analyses of Phase I data. These data had earlier been summarized for project purposes at the end of Phase I, but their more recent availability on magnetic tape has made it possible more recently to explore interrelationships between variables. Briefly, the significant findings from our analyses were as follows:

- Adults were less likely to be ill on the day of the physical examination if they lived in an extended as opposed to a nuclear household, and if the household was not engaged in agriculture as opposed to one engaged in agriculture.

- Relative weight of adult women (measured as Body Mass Index) was in the overweight or obese range for 60% and positively associated with age, number of births, number of live births, and with being in an agricultural household. BMI was negatively associated with height, a finding different from the epidemiology of adult obesity in developed countries. there was no relationship of BMI in women to education, household type or occupation of the household head. These findings were submitted as an abstract to the Vth International Congress on Obesity (September 1986) and accepted, but the paper was not presented as the author who had planned to present it was unable to attend due to illness.

- The relationship of birth order to height in young children was explored, and exhibited an interesting trend. Among 91 boys and 98 girls under age three years, with birth order ranging from one to more than 10, height-for-age (as measured by sex- and age-appropriate Z-score) was somewhat better among boys with birth order 3 or 4 and among girls with birth order 4 or 5 than in those with lower or higher birth orders. The relationship was statistically significant only for girls (See Table 2).

Table 2. Relationship of Birth Order of Height (Z-Score) for Children Under 3 years of Age, Phase I, Kalama

Boys			Girls		
Birth Order	(N)	Mean Z-Score	Birth Order	(N)	Mean Z-Score
1	(1)	-1.98			
2	(8)	-2.15	2	(7)	-2.53
3	(10)	-1.35	3	(21)	-2.46
4	(16)	-1.30	4	(21)	-1.11**
5	(17)	-1.60	5	(14)	-1.48*
6	(14)	-1.44	6	(11)	-2.12
7	(10)	-1.70	7	(14)	-1.91
8	(7)	-1.18	8	(6)	-1.80
9	(7)	-1.48	9	(2)	-3.04
10	(1)	-2.48	10	(2)	-1.34

**Significant difference at .05 from birth orders 9, 2, 3, 6

*Significantly different at .05 from birth order 3 (Multiple Range Tests)

We speculate that a variety of factors may be operating. Birth order is closely related to maternal age, and it may be disadvantageous to have a mother who is relatively young or old. Maternal experience with child care may be less with early children, or the mother because she is younger may have less control over decision-making. Among high-birth-order children, economic and other resource constraints may be more important. Unfortunately, the data do not allow examination of this phenomenon by birth interval following the index child, but this should be possible in Phase II data if the same relationships are seen.

2) Phase II data analysis activities. We have participated as actively as a data availability have allowed in analytical activities, communicating closely with the project statistician at Purdue. These activities are accounted for in detail in the alytical section of our report to the EPP, attached. Dr. Harrison made two trips during the year to Purdue for this purpose, and attended the statisticians' meeting at ME's request in September. Lack of availability of full data sets has hampered our ability to be productive in this area, but we expect that

data analysis will occupy our attention in a major way in the year to follow. We have requested from Kansas a copy of all data so far sent to ME and Purdue.

We are currently engged in final cleaning of the morbidity data set.

TRAVEL

Dr. Harrison attended the DAG meeting at the University of Connecticut in Storrs, Connecticut from October 11 to October 14, 1985. Following that meeting Drs. Farouk Shaheen and Saneya Abdul-Azim Wahba visited the University of Arizona from October 15 to October 20. They attended a 2-day symposium on World Hunger October 16 and 17, conferred with Arizona investigators regarding data quality control, and planned for data analysis strategies.

From January 25 to February 19, 1986, Dr. Harrison was in Egypt. This trip was split, financially and time-wise, with another project. About two weeks were deveoted to CRSP-related activities, including assistance with data flow, plans for local data anlysis in relation to national policy needs, and planning for further activities in the study community.

Dr. Harrison attended the SCB/IC/DAG meeting in Los Angeles February 24 - March 2, 1986. Dr. Cheryl Ritenbaugh attended (on non-CRSP funds) and participated in two days of the data analysis discussions.

Dr. Harrison spent one day at Purdue University on June 13, 1986 meeting with Drs. Avanelle Kirksey, George McCabe, Osman Galal and Ms. Linda McCabe about issues of data analysis.

September 12, 1986 Dr. Harrison represented the PI's at the CRSP statisticians' group meeting in Chicago, at the request of Management Entity (trip report Appendix B). She then traveled to Purdue and spent September 13th working with George and Linda McCabe and Avanelle Kirksey on project-specific analysis issues.

Dr. Harrison was in Egypt twice during the year on non-CRSP business and funds (April 21 - May 13 and September 22 - 29); although time did not allow extended attention to CRSP business, general updating and facilitation of activities did occur and both data and samples were transported back to the US.

STAFF

In January, Sarah Kuester left her position as research assistant to assume a full-time position elsewhere. Sue Wallace-Cabin assumed this part-time position through August, when it ended due to budgetary constraints.

On September 1, 1986 Dr. C. John Mare', Director of International Programs and Title XII Officer for the University of Arizona, left the university to assume responsibility for a project in Lesotho. Dr. Jimmye Hillman has assumed this position and will represent Arizona on the CRSP's Institutional Council and Finance Group.

NEGOTIATIONS WITH COUNTERPART INSTITUTIONS

We requested and received approval from Purdue University to transfer $7850 from our travel account at Thomas Cook into our local budget in the personnel category. Due to our use of joint funding for several trips, substantial savings had been achieved in airfare while personnel costs had been high. In addition, some charges for travel had had to be taken from our local budget because a) it was cheaper to drive than fly (twice from Purdue to Indianapolis); or b) Thomas Cook refused airfare because the CRSP stop was part of a larger trip for which they had not purchased the ticket directly.

PLANS FOR NEXT YEAR

During the last year of the CRSP, our attention will be focused entirely on data analysis and preparation of the final report, in collaboration with our co-investigators. Due to budgetary constraints, the only significant time available to the CRSP will be that of the Principal Investigator, although other Arizona investigators maintain their interest and will contribute as the needs dictate and their own obligations allow.

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ANNUAL REPORT

October 1, 1985 - September 30, 1986

University of Kansas
Egypt Project, Nutrition CRSP

USAID Contract #DAN-1309-G-SS-1070-00
Nutrition Intake and Function

Submitted October, 1986

Norge W. Jerome, Principal Investigator

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

OVERVIEW

This is a status report of activities conducted at the University of Kansas-Egypt project Nutrition CRSP during the period, October 1, 1985 - September 30, 1986. Major emphasis was placed on data processing, data review and examination, and expediting the flow of data to Purdue University. We were challenged to move the data forward to the data analysis unit at Purdue University as quickly as possible after receipt, despite the need to detect and correct numerous errors, to communicate further with Egypt in order to resolve other problems such as obtaining complete documentation of the data received.

I. EGYPT PROJECT STATUS

A. TRAVEL

Dr. Saneya Wahba visited the University of Kansas from October 21-25, 1985 to discuss issues relating to the processing of data from Egypt at the Kansas CRSP Data Management Unit.

Dr. Suzanne Murphy travelled to Kansas on November 27, 1985 to discuss data management methods employed at the Kansas CRSP Data Management Unit.

Dr. George McCabe and Ms. Linda McCabe visited the University of Kansas on December 6, 1985 to discuss data status and priorities for the February, 1986 data analysis meetings at UCLA.

Dr. Norge W. Jerome, Dr. Billy G. Hudson, Beverly Brown and Judith Ricci travelled to UCLA for Nutrition CRSP meetings during the week of February 22, 1986. Dr. Jerome participated in the Scientific Coordination Board, Finance Committee and Data Analysis Group meetings; Dr. Hudson participated in the Institutional Council meetings; and Bev Brown and Judi Ricci participated in the DAG and data management meetings.

Beverly Brown met with Dr. Suzanne Murphy, Claudia Waters and David Lein at Berkeley on February 24, 1986 to discuss various data management concerns including the need for documentation.

Dr. Norge W. Jerome participated in an Egypt Project meeting in St. Louis in April 1986. Discussions focused largely on data flow, error detection and correction and on data analysis.

B. NEGOTIATIONS WITH COUNTERPART INSTITUTIONS

Dr. Jerome revised, prepared and submitted the University of Kansas Egypt Nutrition CRSP Data Management budget for Period IV, V and VI to Purdue University on November 27, 1985. The budget for Periods IV and V (six months only) were approved. If the remainder of Period V (April 1 - September 30, 1986) is not funded, the Kansas DMU will have to discontinue activities.

Kansas received approval to extend employment of the Egypt Data Manager, Beverly Brown, through December 31, 1986. These additional funds will be reflected in our next subcontract amendment.

C. RECRUITMENT OF STAFF FOR PROJECT

Dr. Thiettranh T. Tran, a graduate student in the Department of Preventive Medicine, was recruited on May 5th to assist with data processing.

Lori L. Locke resigned as Data Entry Clerk on July 25th.

D. PLACEMENT OF STAFF IN THE FIELD

None.

E. RESEARCH ACTIVITIES

1. Child Caregiving

Kansas continues to process all available raw child caregiving data collected through December, 1985. The systematic procedure involves translation, coding, data transfer to computer sheets and computer entry. Each step includes specific quality control checks. Remaining data will be processed as soon as they are received.

2. Food Intake

Revalidation and documentation of the Egypt project's Nutrient Composition Database have been completed. Kilocalorie data for all Egyptian foods and beverages are now presented as amount of energy in edible portion of 100 grams of food as purchased.

Kansas prepared the final project document on Egypt food intake methodology. This document includes a detailed description of the methods implemented in the following food intake research activities:

- Phase II core household and individual food intake (during typical and atypical, i.e. fasts and feasts, consumption periods)
- Phase II non-core household food and beverage consumption frequency
- Phase I food intake
- Quality control
- Obtaining respondents' oral reports on food consumption and transforming the data to energy values
- Converting grams of food to food energy (kcals)

Also included in the methods chapter are the final version of the food intake manual, five data collection instruments and food codes for Egyptian foods and beverages.

3. Household Sociodemographics

To reflect the realities of village life and to be consistent with current farming systems terminology also, we renamed Household Subsistence Type (variable HHSUB) as Dominant Occupational Mode. The variable was redefined to capture the dynamic nature of the household as a farming system. The redefinition includes family type (e.g. nuclear or extended) and the dominant occupational mode of the target male and/or household head. Households are classified in one of the following four categories:

FARMING - Target male and household head (if different from target male) are engaged in farming occupations only.

FARMING + NON-FARMING in NUCLEAR FAMILY - Target male is engaged in both farming and non-farming occupations.

FARMING + NON-FARMING in EXTENDED FAMILY - Target male is engaged in non-farming occupation(s); however, household head (senior male) is engaged in farming occupations.

NON-FARMING - Target male and household head (if different from target male) are not engaged in any farming occupation.

The distribution of Egypt Nutrition CRSP core households by Dominant Occupational Mode and SES are presented in **Table 1.** Related tables, i.e. **Tables 2, 3 and 4** are included in this report. (Refer to **Appendix A** for method used to rank households according to social standing and economic situation.)

4. Time Allocation/Activity

Kansas is analyzing Phase I time allocation data. An abstract, entitled "Women's Food Production Activities in an Egyptian Village Undergoing Socioeconomic Transition" by N. Jerome, J. Ricci, H. Aly, S. Wahba, F. Shaheen, A. Abdou, Z. Shaheen, R. El Feky, Z. Abou el Gheit, A. Said, O. Galal, G. Harrison and A. Kirksey was submitted and accepted for inclusion in the Sixth Annual Farming Systems Research and Extension Symposium which convened at Kansas State University during the week of October 5, 1986. The abstract was submitted to Nutrition CRSP channels for pre-submission approval. Approval was granted. A copy is attached. (See **Appendix B.** Also, refer to **Tables 5-8** for preliminary data supporting the abstract. Note that this is an incomplete record.)

Kansas continues to process all available raw time allocation/activity data collected through December, 1985. The systematic procedure involves translation, coding, data transfer to computer sheets and computer entry. Each step includes specific quality control checks. Remaining data will processed as soon as they are received.

TABLE 1

DISTRIBUTION OF CORE HOUSEHOLDS BY DOMINANT OCCUPATIONAL MODE AND SES

SES	Dominant Occupational Mode of the 312 Core Households*											
	Farming (n = 65)		Farming + Non-Farming (Nuclear) (n = 26)		Farming + Non-Farming (Extended) (n = 44)		Non-Farming (n = 174)		Other (n = 2)		Total (n = 311)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
High (n = 42)	1	0.32	4	1.29	7	2.25	30	9.65	0	0.0	42	13.50
Upper Intermediate (n = 50)	4	1.29	4	1.29	10	3.22	32	10.29	0	0.0	50	16.08
Lower Intermediate (n = 135)	33	10.61	11	3.54	18	5.79	72	23.15	1	0.32	135	43.41
Low (n = 84)	27	8.68	7	2.25	9	2.89	40	12.86	1	0.32	84	27.01
Total (n = 311)	65	20.90	26	8.36	44	14.15	174	55.95	2	0.64	311	100.0

* Incomplete data on one household.

TABLE 2

DISTRIBUTION OF KALAMA HOUSEHOLDS[a] BY FAMILY TYPE

Family Types in Kalama Households	Distribution	
	Number	Percent
Nuclear	1,005	68.5
Extended - Simple[b]	384	26.1
Extended - Joint[c]	79	5.4
TOTAL	1,468	100.0

[a] n = 1,468 households

[b] A family consisting of a senior couple, their unmarried children (if any), a married son (usually the oldest) and the young couple's unmarried children.

[c] A family consisting of a senior couple, their unmarried children (if any), married sons, their spouses and their unmarried children.

TABLE 3

DISTRIBUTION OF HOUSEHOLDS BY DOMINANT OCCUPATIONAL MODE

Dominant Occupational Mode of Households	Distribution[a]	
	Number	Percent
Farming	65	20.9
Non-Farming	174	56.0
Farming + Non-Farming[b] (in Nuclear Family)	26	8.0
Farming + Non-Farming[c] (in Extended Family)	44	14.5
Other	2	0.6

[a] n = 311 households

[b] At least two wage earners - one or more engaged in an agricultural occupation and one or more engaged in a non-agricultural occupation.

[c] At least one wage earner engaged in both agricultural and non-agricultural occupations.

TABLE 4

DISTRIBUTION OF HOUSEHOLDS BY SES

SES	DISTRIBUTION OF HOUSEHOLDS*	
	Number	Percent
High	42	13.5
Upper Intermediate	50	16.0
Lower Intermediate	135	43.3
Low	85	27.2

* n = 312 households

TABLE 5

DISTRIBUTION OF OBSERVATION PERIODS[a] BY SUBJECTS' HOUSEHOLD OCCUPATIONAL MODE AND SES

SES	Dominant Occupational Mode			
	Farming (n = 125)	Non-Farming (n = 351)	Farming + Non-Farming (Nuclear) (n = 105)	Farming + Non-Farming (Extended) (n = 33)
High (n = 92)	2	69	13	8
Upper Intermediate (n = 106)	11	68	26	1
Lower Intermediate (n = 245)	52	141	38	14
Low (n = 171)	60	73	28	10

[a] n = 614 two-hour observation periods. Women were observed in pre- and post-harvest food production activities.

TABLE 6

AMOUNT OF TIME SPENT IN ALL FOOD PRODUCTION ACTIVITIES BY WOMEN[a] IN HOUSEHOLDS DISTRIBUTED BY THREE OCCUPATIONAL MODES AND TWO SES GROUPS

SES	Mean Number of Minutes[b] Spent in Food Production		
	Farming (n = 112)	Non-Farming (n = 214)	Farming + Non-Farming (Nuclear) (n = 66)
Lower Intermediate (n = 231)	26.63 ± 33.70 (n = 52)	23.34 ± 32.45 (n = 141)	20.68 ± 26.11 (n = 38)
Low (n = 161)	32.17 ± 32.33 (n = 60)	27.70 ± 32.03 (n = 73)	27.29 ± 39.36 (n = 28)

[a] n = 392 two-hour observation periods.

[b] Mean ± standard deviation was calculated for a two-hour observation period.

TABLE 7

AMOUNT OF TIME SPENT IN FOOD PREPARATION ACTIVITIES BY WOMEN[a] IN HOUSEHOLDS DISTRIBUTED BY THREE OCCUPATIONAL MODES AND TWO SES GROUPS

SES	Mean Number of Minutes[b] Spent in Food Preparation		
	Farming (n = 112)	Non-Farming (n = 214)	Farming + Non-Farming (Nuclear) (n = 66)
Lower Intermediate (n = 231)	14.87 ± 21.70 (n = 52)	15.13 ± 25.92 (n = 141)	12.74 ± 18.81 (n = 38)
Low (n = 161)	21.27 ± 26.89 (n = 60)	16.29 ± 22.78 (n = 73)	14.68 ± 28.02 (n = 28)

[a] n = 392 two-hour observation periods.

[b] Mean ± standard deviation was calculated for a two-hour observation period.

TABLE 8

AMOUNT OF TIME SPENT IN FOOD PROCESSING ACTIVITIES BY WOMEN[a] IN HOUSEHOLDS DISTRIBUTED BY THREE OCCUPATIONAL MODES AND TWO SES GROUPS

SES	Mean Number of Minutes[b] Spent in Food Processing		
	Farming (n = 112)	Non-Farming (n = 214)	Farming + Non Farming (Nuclear) (n = 66)
Lower Intermediate (n = 231)	8.25 ± 25.42 (n = 52)	5.49 ± 19.18 (n = 141)	2.79 ± 12.39 (n = 38)
Low (n = 161)	3.85 ± 13.10 (n = 60)	7.18 ± 19.47 (n = 73)	8.39 ± 27.10 (n = 28)

[a] n = 392 two-hour observation periods.

[b] Mean ± standard deviation was calculated for a two-hour observation period.

F. DATA MANAGEMENT

1. Meetings

Dr. Norge W. Jerome, Beverly Brown and Judith Ricci met with Dr. Saneya Wahba (October 21 - 25, 1985), Dr. Suzanne Murphy (November 27, 1985) and Dr. George McCabe and Ms. Linda McCabe (December 6, 1985) at the University of Kansas on various Egypt project data management and data analysis issues.

Accomplishments of meetings with Dr. Saneya Wahba include:

- Examination of printouts run on both official tapes #6 and #7 from Egypt to find additional out of range values.
- Discussion of the five possible error types (invalid data, questionable values, possible duplicates, questionable ID values and households not included in the core) previously identified on data keyed in Egypt.
- Development of a list identifying the 312 CRSP core households.
- Confirmation of the CRSP Baby List.

Accomplishments of meeting with Dr. Suzanne Murphy include:

- Discussion of the logical flow of data at Kansas with special emphasis on error detection and resolution and distribution of printouts and data resolutions forms to investigators.
- Discussion of the conversion of individual and household food intake data to kcal values.

Accomplishments of meeting with Dr. George McCabe and Ms. Linda McCabe include:

- Determination of the status of cognitive and RMR data sets.
- Establishment of data management and analysis priorities for the data analysis meetings at UCLA in February, 1986.
- Discussion of the accuracy of toddler birthdates.
- Review and discussion of the Egypt Project Annual Report (10/1/84 - 9/30/85).

Beverly Brown met with Dr. Suzanne Murphy, Claudia Waters and David Lein at Berkeley on February 24th. Accomplishments of this meeting include:

- Discussion of i) the preliminary reports summarizing data received by ME from the Kansas DMU, ii) the Basic Data Set of 9/84 with emphasis on the variable, HHTYPE, and the Household Entry-Change-Exit file and iii) target pregnancies.

- Determination of the need for documentation of the Basic Data Set and project specific variables, sufficient variable mapping and the ranges used in checking.

2. Error Detection and Correction

Anthropometry, morbidity, medical history, physical exam and immunology data resolution forms were examined for unresolved problems.

Household food intake data were corrected.

The identity of records with invalid values for the Morbidity Recall variables, Temperature and/or Final Diagnosis, were submitted to Egypt for correction. These include Morbidity Recall data collected from August 1984 through December 1985.

Errors detected in the following data sets processed to date were corrected: individual food intake, household and individual sanitation and hygiene and time allocation/activity.

3. Distribution of Data Tapes

Five tapes were sent to Berkeley containing the following Phase II core data:

Tape 1:
Community socioeconomic (9 observations)
Household socioeconomic (14 observations)
Reproductive history (52 observations)
Monthly pregnancy survey (50 observations)
Lactation and infant feeding (3 observations)
Child behavior rating (25 observations)
Schooler classroom observation (52 observations)
Toddler cognitive (29 observations)
Schooler cognitive (20 observations)
Adult female cognitive (26 observations)
Adult male cognitive (11 observations)
Behavioral observation (640 observations)
Hematology (400 observations)
Urine examination (348 observations)
Household socioeconomic status (192 observations)

Tape 2:
Biological data - Form 1 (504 observations)
Biological data - Form 2 (28 observations)
RMR (198 observations)
Immunology cell-mediated immunity (125 observations)
Immunology humoral immunity (177 observations)
Immunology complement (176 observations)
Immunology serum proteins (177 observations)
Medical history - Form 1 (279 observations)
Medical history - Form 2 (995 observations)
Physical exam - Form 1 (279 observations)

Physical exam - Form 2 (940 observations)

Tape 3: Anthropometry - targets (4,828 observations)
Anthropometry - non-targets (173 observations)
Anthropometry - pregnant females (766 observations)
Anthropometry - lactating females (746 observations)
Anthropometry - infants (942 observations)

Tape 4: Revised individual food intake (3,292 observations)
New individual food intake (9,441 observations)

Tape 5: Household food intake (4,209 observations)
RMR (798 observations)

Five tapes were sent to the statistician at Purdue containing the following Phase II core data:

Tape 1: Community socioeconomic (9 observations)
Household socioeconomic (191 observations)
Reproductive history (118 observations)
Monthly pregnancy survey (50 observations)
Lactation and infant feeding (3 observations)
Child behavior rating (25 observations)
Schooler classroom observations (113 observations)
Toddler cognitive (53 observations)
Schooler cognitive (41 observations)
Adult female cognitive (44 observations)
Adult male cognitive (20 observations)
Behavioral observation (640 observations)
Hematology (872 observations)
Urine examination (737 observations)
Anthropometry, non-targets (386 observations)
Demography (1,337 observations)
Parasitoloty (656 observations)
Entry/change/exit (223 observations)

Tape 2: Biological data - Form 1 (504 observations)
Biological data - Form 2 (28 observations)
RMR (198 observations)
Immunology cell-mediate immunity (125 observations)
Immunology humoral immunity (177 observations)
Immunology complement (176 observations)
Immunology serum proteins (177 observations)
Medical history - Form 1 (279 observations)
Medical history - Form 2 (995 observations)
Physical exam - Form 1 (279 observations)
Physical exam - Form 2 (940 observations)

Tape 3: Anthropometry - targets (4,828 observations)
Anthropometry - non-targets (173 observations)
Anthropometry - pregnant females (766 observations)
Anthropometry - lactating females (746 observations)
Anthropometry - infants (942 observations)

Tape 4: Revised individual food intake (3,292 observations)
New individual food intake (9,441 observations)

Tape 5: Household food intake (4,209 observations)
RMR (798 observations)

One tape was sent to Egypt containing the following Phase II core data:

Tape 1: Revised individual food intake (3,292 observations)
New individual food intake (9,441 observations)

Five tapes were sent to Berkeley and Purdue containing the following Phase II core data:

Tape 1: 5/7/86
Morbidity illness episodes (2,148 observations)
Weekly morbidity recall (50,766 observations)

Tape 2: 5/30/86
Individual food intake (2,292 observations)
Anthropometry - targets (1,795 observations)
Anthropometry - non-targets (44 observations)
Breastfed toddlers (2,674 observations)
Festive events affecting individual food intake (732 observations)
Demography (2,180 observations)
Individual socioeconomics (2,180 observations)

Tape 3: 7/18/86
Morbidity illness episodes (3,683 observations)
Weekly morbidity recall data (82,796 observations)
Individual food intake (490 observations)
Physiologic state of target female (4,963 observations)

Tape 4: 9/16/86
Individual food intake (16,077 observations)
Weekly morbidity recall (88,921 observations)
Morbidity illness episodes (3,888 observations)
Household socioeconomic status (312 observations)
Hematology and urine examination (3,961 observations)

Tape 5: 9/30/86
Number of meals/day consumed by target male (4,763 observations)
Breastfed and non-breastfed toddlers (2,799 observations)
Physiologic state of target female (5,150 observations)
Pregnancy outcome (124 observations)
Dubowitz (110 observations)
Toddler behavioral observations (2,586 observations)
Infant behavioral observations (246 observations)

One tape was sent to Egypt on April 1, 1986 containing Phase II core household food intake data - 4,209 observations.

4. Programs Written

#245 Listing of food and beverage prices (9 observations)

#246 6th official tape from Egypt: Frequencies for anthropometric data for the period 8/84 - 3/85 (4,184 observations)

#247 7th official tape from Egypt: Frequencies for lactation/infant feeding data for the period 8/84 - 1/85 (279 observations)

#248 Listing of Phase II data sets sent on tape to Berkeley

#249 Listing of Phase II data sets sent on tape to Purdue

#250 Listing of new food intake codes (460 observations)

#251 Listing of SES values for an additional 30 households

#252 Frequencies for individual food intake data by month (8/84 - 12/84)

#253 Frequencies for household food intake data by month (8/84 - 12/84)

#254 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#255 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#256 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#257 Listing of Phase II data sets sent on tape to Egypt

#258 a. Frequencies for individual sanitation and hygiene data - Observational protocol (393 observations)

b. Listing of individual sanitation and hygiene data - Observational protocol (393 observations)

#259 a. Frequencies for household sanitation and hygiene data - Observational protocol (384 observations)

b. Listing of household sanitation and hygiene data - Observational protocol (384 observations)

#260 a. Frequencies for household sanitation and hygiene data - Interview protocol (170 observations)

b. Listing of household sanitation and hygiene data - Interview protocol (170 observations)

#261 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#262 Listing of Phase II data sets sent on tape to Egypt

#263 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#264 Listing of Illness Episodes for Attachment B which are no longer classified severe after revision of the severity codes (55 observations)

#265 Listing of requested sex and birthdate for target subjects (179 observations)

#266 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#267 Number of tonsils present by target individuals

#268 Listing of requested values for number of months pregnant, height, weight and ferritin for analysis with the immunology data (633 observations)

#269 Listing of pregnancy outcome data (124 observations)

#270 Listing of Dubowitz data (110 observations)

#271 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#272 Frequencies of SES scores for all 312 core households

#273 Frequency of primary occupations by household subsistence and sex

#274 Listing of activity record data by household subsistence, SES and individual ID

#275 Frequencies for SES categories by household subsistence

#276 Mean minutes spent in food production activities by household subsistence and SES

#277 Listing of questionable food intake data to be verified - data keyed at Kansas

#278 Listing of questionable food intake data to be verified - data keyed at Al-Ahram

#279 Listing of invalid individual IDs on the food intake data (366 observation)

#280 Listing of conflicting food intake values, invalid values for target and invalid values for date

#281 Mean minutes spent in food production activities by household size and number of females

#282 Distribution of households with no food production activities by household subsistence and SES

#283 Distribution of households with no food production activities by household size and number of females

#284 Listing of Phase II data sets sent on tape to Berkeley and Purdue

#285 Mean minutes spent in food production activities per household by household subsistence and SES

#286 Mean minutes spent in food production activities per household by household size and number of females

#287 Mean minutes spent in each food production activity per household by household subsistence and SES

#288 Mean minutes spent in all food production activities per household by household subsistence and SES

#289 Minutes spent in each food production activity by observation periods for target females by household subsistence and SES

#290 Minutes spent in all food production activities by observation periods for target females by household subsistence and SES

#291 Percentages for each food production activity within household subsistence and SES groups

#292 One-way ANOVA on food preparation and food processing activities by household subsistence and SES

#293 One-way ANOVA on all food production activities by household subsistence and SES

#294 Listing of Phase II data sets sent on tape to Berkeley and Purdue

i. Data Entry

The following Phase II core research data were keypunched and verified:

- Sociodemography - 47 forms; 780 lines; 39,642 bytes
- Socioeconomic Update - 31 forms; 524 lines; 37,728 bytes
- Activity Record - 74,815 lines; 5,910,385 bytes
- Demographic Reproductive History - 30 forms; 238 lines; 7,140 bytes
- Biological Samples - 42 forms; 126 lines; 2,772 bytes
- Immunology Cell Mediated Immunity - 2 forms; 44 lines; 1,320 bytes
- Immunology Humoral Immunity - 1 form; 70 lines; 3,080 bytes
- Immunology Complement - 1 form; 71 lines; 3,124 bytes

- Medical History - 55 forms; 307 lines; 22,411 bytes
- Physical Examination - 57 forms; 576 lines; 43,200 bytes
- Demographic Update - 92 forms; 1,778 lines; 43,768 bytes
- Hematology Measurement - 50 forms; 186 lines; 3,348 bytes
- School Child Cognitive Testing - 6 forms; 6 lines; 432 bytes
- Toddler Cognitive Testing - 2 forms; 2 lines; 134 bytes
- Adult Cognitive Testing - 4 forms; 4 lines; 284 bytes
- School-Age Child Classroom Observation - 7 forms; 14 lines; 784 bytes
- Behavioral Observation - 6 forms; 27 lines; 1,022 bytes
- Urine Examination - 115 forms; 308 lines; 5,454 bytes
- Household Food and Beverage Consumption Frequency Record - 19 forms; 209 lines; 15,048 bytes
- Individual Food Intake Record - 231 forms; 17,250 lines; 537,750 bytes
- Household Food Intake Record - 231 forms; 5,834 lines; 157,518 bytes

The following Phase I data were keypunched and verified:

- Physical Assessment - 63 forms; 745 lines; 52,753 bytes

The following Phase II core research data were keypunched and verified

- Household frequency of activity - 7 forms; 21 lines; 1,386 bytes
- Activity record - 69,116 lines; 2,460,164 bytes
- Household sanitation and hygiene (interview) - 54 forms; 162 lines; 10,692 bytes
- Urine examination - 61 forms; 372 lines; 6,696 bytes
- Reproduction/Lactation history - 17 forms; 34 lines; 2,380 bytes
- Hematology measurements - 16 forms; 37 lines; 666 bytes
- Physical examination - 16 forms; 144 lines; 10,800 bytes
- Individual sanitation and hygiene - 58 forms; 58 lines; 2,784 bytes
- Medical history - 23 forms; 106 lines; 7,738 bytes

- Household sanitation and hygiene (observation) - 52 forms; 104 lines; 7,176 bytes
- Anthropometry - 44 forms; 89 lines; 5,785 bytes
- Behavioral observations - 8 forms; 31 lines; 2,263 bytes
- Child-care frequency record - 272 forms; 3,360 lines; 73,719 bytes
- Sociodemographic survey update - 21 forms; 281 lines; 13,943 bytes
- Food intake (Form V) - 735 forms; 5,646 lines; 135,360 bytes
- Food intake (Form IV) - 110 forms; 1,199 lines; 87,527 bytes
- Lactation/infant feeding history - 5 forms; 40 lines; 2,920 bytes
- Pregnancy monthly visits - 20 forms; 40 lines; 2,840 bytes
- Supplementary foods - 3 forms; 6 lines; 468 bytes
- Morbidity recall - 48 forms; 1,018 lines; 24,432 bytes
- Food intake (Festive) - 239 forms; 239 lines; 3,107 bytes
- Morbidity recall attachments - 2,234 forms; 4,013 lines; 278,946 bytes

G. ADMINISTRATION

Dr. Norge W. Jerome continued in her capacity as Egypt Project Representative. Her activities included i) receiving and coordinating PI responses to ME and SCB initiatives and responding to these initiatives, ii) coordinating project activities with Egypt, Purdue administration and ME and iii) coordinating data analysis activities with statisticians at Purdue.

Dr. Jerome also continued overall project management and supervision of project personnel at the University of Kansas.

Dr. Jerome completed her term as Egypt Project Representative in April. She continued overall project management and supervision of project personnel at the University of Kansas.

II. CRSP INVOLVEMENT

A. INTERPROJECT ACTIVITIES

Kansas submitted the Egypt Project Food Intake Methods Chapter to the University of Connecticut on June 5th for incorporation into the food intake methodology section of the Nutrition CRSP final report.

(Also, refer to Section I.A. - TRAVEL.)

III. PLANS FOR NEXT PERIOD

A. ROUTINE

Kansas expects to receive all remaining raw child caregiving, time allocation and individual and household sanitation and hygiene data from Egypt by May 1, 1986. These data will then continue to be processed as indicated in Section I.E. Planned analyses for these data will be discussed.
Dr. Jerome will review and coordinate methodology manuals from the Mexico, Kenya and Egypt projects for i) collection of child caregiving data and individual and household sanitation and hygiene data and ii) data management procedures. Final Nutrition CRSP Methods Manuals will be prepared for ME by June 15, 1986.

Egypt project data analysis meetings (for integrated analysis) with the McCabes will take place as often as needed to achieve CRSP goals.

Dr. Jerome plans to participate in the Scientific Coordination Board meetings to be held at Berkeley in November 1986.

Kansas expects to receive all remaining data from Egypt originally promised by May 1, 1986. These data will then continue to be processed and disseminated in the most timely manner.

Egypt project data analysis meetings (for integrated analysis) with the McCabes will take place as often as needed to achieve CRSP goals.

B. SPECIAL NEEDS TO CONTINUE DATA PROCESSING FROM JANUARY 1987

We have not yet received all of the child care and time allocation data. In order to complete processing these data, i.e. translation, coding, entry and verification, we will need additional funds. We have estimated our needs to be approximately $33,631.00, beginning 1/1/87. This does not include data analysis.

RANKING HOUSEHOLDS ACCORDING TO SOCIAL STANDING AND ECONOMIC SITUATION

Three, three-tiered ordinal scales have been developed to rank respondent households' SES based on demographic and socioeconomic data collected on 199 core households:

- Demographic Indicators Scale
- Economic Indicators Scale I - Household Assets
- Economic Indicators Scale II - Farm Assets

Refer to pages 3 and 4 for scales.

Household SES can be evaluated singularly or compositely on these scales.

The Demographic Indicators Scale is based on the level of formal education and primary occupation of the target male. Phase I sociodemographic and ethnographic data indicate that these two variables accurately estimate social standing with strong economic overtones.

The Econonic Indicators Scale I - Household Assets measures economic rank and is also sensitive to social standing. Its format is based on a tally of common, valuable and prestigious items observed in respondents' homes. The value of these items was determined by the frequency of their occurrence in village households and by Kalama residents' perception of their worth.

Another scale, the farm assets scale, was developed to more accurately rank agricultural households on the basis of their farm assets. The variables included in this scale are amount of land owned or rented and number of animals and birds owned or shared. The scale was constructed by ranking 199 core households' responses from lowest to highest, observing natural breaks in the data and assigning SES levels accordingly.

The household assets scale ranges from 0-3 points (low) to 7-9 points (high) with 4-6 points as intermediate. Refer to Table 1 for this scale's conceptual design. The score is calculated by totaling the number of relevant household assets present in a respondent's house.

By contrast, both the demographic and farm assets scales range from one point (low) to three points (high) with two points as the intermediate level. The demographic and farm assets scores are calculated by adding the numerical value assigned each of the indices and then dividing by the total number of indices.

Households are classified into SES groups according to their overall SES score, i.e. the composite score calculated by summing the individual scores from each component SES scale. The scores are stratified as follows:

> 2.5 and ≤ 3.0 = High SES

> 2.0 and ≤ 2.5 = Upper Intermediate SES

> 1.5 and ≤ 2.0 = Lower Intermediate SES

≥ 1.0 and ≤ 1.5 = Low SES

Table 1

Conceptual Design for Ranking Household Assets
Economic Indicators I

HOUSEHOLD ASSETS	HOUSEHOLD RANK BASED ON PRESENCE OF ASSETS*		
	LOW	INTERMEDIATE	HIGH
Television (black and white or color)	1	1	1
Butane stove	1	1	1
Electricity	1	1	1
Clay brick house	0	1	1
Washing machine	0	1	1
Radio cassette	0	1	1
Carpet	0	0	1
Reception room	0	0	1
Refrigerator	0	0	1
TOTAL	0-3 points	4-6 points	7-9 points

*One ("1") point indicates asset is present in house; zero ("0") points indicates asset is not present in house.

SCALES FOR RANKING HOUSEHOLDS ACCORDING TO SOCIAL STANDING AND ECONOMIC SITUTATION

Demographic Indicators Scale

1. Occupation of target male

Administrator/manager, public sector Business owner/merchant, private sector Landlord, farm cultivator, agricultural Landlord & tenant farm cultivator, agricultural Professional, public sector Professional, private sector Skilled craftsman/merchant, private sector Skilled technician, public sector Skilled technician, private sector	= 3 (HIGH)
Business sales manager, private sector Secretary/clerk, public sector Secretary/clerk, private sector Shop salesman Small merchant/shop owner, private sector	= 2 (INTERMEDIATE)
Hired agricultural laborer, non-technical Hired laborer, livestock care Non-technical helper (e.g. porter), public sector Non-technical helper, private sector Tenant farm cultivator	= 1 (LOW)

2. Number of years of formal education - target male:
   - $\geq$ 9 years of formal education = 3 (HIGH)
   - 6-8 years of formal education = 2 (INTERMEDIATE)
   - $<$ 6 years of formal education = 1 (LOW)

Economic Indicators Scale I - Household Assets:

3. Number of household assets indices present in house.

Black and white TV	= 1
Butane stove	= 1
Electricity	= 1
Clay brick house	= 1
Washing machine	= 1
Radio cassette	= 1
Carpet	= 1
Reception room	= 1
Refrigerator	= 1

Economic Indicators Scale II - Farm Assets:
(FOR AGRICULTURAL HOUSEHOLDS ONLY)

4. Amount of land owned or rented.
   - More than 24 qarats = 3 (HIGH)
   - 1 - 24 qarats = 2 (INTERMEDIATE)
   - No qarats = 1 (LOW)

5. Amount of land owned.
   - More than 24 qarats = 3 (HIGH)
   - 1 - 24 qarats = 2 (INTERMEDIATE)
   - No qarats = 1 (LOW)

6. Number of animals owned or shared.
   - More than 6 animals = 3 (HIGH)
   - 1 - 6 animals = 2 (INTERMEDIATE)
   - No animals = 1 (LOW)

7. Number of animals owned.
   - More than 6 animals = 3 (HIGH)
   - 1 - 6 animals = 2 (INTERMEDIATE)
   - No animals = 1 (LOW)

8. Number of birds owned or shared.
   - More than 6 birds = 3 (HIGH)
   - 1 - 6 birds = 2 (INTERMEDIATE)
   - No birds = 1 (LOW)

9. Number of birds owned.
   - More than 6 birds = 3 (HIGH)
   - 1 - 6 birds = 2 (INTERMEDIATE)
   - No birds = 1 (LOW)

APPENDIX B

ABSTRACT - FARMING SYSTEMS SYMPOSIUM 1986

WOMEN'S FOOD PRODUCTION ACTIVITIES IN AN EGYPTIAN VILLAGE UNDERGOING SOCIOECONOMIC TRANSITION

Jerome, Norge W.; Ricci, Judith A.; Aly, Hekmat; Wahba, Saneya; Shaheen, Farouk; Abdou, Amin I.; Shaheen, Zeinab; El Feky, Ragae; Abou el Gheit, Zeinab; Said, Amin K., Galal, Osman; Harrison, Gail, G.; and Kirksey, Avanelle. University of Kansas School of Medicine; Egypt Nutrition Institute; University of Arizona; and Purdue University.

Kalama, an Egyptian village in the rich Nile delta region, is located 25 kilometers from the heart of Cairo. Kalama is best described as a village undergoing rapid socioeconomic transition. Its proximity to Cairo is but one factor facilitating change. The village is also bisected by the major highway which connects Cairo to Alexandria. In addition, Kalamans communicate regularly with family members working in the oil-rich gulf countries; many residents own television sets and/or radio cassette equipment.

The village economy is mixed. In 1982, 24% of the 1,470 households derived its subsistence largely or solely from farming, 65% from commercial and governmental occupations, and 9% from a mixture of the two sources. Despite this economic mix, women's food production activities remain unaltered. This is not surprising since village culture supports economic diversity at all levels of social organization. Economic diversity is particularly evident in extended households.

This paper will describe women's food production activities in the various types of households. It will also provide a cultural analysis of village life to illustrate how cultural expectations of women support their involvement in a wide variety of food production activities. Socioeconomic factors such as household economic resources and amount of formal education appear to have less influence on women's food production activities than do cultural expectations.

Our data support the need for a comprehensive cultural analysis of change processes in transitional or mixed economies in order to determine the rate and direction of change for specific elements of a culture. We hypothesize that maintenance of traditional food production activities is closely linked to maintenance of food habits, food consumption patterns and nutrition. If so, there are important policy implications here.

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Egypt Project, Human Nutrition CRSP

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Nutrition Intake and Function

Submitted October 1986

Avanelle Kirksey, Principal Investigator

TABLE OF CONTENTS

I. EGYPT PROJECT STATUS

A. Travel

October 11-14, 1985. Dr. George McCabe and Linda McCabe attended the DAG meeting at the University of Connecticut in Storrs, Connecticut (see "Statisticians' Report for the Data Analysis Group Meeting at the University of Connecticut" by George McCabe, December 3, 1985).

October 21-26, 1985. Dr. Farouk Shaheen visited Purdue University to discuss data analysis progress to date and to interact with the statisticians regarding future data analysis strategies. He met with all Purdue CRSP participants to brief them on the status of the CRSP project in Egypt.

October 26-December 20, 1985. Dr. Kirksey was in Egypt to assist in general project management of CRSP activities. She assisted Drs. Galal, Dakroury and Bassily in data entry for reproduction, RMR and hematology and in data cleaning and flow of data to U.S.

December 6-7, 1985. Dr. George McCabe and Linda McCabe visited the data management group at the University of Kansas to discuss data flow procedures and problems relative to data analyses.

December 16-18, 1985. Dr. George McCabe visited ME at Berkeley to discuss analytical strategies with Dr. George Beaton and ME personnel (see "Comments on RMR/BMR and Related Analyses" by Dr. George McCabe, January 21, 1986).

February 23-26, 1986. Dr. George McCabe and Linda McCabe attended the DAG meetings at UCLA (see "Statistics Report" by Dr. George McCabe, March 10, 1986).

February 23-March 1, 1986. Dr. Kirksey attended the SCB/IC/DAG meeting at UCLA.

February 24-26, 1986. Dr. D.R. Smith and Mr. Jay Menacher represented Purdue University at the IC meetings at UCLA.

April 16, 1986. Dr. Avanelle Kirksey, Dr. George McCabe and Linda McCabe attended a meeting of the Egypt project at the American Institute of Nutrition meetings in St. Louis.

June 24-25, 1986. Dr. George McCabe and Linda McCabe hosted a meeting at Purdue for project statisticians from UCLA and University of Connecticut.

August 18-21, 1986. Dr. George McCabe and Linda McCabe attended the Joint Statistical Meetings in Chicago. Various aspects of the statistical analyses for the project were discussed with other statisticians and sessions dealing with similar methodologies were attended.

September 12, 1986. Dr. George McCabe and Linda McCabe attended a meeting of project statisticians at Chicago.

B. Negotiations with Counterpart Institutions

Universities of Arizona, Kansas and Purdue revised their institutional

budgets for CRSP to re-instate certain project activities which were previously deleted due to budgetary constraints. Upward revisions of the budget were done in response to information from ME that some additional funding for data analyses would be requested from AID. Since this was not forthcoming final revisions of the budgets were made following the February meeting at UCLA.

C. Recruitment of Staff to the Project

None

D. Research Activities

1. Data Analysis. The two DAG meetings (Connecticut, 10/11-14/85) and UCLA, 2/23-26/86) represented focal points for the statistical activity during this period. Results of analyses performed and plans for future work were the major concerns at each of these meetings. At Storrs, some detailed analyses of toddler data were presented and compared across projects. Variables included food intake, anthropometry and morbidity. This was the first attempt at parallel analyses in a common format. Discussions of analytical strategies and, in particular, data problems were very useful. Although the data sets analyzed were far from complete, it became evident that the relatively simple preliminary approaches need considerable refinement in order to address the major research questions. For the UCLA meeting it was decided to undertake a preliminary analysis of the adult data, including RMR.

Methodological questions concerning the RMR data were discussed at Berkeley (12/16-18/85). Valuable input was received from Dr. George Beaton and a plan of attack for these data was devised. At the UCLA meeting, detailed RMR analyses were presented and discussed. Approaches for constructing composite variables were explored. Time plots of different variables for selected toddlers were examined. Plans were developed for concentrating on morbidity and growth.

The statistical activity has concentrated primarily on what might be called data analysis rather than statistical inference. This emphasis has been both necessary and appropriate due to the complexity of the data and the problems with incomplete and missing observations. Thus, the statisticians have attempted to describe and study the data available so that suitable models can be built for examination of the research questions. Examples include the detailed toddler plots mentioned above and the detailed description of toddler illness episodes. Thus the statistical activity for the Egypt project has ranged from exploratory data descriptions to the development of analytical strategies for addressing the CRSP research questions. An overview of some of these activities is contained in the Statisticians' Report by George P. McCabe, October 16, 1986 (Attachment A). Details of many of the statisticians' efforts are also contained in a series of about 100 short reports. The following is a brief summary of the contents of these reports.

For morbidity, the statisticians have prepared a collection of data summaries dealing with various quantifications. Thus, wellness intervals, illness durations and illness frequency were examined in different ways. Illnesses have been studied by type with separate analyses for respiratory, digestive and skin. Monthly variation has also been examined. Most of the summaries are for toddlers but a few deal with infants. One particularly interesting report concerned overlapping illnesses. As a result of this report,

such events have been categorized and some research questions relating to progressive illnesses have been defined. Anthropometry has received much attention. Yearly growth rates have been calculated using linear fits to the data and these have been correlated with other variables. Monthly variation has been examined.

RMR has been studied in much detail. The underlying variables which generated the RMR measures were examined and in this process some difficulties with the data were uncovered that are perhaps related to malfunction of the Beckman equipment. A collection of reports deal with VO_2, RQ, heart rate and variation over time within a recording session.

Relationships among the variables have been examined in many of the reports. Thus, simple correlations are given and a large number of autoregression results are detailed. The data that the statisticians have received contain many errors and are incomplete. Much work was done by the statisticians to address these difficulties which is not evident in the reports. However, some results of efforts to identify questionable values and to examine the extent of missing data are given in several statistics reports. It is clear that these reports will need to be redone as more data are received. A large amount of data were sent to the statisticians within the past month. Unfortunately, the quality of the data received and the lateness of its arrival at Purdue have hampered progress. Obviously bad values, missing codes, duplicate records and numerous other inadequacies consumed an excessive amount of time.

2. Psychology. There is little change in the status of the psychology area. Dr. Wachs has been in contact with Dr. Bishry and members of her field staff in Egypt in terms of certain scoring procedures and data handling. He also has been working with Dr. George McCabe, project statistician, in terms of data cleaning procedures here for a small segment of data which appears to have been sent from Egypt without being cleaned. However, progress cannot be expected until data actually are transmitted to the U.S. from Egypt.

Only recently (October 1-14, 1986) actual data files were received from Egypt and Kansas for parent-infant and parent-toddler interaction. However, early this summer summary sheets from Egyptian scientists were recieved containing the non-cleaned cognitive data on infants, toddlers, schoolers and adults. The actual data files containing this information have not yet been received. Rather than delaying further, the uncleaned data were entered at Purdue from the summary sheets. The first step was thus to enter all of the data from the summary sheets into the computer. Given the focus on toddlers for the November meeting, the concentration was on doing range checks and data cleaning for the toddlers. A total of 198 data protocols were entered for the toddlers. Single or multiple suspect data points were found on 119 of the protocols. Of these suspect protocols, 53 suspect data points were corrected at Purdue through manual inspection of the summary sheets and recomputation of the suspect values. The remaining 66 protocols in which suspect values were found have been sent to Egypt for clarification. Currently no information is available on these protocols. For the protocols which were validated, range values were computed and, for subjects for whom multiple testings were made changes over time have been computed. Within two weeks preliminary analyses will begin on the validated toddler protocols, in terms of relating variability in performance to variability in predictor variables obtained by other sections

of the project. Due to budgetary constraints, Dr. Wachs' formal participation in the project ended on 9/30/86. However, Dr. Wachs has agreed to continue to be involved on his own time with the data anlysis and data writeup aspects of the project.

3. Reproduction. Dr. Kirksey spent time in Egypt October 26-December 20, 1985 collaborating with Dr. Farouk Shaheen and Dr. Nargis Bassily in preparing raw data forms for reproduction/lactation/infant growth data for computer entry. Also procedures were developed for data cleaning.

Status of Data. The number of target pregnant women who entered and completed the study and the number who were entered and then withdrew from the study for various reasons are summarized in Table 1. Among 145 pregnant women who participated in the study, 12 women reported fetal deaths and 133 had normal deliveries.

Table 1. Target pregnant women: Entry/withdrawal from study and pregnancy outcome

	No. of subjects	
Entry into study		192
Normal delivery	133	
Fetal deaths	12	
Withdrawal from study		47
>5 mo pregnant at entry	7	
Pseudo-pregnancy	10	
Moved, uncooperative, other	5	
Not followed-up	25	
Completion of study		133

Birthweight measurements were obtained for 102 infants (77% of the total deliveries); the reasons for missing birthweight measurements are shown in Table 2.

Table 2. Target infants: Summary of birthweight measurements

		Reasons for no birthweight measurements				
Infant	Birthweight measurement within 24h	Parents withdrew infant from study	Parents refused birthweight measurement	Early unexpected delivery	Infant died	Total
No	102	10	4	15	2	133
%	76.7	7.5	3.01	11.3	1.5	100

Complete follow-up information for 6 months was obtained for 71 infants and lactating mothers and almost complete data (1-2 months missing) for 21 infants and mothers (Table 3). Eight infants died during the course of the study; the age of infants at the time of death varied from a few days of age to 5 months (Table 4).

Table 3. Target infant: Follow-up information

	Infants	
	Number	Percent
Data complete (6 months)	71	53
Data almost complete (1-2 mo missing)	21	16
Infant deaths	8	6
Withdrawal from study		
Day of birth	10	8
After 1-2 mo	23	17
Total	133	100

Table 4. Target infant: Mortality

Infants	
Age	Number
1-3 days	2
8 days	2
1 month	1
2 months	2
5 months	1
Total	8

4. Infant Growth. Birthweights were measured for 102 infants among whom 9% were low birthweight (<2500 g)(Table 5). Frequency distributions of infants by birthweight indicated that 43% weighed between 3000 to 3500 g and 25% weighed ≥3500 g.

Table 5. Frequency distribution of infants by birthweight

		Birthweight (g)					
Infants		<2000	2000-	2500-	3000-	3500-	4000+
No	102	1	8	23	44	24	2
%	100	0.9	7.8	22.6	43.2	23.5	1.9

Weight data for 72 male and female infants were classified according to whether their weights at birth and 6 months were greater than or less than the 50th percentile of the National Center for Health Statistics (NCHS) for their age and sex (Figures 1 and 2). Among the 31 female and 41 male infants for which 6 repeated weight measurements were made, the mean weights of only 6 male infants exceeded the 50th percentile at birth and continued to exceed this norm to 6 months of age when the study was terminated (Figures 1 and 2). Mean weights of both male and female infants, less than the 50th percentile at birth, continued to be less than the 50th percentile from 1 to 6 months of age. Also most male and all female infants whose weights exceeded the 50th percentile at birth showed growth faltering at 3 to 4 months of age. The faltering continued below the 50th percentile until the study was terminated at 6 months of age. Several factors which have been associated with faltering in infant growth will be examined. These include Kcal intake of the mother, Quetelet index of the

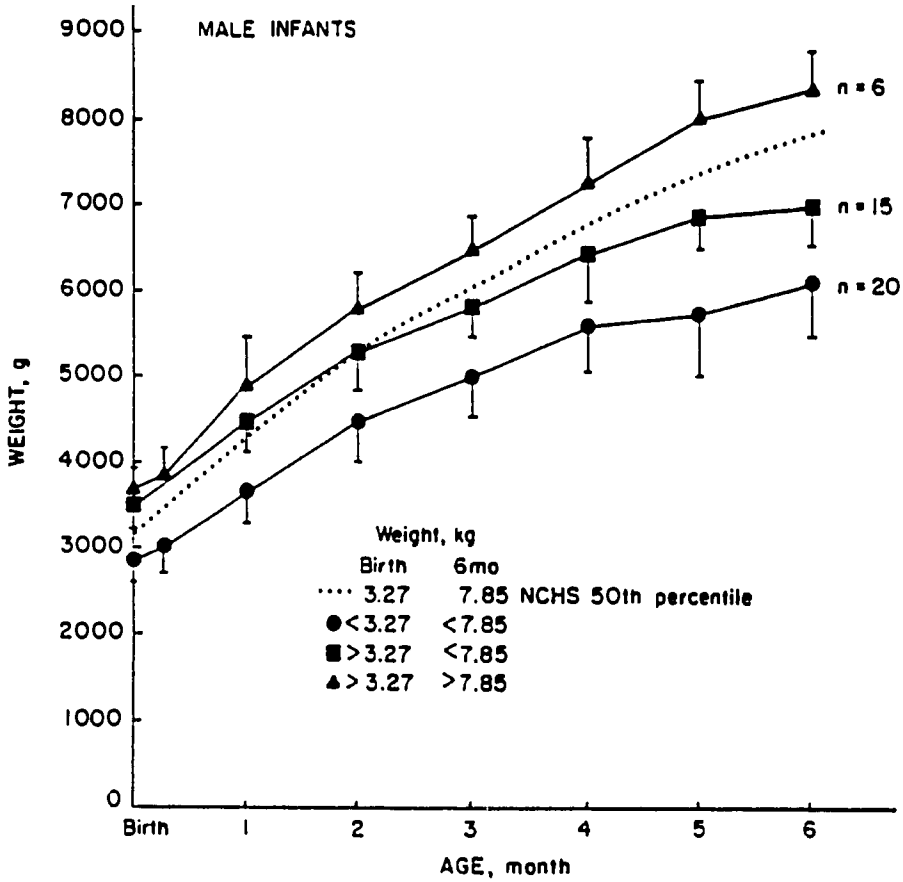

Figure 1. Weights of male infants classified at birth and at 6 months of age as to whether measurements were less than or exceeded the 50th percentile of the National Center for Health Statistics (NCHS). (Vertical bars = Mean ± SEM)

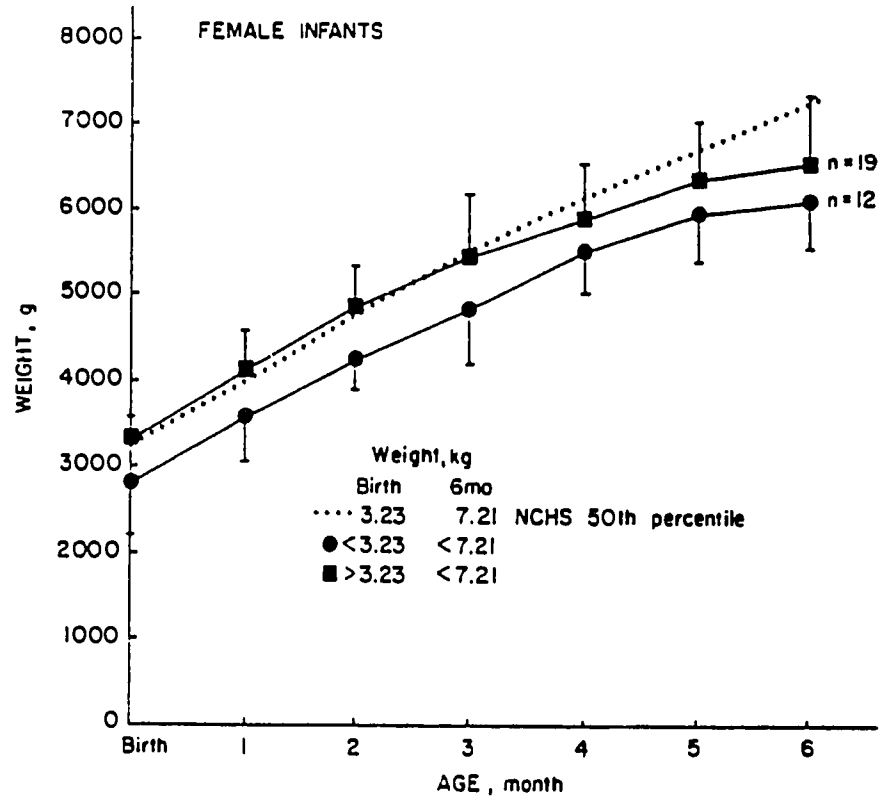

Figure 2. Weights of female infants classified at birth and at 6 months of age as to whether measurements were less than or exceeded the 50th percentile of the National Center for Health Statistics (NCHS). (Vertical bars = Mean ± SEM)

mother (weight/height), length of last birth interval, history of death among siblings, sociosanitary index, morbidity of the infant and mother, breastfeeding practices, and introduction of supplementary foods.

5. Hematological Status

Toddlers. Iron deficiency anemia appeared to be a problem among the toddlers as indicated by a mean hemoglobin level of 10.6 ± 1.32 g/dl for 127 toddlers studied (Table 6) and by the frequency distribution of the values (Table 7). Hemoglobin concentrations <11.0 g/dl were found in 60.4% of the toddlers, <10.0 g/dl in 24.4% and serum ferritin concentrations <10.0 ng/ml in 28.0% of the group studied (Table 8). For the evaluation of hematological status, toddlers were divided into three age groups of 18 months (range 14.3-20.9), 24 months (range 21.0-26.9) and 30 months (range 27-33) (Table 8). A higher percentage of toddlers in the oldest group compared to the other

Table 6. Hemoglobin, hematocrit and ferritin levels in toddlers and schoolers

	Age	Hemoglobin	Hematocrit	Ferritin
		g/dl	%	ng/ml
Toddlers	14.3-33 (mo)	10.6 ± 1.32[1](127)[2] (5.6 - 13.5)[3]	34.3 ± 3.4 (122) (23.0 - 47.0)	19.8 ± 15.1 (100) (2.0 - 75.5)
Schoolers	5.4-9.8 (yr)	12.6 ± 1.17 (99) (8.1 - 14.8)	37.4 ± 2.5 (97) (26.5 - 45.0)	29.3 ± 19.1 (82) (2.0 - 93.0)

[1]Mean ±SD
[2]Number of subjects
[3]Range

groups had acceptable values for hemoglobin, hematocrit and serum ferritin. Figure 3 shows the frequency distribution of hemoglobin by age groups. The differences observed in hematological status of younger and older toddlers will be examined relative to Kcal intake; duration of breastfeeding; and time of introduction of solid foods: type, quantity, frequency. Hematological status of toddlers will also be assessed relative to functional outcomes: (a) disease: number of episodes, type, duration, severity; and (b) cognitive measures: Bayley mental, specific abilities (memory), toy play tasks, social interactions, language use and exploratory activity.

Schoolers. The incidence of anemia among schoolers was low and markedly less than was observed for toddlers (Figure 4, Table 8). Less than 10% of schoolers had hemoglobin concentrations below the acceptable level according to norms of the International Nutrition Anemia Consultative Group (INACG) and only 2% had hematocrits of less than 33% (Table 8). Use of WHO and CDC standards indicated a higher percentage of schoolers below the acceptable levels for hemoglobin and hematocrit than shown by INACG standards (Table 8). However the incidence of anemia in schoolers was still markedly less than for toddlers. This is further supported by the higher serum ferritin levels (higher body iron stores) observed in schoolers compared to toddlers (Table 6). This difference in hematological status of toddlers and schoolers will be explored relative to functional outcomes including illness (episodes, type, duration and severity) and cognition/behavior of the children.

Table 7. Frequency distribution of hemoglobin, hematocrit and serum ferritin in toddlers and schoolers

Group (Age)	Hemoglobin (g/dl)							
	<8.0	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-12.9	13.0-13.9	≥14.0
	% of subjects							
Toddlers 14.3-33 mo (n=127)	3.1 (4)[1]	7.1 (9)	14.2 (18)	36.2 (46)	26.0 (33)	10.2 (13)	3.1 (4)	0.0 (0)
Schoolers 5.4-10 yrs (n=99)	0.0 (0)	1.0 (1)	1.0 (1)	6.0 (6)	15.0 (15)	37.0 (37)	25.0 (25)	14.0 (14)

	Hematocrit (%)					
	<30.0	30.0-32.9	33.0-35.9	36.0-38.9	39.0-41.9	≥42
	% of subjects					
Toddlers 14.3-33 mo (n=122)	6.5 (8)	23.0 (28)	36.9 (45)	24.6 (30)	8.2 (10)	0.8 (1)
Schoolers 5.4-10 yrs (n=97)	1.0 (1)	1.0 (1)	16.5 (16)	52.6 (51)	25.8 (25)	3.1 (3)

	Serum Ferritin (ug/l)						
	<5.0	5.0-9.9	10.0-19.9	20.0-29.9	30.0-39.9	40.0-49.9	≥50.0
	% of subjects						
Toddlers 14.3-33 mo (n=100)	9.0 (9)	19.0 (19)	34.0 (34)	17.0 (17)	10.0 (10)	6.0 (6)	4.0 (4)
Schoolers 5.4-10 yrs (n=84)	1.2 (1)	3.6 (3)	28.6 (24)	33.3 (28)	11.9 (10)	2.4 (2)	19.0 (16)

[1]Number of subjects

Table 8. Hematological status of toddlers and schoolers by age group

	Hemoglobin (g/dl)			Hematocrit (%)			Serum Ferritin (ng/ml)		
	Deficient	Marginal	Acceptable [1]	Deficient	Marginal	Acceptable [1]	Deficient	Marginal	Acceptable [2]
Age	<10.0	10.0-10.9	≥11.0	<30.0	30.0-32.5	≥33.0	<10.0	10.0-11.9	≥12.0
Toddler (mo)					% of toddlers				
14.3-20.9	25.7 (28/109) [3]	33.9 (37/109)	40.4 (44/109)	6.7 (7/105)	23.8 (25/105)	69.5 (73/105)	36.9 (17/46)	4.3 (2/46)	58.7 (27/46)
21-26.9	22.6 (14/62)	32.3 (20/62)	45.1 (28/62)	12.9 (8/62)	21.0 (13/62)	66.1 (41/62)	24.6 (15/61)	8.2 (5/61)	65.6 (40/61)
27-33	18.7 (12/64)	23.4 (15/64)	57.8 (37/64)	1.6 (1/64)	15.6 (10/64)	82.8 (53/64)	14.8 (8/54)	3.7 (2/54)	81.5 (44/54)
Combined (14.3-33)	24.4 (31/127)	36.2 (46/127)	39.4 (50/127)	6.6 (8/122)	22.9 (28/122)	70.5 (86/122)	28.0 (28/100)	9.0 (9/100)	63.0 (63/100)
Schooler (yr)					% of schoolers				
5.4-10	2.0 (2/99)	6.1 (6/99)	91.9 (91/99)	1.0 (1/97)	1.0 (1/97)	98.0 (95/97)	4.8 (4/84)	8.3 (7/84)	86.9 (73/84)

	Deficient	Marginal	Acceptable [4,5]	Deficient	Marginal	Acceptable [5]
	<11.0	11.0-11.9	≥12.0	<33.0	33.0-35.5	≥37
Schooler (yr)						
5.4-10	8.0 (8/99)	15.0 (15/99)	77.0 (76/99)	3.1 (3/97)	16.5 (16/97)	81.4 (79/97)

[1] Report of the International Nutritional Anemia Consultative Group (INACG), The Nutrition Foundation, 1981.

[2] Dallman, P.R., Siims, M.A., Stekel, A. Iron deficiency in infancy and childhood. Am J Clin Nutr 33:86-118, 1980.

[3] Number of subjects/total subjects

[4] WHO Technical Report Series No. 405, Nutritional Anemias, 1968.

[5] Centers for Disease Control Nutritional Surveillance, 1980.

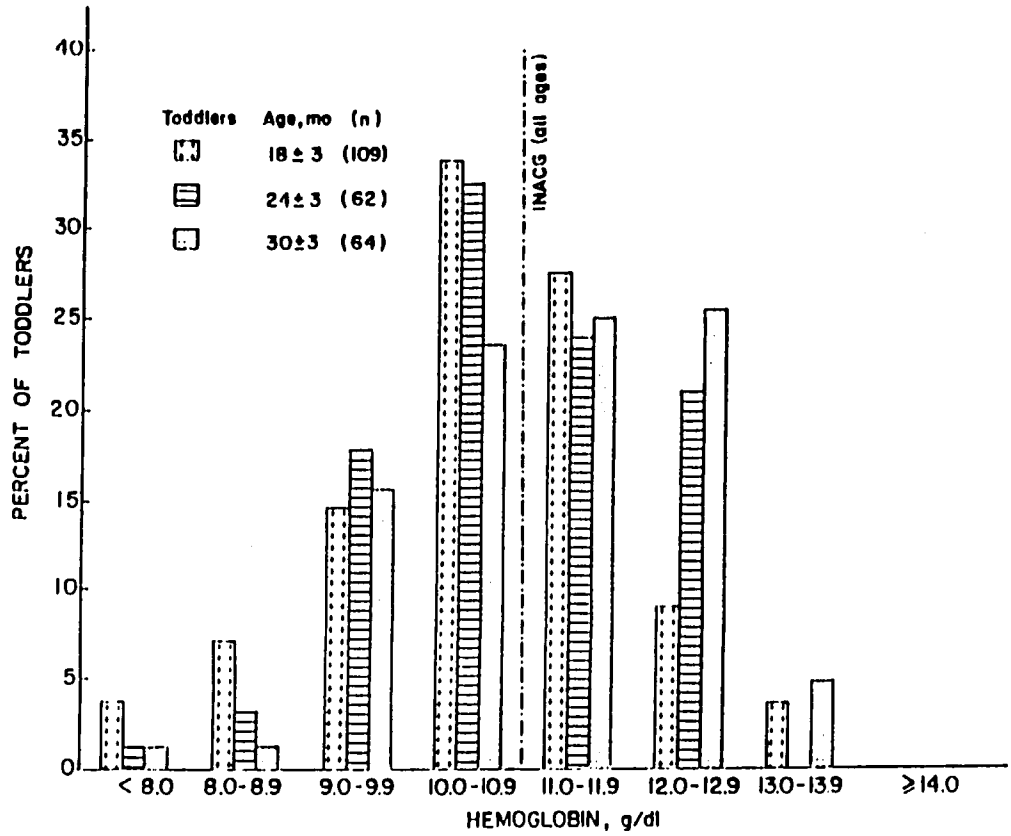

Figure 3. Frequency distribution of hemoglobin concentration among toddlers of different ages.

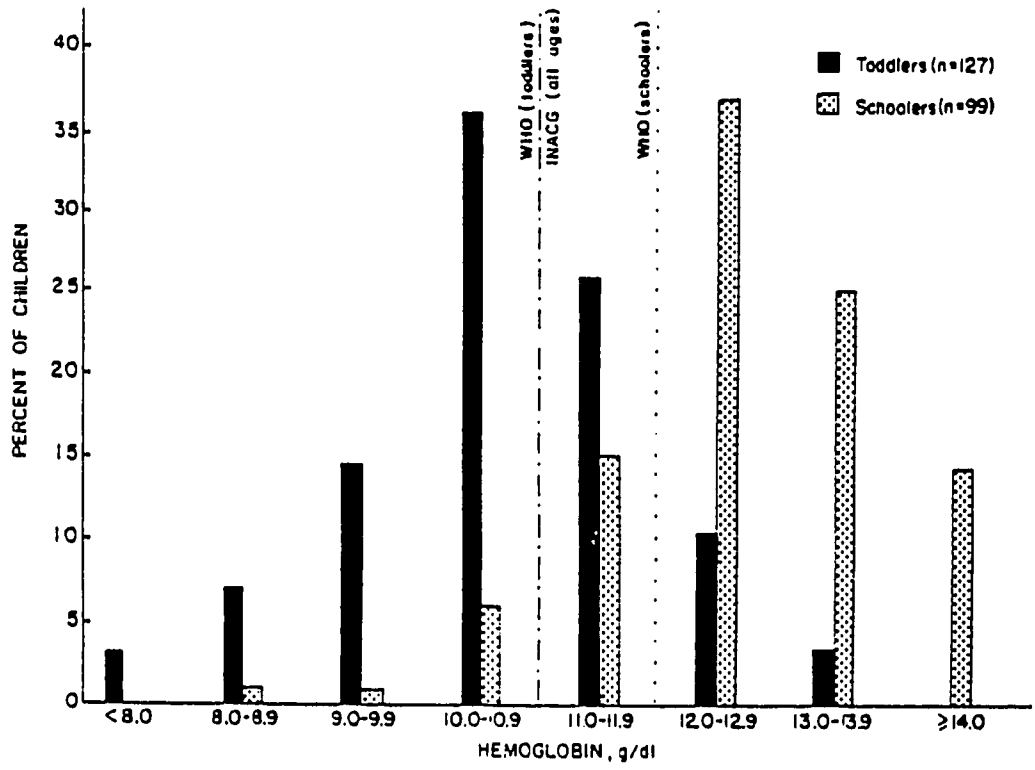

Figure 4. Frequency distribution of hemoglobin concentration among toddlers and schoolers.

6. Zinc Status of Egyptian Women During Pregnancy and Lactation. The main objectives in assessing the zinc status of Egyptian women during pregnancy were to determine: 1) whether levels of plasma zinc were in the normal range and whether the levels showed a normal decline with the progression of gestation; 2) whether zinc status assessed at mid-pregnancy by plasma zinc measurement was related to pregnancy outcome (i.e. hemhorrage, abortion, C-section, still birth (fetal deaths)); and 3) whether zinc levels in plasma during early or midpregnancy were correlated with birthweight and neurological or clinical features of the newborn infant assessed by the Dubowitz measurement.

Eighty-six plasma samples were obtained at different trimesters of pregnancy. Excluding duplicate samples and those without labels, these represented 67 subjects at different stages of pregnancy as follows:

Stage of Pregnancy Trimester	Number of Subjects
1	20
2	41
3	6

Plasma zinc levels declined significantly during the course of pregnancy from the 1st to 2nd trimester (Table 9). A frequency distribution of plasma

Table 9. Plasma Zinc Levels of Egyptian Women During Pregnancy

Plasma Zinc (g/dl)	
1st trimester	2nd trimester
81 ± 20 [1]	62 ± 18
(32 - 116) [2]	(8 - 86)
(19) [3]	(35)

[1] Mean ± SD
[2] (Range)
[3] (No of subjects)

zinc values during the 1st and 2nd trimesters of pregnancy is shown in Figure 5. Plasma zinc values of Egyptian women in the 1st trimester were higher than those reported for American women by Hambidge et al (Am J Clin Nutr 37:429-42, 1983), Mukherjee et al (Am J Clin Nutr 40:496-507, 1984), and Cherry et al (Am J Clin Nutr 34:367-75, 1981) but were comparable to those reported by Breskin et al (Am J Clin Nutr 38:943-53, 1983). Values in the 2nd trimester were comparable with those reported for American women by Metcoff et al (Am J Clin Nutr 34:708-21, 1981), Vir et al (Am J Clin Nutr 34:2800-7, 1981), Moser et al (Am J Clin Nutr 38:101-8, 1983), and Cherry et al (Am J Clin Nutr 34:2367-75, 1981). Plasma zinc levels of pregnant Egyptian women were, therefore, comparable to those reported for American women.

Mukherjee et al (Am J Clin Nutr 40:496-507) and Jameson (Acta Med Sand 1979) observed that complications of pregnancy were associated with a greater

percentage of women with plasma zinc levels in the lowest quartile than in the highest quartile. Among Egyptian women, those in both the lowest and the highest quartile of plasma zinc were observed to have complications of pregnancy (Table 10).

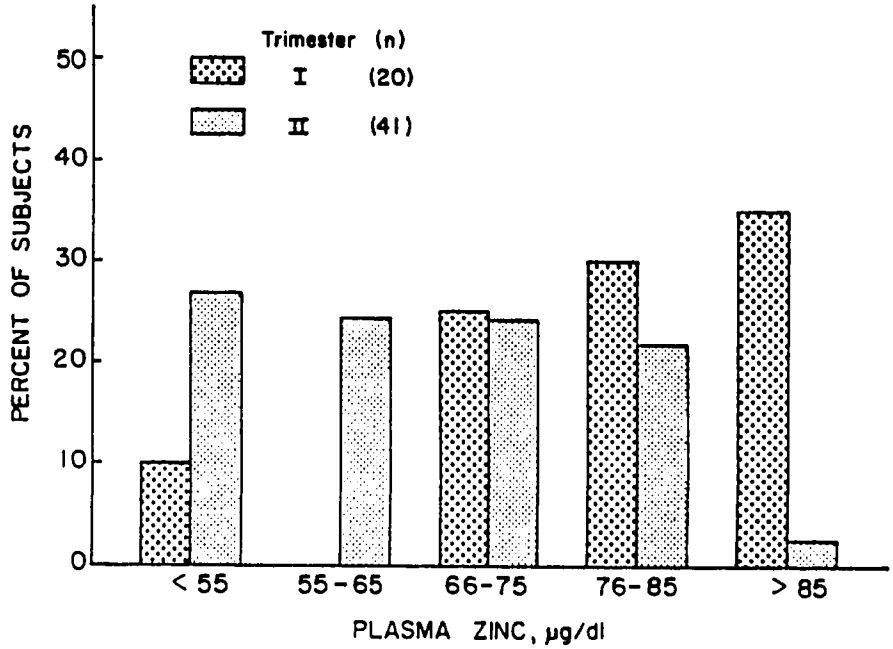

Figure 5. Frequency distribution of plasma zinc concentrations among Egyptian women in the 1st and 2nd trimesters of pregnancy.

Table 10. Relationship of complications of pregnancy to high and low plasma zinc levels

Complications of pregnancy	Plasma Zinc Concentration			
	Low		High	
	No. subjects	g/dl	No. subjects	g/dl
Fetal death (>28 wk)	1	56	1	81
Forceps delivery	---	---	1	80
Hemorrhage	1	54	1	80
SGA infant	1	53	2	83,95
	n=3 (4.5%)[2]	Mean=54 [1]	n=5 (7.5%)	Mean=84

[1] Mean
[2] (Percent of total population, n=67)

Contrary to the findings of Mukherjee et al (Am J Clin Nutr 40:496-507, 1984) and Metcoff et al (Am J Clin Nutr 34:708-721, 1981) who observed that maternal plasma zinc was negatively correlated with birthweight, in this study maternal plasma zinc in the 1st and 2nd trimesters was positively correlated with birth weight. Findings of this study suggested that maternal plasma zinc levels in early and especially in mid-pregnancy cannot be ruled out as a predictor, in part, of fetal growth. Concentrations of plasma zinc and ferritin

of the mother and gestational age of the infant together accounted for 30% of the birthweight prediction.

Concentration of plasma zinc measured in the 2nd trimester has a significant inverse relationship (multiple-regression) with the clinical score of infants for skin coloration and the neurological score for ankle dorsiflexion. However, the total neurological or clinical scores assessed by the Dubowitz measurement were not significantly correlated with maternal plasma zinc levels.

Plasma zinc concentrations of 17 lactating Egyptian mothers were compared to those of American mothers at the same months of lactation. Plasma zinc values of Egyptian lactating women were comparable to those of American women who received no zinc supplements (Table 11).

Table 11. Plasma zinc levels of Egyptian and American women at different stages of lactation

	Plasma Zinc Concentrations Months of Lactation			
Country	1	2	3	4
	g/dl			
Egypt	81 ± 8[1] ($\bar{4}$)[2]	75 ± 5 ($\bar{8}$)	75 ± 4 ($\bar{3}$)	78 ± 14 ($\bar{2}$)
U.S.A.	74 ± 2 ($\bar{17}$)	---	---	81 ± 2 ($\bar{19}$)

[1] Mean ± SE
[2] No. of subjects

Stage of lactation has been reported to have a significant effect on the level of zinc in milk. During a 6-month period of lactation, milk samples obtained from Egyptian women between 10 AM-2 PM were compared with samples obtained from American counterparts at the same time. Concentration of zinc in milk from Egyptian women and from zinc supplemented and unsupplemented American women are shown in Figure 6. Zinc concentration in milk decreased with the progression of lactation ($p<0.05$) in all 3 groups. Levels of zinc in unsupplemented American women were not significantly different from those of Egyptian women at any stage of lactation. However, American women supplemented with 25 mg zinc/day had higher ($p<0.05$) levels than the other two groups. Concentrations of zinc in breast milk and the longitudinal decline observed over a 6 month period agreed with previous findings (Acta Pediatra Scand 70:189-94, 1981). The scientific basis for the decrease is obscure. Possibly changes in levels of major zinc binding ligands in milk are responsible (Ann Rev Nutr 3:261-88, 1983). The existence of a physiological control is strengthened by the observations of similar changes in zinc levels in milk of Egyptian and American women. Since the Middle East and Egypt, in particular, are areas noted for zinc deficiency, our hypothesis was that Egyptian women would have lower levels of zinc in their milk than American women. However, in spite of considerable cross-cultural differences in parity, dietary intakes and infant feeding practices, a remarkable similarity existed in zinc concentration and

longitudinal changes in zinc levels of milk in Egyptian and American women during the first 6 months of lactation.

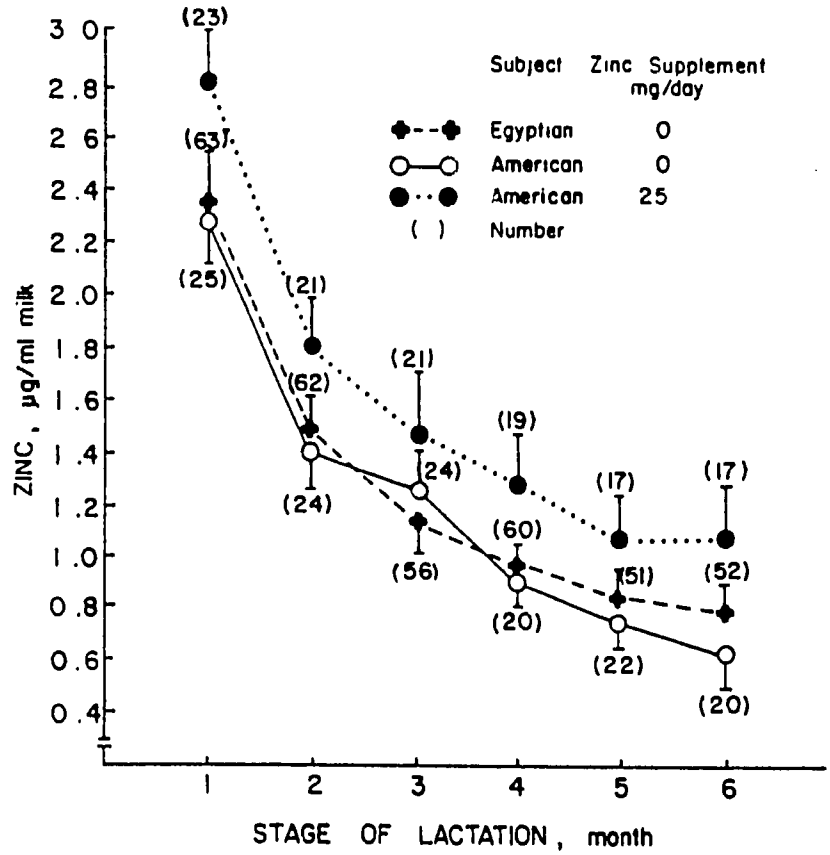

Figure 6. Zinc concentration of milk samples collected at a single feeding (10 AM-2 PM) from Egyptian women and zinc-supplemented and unsupplemented American women at 1 to 6 months of lactation.

7. Other Research Activities. Mihira Karra (Purdue University) who traveled to Egypt in July 1985 (non-CRSP funds) for a 5 week stay has analyzed approximately 600 human milk samples from Egyptian women for zinc, calcium and magnesium as a part of her doctoral research. The data have been analyzed and two manuscripts were sent to ME for circulation to the SCB for review and have been approved to submit for publication.

A manuscript entitled "Fatty Acid Composition of Mature Human Milk of Egyptian and American Women" by Marlene W. Borschel, Robert G. Elkin, Avanelle Kirksey, Jon A. Story, Osman Galal, Gail G. Harrison and Norge W. Jerome has been published in the American Journal of Clinical Nutrition. This paper includes data collected during Phase I of the project.

A research proposal entitled "Functional Consequences of Different Levels of Vitamin B-6 in Breast Milk" was submitted by Dr. Kirksey to the Thrasher Research Fund and was funded in January 1986. The grant will enable Dr. Kirksey and her colleagues to assess in solely breastfed infants in rural Egypt the possible functional consequences of different levels of vitamin B-6 provided to them in their mother's milk. The information gained from this study will be complementary to the main project. The grant allows research which would not

otherwise be accomplished under the project's auspices.

II. INTERPROJECT ACTIVITIES

Interproject meetings listed under section IA, Travel.

III. CURRENT STATUS AND PLANS FOR THE NEXT PERIOD

1. Continued collaboration with other PIs and Egyptian scientists in the completion of data entry, cleaning and flow to the U.S.

2. Analysis of morbidity, growth and cognitive data will continue to be of the highest priority. First analyses of these data are on-going.

3. A meeting of statisticians from all projects is planned for November 10-13 at Berkeley.

4. PI's support of and consultation with Dr. McCabe and his staff in completion of the data analysis tasks agreed upon at the November SCB/DAG at Berkeley.

Attachment A

STATISTICIANS' REPORT

George P. McCabe
October 16, 1986

I. Introduction

This document is prepared for circulation to members of the EEP and others who will participate in the November 1986 CRSP meetings at Berkeley. Its purpose is to describe the current state of progress regarding the statistical analysis of data with an emphasis on common aspects across projects.

At the meeting we will present a variety of displays and tables summarizing different aspects of our work. This report is designed to facilitate those presentations by explaining how some of our current understandings have evolved and by illustrating some of the preliminary results.

II. Overview

As statisticians, our purpose is to *develop* and *implement* analytical strategies designed to address the major research questions of the CRSP. Our philosophy is that the simplest correct analysis which answers the important questions is best.

The central question is easily stated: to what extent does food intake relate to function? Careful examination of this question, however, reveals that translation to an analytical strategy is a complex problem. We have learned that simple textbook approaches are inadequate. Therefore, a major part of our effort has been directed toward the development component of our purpose. When understood in the context of the questions and data available, it is clear that this is the only way to proceed toward *meaningful* results.

The analytical strategy must be driven by the interaction between the research questions and the data available. We have learned that both the questions and the data are complex. It is not sufficient to consider the research questions in the context of the way the data should or might be. Similarly, concentration on the data ignoring the conceptual framework provided by the research questions is also inadequate. We have tried to operate within these two extremes.

The analytical process, deriving from the interaction between research questions and data, requires a similar interaction between the PI's and the statisticians. Our proposed methodologies come from an attempt at translating their questions into our terms in the context of the data. Only they can give us the necessary feedback to determine the extent to which the translation has been effective.

III. Between and Within Questions

Since much of our effort to date has been spent on the toddler data, ideas presented in this section will be illustrated using what we have learned for this target group. However, it should be kept in mind that similar ideas are relevant to the analyses of all target groups.

To understand our current thinking regarding analytical approaches, it is important to distinguish *between* and *within* questions. To illustrate these ideas, let us consider, for example, the question of how food intake relates to anthropometry, where we use weight as our exemplar for the latter.

Basically, a *between* question involves contrasting individuals. For example, do toddlers who have higher food intake grow more? In contrast, a *within* question involves a within person comparison with statistical pooling across individuals. For example, are periods of higher food intake associated with periods of greater growth for each toddler. Note that for the between question, higher or lower is defined relative to the group; whereas, for the within question the reference point is relative to the individual.

About a year ago, we prepared some preliminary analyses using the between approach. A variety of correlations were calculated for each of the three projects and the results compared. We learned (1) that cross-project analyses were feasible (2) that our results were similar and (3) that the answers we sought would not be so easily found. These analyses represented a necessary first step whereby we each confronted the particular difficulties involved in dealing with our data sets.

During the past year two facts have become increasingly clear. First, our problems are truly multivariate involving the interplay of many variables. Second, if we are to adequately address the research questions we must consider the within questions in addition to the between. Some comments regarding the first point are discussed in the next section while the second is addressed in section V.

IV. Conditioning

Let us return to our illustration concerning food intake and weight for toddlers. First we note that food intake is a measured variable. However, as an analytical variable, it has been suggested that we use KCAL per KG of body weight. This is an example of the statistical *conditioning*. The idea is to adjust by or condition on weight when examining food intake.

Similarly, we might consider the ratio of weight to height, etc. In each case, we are trying to construct a variable which makes comparisons more meaningful. Note that for this type of conditioning we would like to have both variables measured on the same day. To the extent that this is not true, we are making compromises.

The method described above is but one of a variety of ways to condition. We can also form conditioning subgroups by dividing the individuals into groups with similar values on the conditioning variable. Each method has its advantages and disadvantages. One disadvantage that the above two methods share is that the process becomes increasingly

difficult when we try to simultaneously condition on several variables. For the first method it is often unclear how to proceed and for the second, we can get subgroups which are too small to deal with. The alternative is to build a statistical model which incorporates all of the relevant conditioning variables. In this way we can account for the multivariate complexity present in the questions and the data.

Note that we are not suggesting abandonment of the first two approaches. To the extent possible, we can try to translate the results into these frameworks which appear to be easier to interpret and explain.

Thus far, we have considered only conditioning on a variable measured at (approximately) the same time as the variable of interest. There are two other types of conditioning variables that we need to use.

The first set are variables which do not change over time such as SES and household size. Our models can easily deal with these. The only compromise we make is the assumption of constancy which may not hold precisely.

Returning to our example concerning weight, it is natural to consider previous weight as a conditioning variable. This is our second type of variable. Ideally, we would like all weight measures to be equally spaced in time. To the extent that this is not true, we must make compromises or build such considerations into the model.

To summarize, statistical conditioning is a process whereby we perform calculations designed to adjust for differences in the conditioning variables. By doing so, we produce a more sensitive evaluation of the effects of the key variables of interest. The basic idea is the same as that which underlies the analysis of covariance technique.

In the next section, the present and previous sections are tied together to explain the autoregression models that we are currently using.

V. Autoregression Models

Autoregression models allow us to combine between and within information while simultaneously conditioning on a collection of variables. These methods have been used for many years in econometrics but their use in other fields has been more limited. A recent reference is Rosner *et. al.*, *Statistics in Medicine*, 1985, p. 457–67.

Although some fine details of the model are rather involved, the basic ideas are quite simple. We return to the question regarding weight and food intake for toddlers to illustrate the basic concepts.

First we consider the variables that can influence a given toddler's weight at a given time, say t. The first, and presumably most important, is the toddler's weight when last measured (this should be one month previous), say at time $t-1$. Thus, to model WT_t we start with WT_{t-1}. Other variables we might consider at time $t-1$ are height (HT_{t-1}), and morbidity variables, such as days sick during the last month (S_{t-1}) days with diarrhea (D_{t-1}), and days with fever (F_{t-1}). Since the purpose of the analysis is to investigate the effect of food intake, we must include FI_{t-1}. Another class of variables are those which

do not vary over time such as sex (S), household size (H) (perhaps transformed with a square root or log) and socioeconomic status (SES).

We now put the variables together in a regression model. We try to predict WT_t using WT_{t-1}, FI_{t-1}, HT_{t-1}, S_{t-1}, D_{t-1}, F_{t-1}, S, H and SES. To do this we combine all cases where valid data exist for the variables in the model. Note that an individual toddler can contribute several cases. Thus, we are combining between and within information in constructing the model.

This technique is based on the assumption that the residual errors are approximately normally distributed with constant variance. The validity of this assumption can be checked using residual analysis.

The above discussion is intended as an intuitive overview of the autoregression model as it is usually defined. Those wishing to see equations and the theoretical foundations are referred to the aforementioned paper by Rosner *et. al.* or any econometrics text.

VI. Implementation

When the above approach was discussed at the statistician's meting in June at Purdue, there was general enthusiasm for moving in this direction. Since that time we have had considerable experience with this approach and have tried many variations.

From our previous data analyses we became aware of three important considerations relating to the data which impact on the model. First, there is a substantial amount of noise in many of the variables. To deal with this fact, we have constructed baseline measures for many of the variables and included them in the model. The baseline period consists of the first three months. Since we theoretically have 12 months of data, this means that we use the observations for months 4 through 12 in the above framework.

The second consideration concerns missing data. As we include more variables the problem becomes more acute. If we restrict inclusion only to cases with complete records, we sometimes observe a drastic reduction in the sample size with a consequent loss of statistical power. To remedy this situation, we have investigated the use of dummy or indicator variables. By this technique, we attempt to use the partial information available in many of the records.

Finally, although the model assumes that the observations are taken at one month intervals, the data indicate that this is frequently not the case. We have tried some adjustments to account for this discrepancy.

As mentioned in the previous section, autoregression models have been widely used in econometrics and have their roots in that field. The structure and problems associated with our data sets are quite different than those found in econometric time series. As a result we have had to develop and adapt the methodology to suit our circumstances. This process has many aspectss not discussed above and is actively in progress.

V. Examples of Parallel Analyses

To illustrate the ideas described above, we present the examples of preliinary results which we have obtained. In each case the variable predicted is weight. The predictors are

CONST = a constant term.
LWT = weight in the previous month (lagged),
BWT = baseline weight,
LHT = height in the previous month,
BHT = baseline height,
BKCAL = baseline food intake (divided by 1000),
LKCAL = food intake (divided by 1000) in the previous month.

In the following tables, we use the notation K = Kenya, M = Mexico and E = Egypt.

Example 1

	Coefficient		Std. Error		t		p	
Variable	*M*	*E*	*M*	*E*	*M*	*E*	*M*	*E*
CONST	−.12	−1.32	–	–	–	–	–	–
LWT	.62	.77	.05	.04	11.2	17.9	.00	.00
BWT	.36	.23	.08	.05	4.5	4.2	.00	.00
BHT	.01	.02	.02	.02	.6	1.2	.53	.22
LKCAL	.09	.19	.06	.10	1.6	2.0	.11	.05
BKCAL	−.14	−.05	.13	.14	−1.1	−0.4	.28	.72

	M	E
n	251	220
R^2	.76	.85
Residual standard deviation	.67	.66
Test for $LKCAL, BKCAL - F, df, p$	1.49, (2,245),.23	2.20, (2,214),.11

Example 2

	Coefficient		Std. Error		t		p	
Variable	*K*	*E*	*K*	*E*	*K*	*E*	*K*	*E*
CONST	−2.30	−2.57	–	–	–	–	–	–
LWT	.62	.71	.05	.05	13.7	13.2	.00	.00
BWT	.30	.25	.05	.06	6.5	4.0	.00	.00
LHT	.07	.07	.02	.02	4.6	3.1	.00	.00
BHT	−.02	−.03	.01	.02	−1.7	−1.1	.09	.26
LKCAL	.05	.16	.05	.10	.9	1.6	.37	.11
BKCAL	−.04	−.08	.08	.14	−.6	−.5	.57	.59

	K	E
n	402	204
R^2	.91	.87
Residual standard deviation	38	.62
Test for $LKCAL, BKCAL - F, df, p$	.64, (2,395),.53	1.39, (2,197),.25

Note that the second example differs from the first by the addition of LHT to the equation.

A noticeable feature of the two examples is the similarity of many of the coefficients. Note that the sample size is considerably larger for Kenya. One would expect this to produce smaller standard errors for the coefficients but this effect is not consistently evident. The residual standard errors are similar for Mexico and Egypt while the value for Kenya is considerably smaller.

Since food intake is entered into the equation with two variables, it is appropriate to test the pair simultaneously. At this stage of analysis, it is very inappropriate to place excessive reliance on the fine details of the statistical tests. Some data sets are still being cleaned and updated. The models are still under development. Obviously additional variables can be added to the equation.

For the Egypt data we have produced a variety of models in which the coefficient of food intake is statistically significant, sometimes with a one-sided p-value of .01. These results are mildly encouraging but we will not engage in the statistically unsound strategy of picking the model which makes this effect most significant.

Given all of the qualifications regarding the preliminary nature of these results, we can still make some attempt at interpretation. Consider the first model for Egypt where the coefficient of $LKCAL$ is .2 (rounded off). Consider an increase in (daily) $KCAL$ of 100. Given our scaling, this correponds to an increase of .1 in our $LKCAL$ variable. The monthly effect is thus $(.2)(.1) = .02$ or on a yearly basis, .24. Thus, for individuals with similar previous weight, base weight, height and food intake, the increase of 100 $KCAL$ per day roughly corresponds to $1/4$ KG of increased weight. Note that this calculation is rough and ignores considerations of morbidity and other factors.

We have sought different statistical quantifications for the effect of food intake. The change in R^2 approach is somewhat misleading because of the large effect of WT_{t-1}. Similarly, expressing the residual variation reduction relative to the unexplained variation is not entirely satisfactory because much of the unexplained variation is due to measurement error over which we have not control.

The issue of measurement error is important in interpreting any of these results. Making exact calculations is difficult, but qualitatively, we can say that the consequence is that in general we will be underestimating effects of interest.

VI. Other Outcome Variables

The autoregression models appear to be sufficiently general to be used for other outcome variables. We have some experience in using this framework for morbidity. However, as described above, the general theory needs considerable adaption and development to be useful. This is particularly true for morbidity where the key events are illnesses with durations that do not fit neatly into the monthly summary structure. For example one illness episode can easily have a duration intersecting more than one of our somewhat arbitrary monthly time divisions.

VII. Plans

We are now generating a variety of descriptive summaries which we will present at the November meetings. To the extent possible these will allow some cross-project comparisons.

The generation of these descriptive summaries is relatively routine but sometimes rather time consuming. In prioritizing our efforts, we have had to choose between development of the analytical strategies for the major research questions and production of these summaries. We have chosen to invest the major part of our energies in the former task and this report reflects that choice.

Our plans for the future can be viewed in terms of the development and implementation dichotomy described in section II. Work on refinement of the autoregression approach is actively in progress and will continue. Implementation of these methods and descriptive techniques will be accomplished. In the course of our analyses we have encountered many particular questions needing statistical analyses. For some of these, routine methodology is adequate while for others more development work is required.